Lower Fraser Valley Streams Strategic Review

Lower Fraser Valley Stream Review, Vol. 1

Fraser River Action Plan
Habitat and Enhnacement Branch
Fisheries and Oceans Canada
360 - 555 W. Hastings St.
Vancouver, British Columbia
V6B 5G3

1999

Canadian Cataloguing in Publication Data

Main entry under title:

Lower Fraser Valley streams strategic review

(Lower Fraser Valley stream reveiw : vol. 1)
Includes bibliographical references.
ISBN 0-662-26167-4
Cat. no. Fs23-323/1-1997E

1. Stream conservation -- British Columbia --Fraser River Watershed.
2. Stream ecology -- British Columbia -- Fraser River Watershed.
3. Pacific salmon fisheries -- British Columbia --Fraser River Watershed.
I. Precision Identification Biological Consultants.
II. Fraser River Action Plan (Canada)
III. Canada. Land Use Planning, Habitat and Enhancement Branch.
IV. Series.

QH541.5S7L681997 333.91'6216'097113 C97-980399-3

PREFACE

The **Lower Fraser Valley Streams Strategic Review** provides an overview of the status and management issues on many of the salmon bearing streams in the Lower Fraser Valley. This information has been compiled to assist all concerned with managing and protecting this important public resource. This includes federal, provincial and local governments, community groups, and individuals.

While the federal government, specifically Fisheries and Oceans Canada, is responsible for managing fish and fish habitat (goals included in sidebar), this important public resource is completely dependent upon land and water to produce and sustain its habitat base. The Province of British Columbia has the constitutional mandate to manage land and water resources. In settlement areas where the vast majority of the land base is privately owned, responsibility for land use and development planning has been delegated to local governments. In the Lower Fraser Valley this responsibility rests with 24 different municipalities and 2 regional districts which do not currently share a common vision for stream protection.

The prognosis for settlement area streams is not encouraging if this legacy of fragmented jurisdiction and poorly integrated land and water use planning continues. All levels of government and the community at large must place a higher priority on watershed protection if viable wild fish stocks are to be sustained into the future. It is hoped that this document (and its companion publications) will be used by all potential partners to better steward this valuable public resource, and direct development away from environmentally sensitive aquatic areas.

Goals for Sustainable Fisheries

Fisheries and Oceans Canada has identified seven measurable and achievable goals for sustainable fisheries. These are as follows:

1. ***Avoid irreversible human induced alterations to fish habitat.***
   Alterations to fish habitat that reduce its capacity to produce fish populations which cannot be reversed within a human generation are to be avoided.

2. ***Maintain the genetic diversity of fish stocks.***
   No fish stock, regardless of its size, will be arbitrarily eliminated and, where possible efforts to conserve and rebuild small and remnant stocks will be made.

3. ***Maintain the physical and biological diversity of fish habitats.***
   Physical and biological diversity of habitat provides fish with an opportunity to adopt alternative life history strategies, thereby providing protection from natural habitat variation.

. . . . / continued on next page

To assist stewardship efforts, the Fraser River Action Plan (DFO) has produced this document, which is part of a three volume package of information on streams of the Lower Fraser Valley. This package includes maps of stream locations, a stream status report, and watershed management issues and corrective prescriptions that must be applied to these streams if they are to be protected and restored for future generations. The three volumes in the **Lower Fraser Valley Stream Review** series, which is produced in partnership by DFO and BC Ministry of Environment, Lands and Parks, include:

Volume 1: Lower Fraser Valley Streams Strategic Review (1999)*****
A comprehensive 450 page review of salmon bearing streams in the Lower Fraser Valley. Contains maps and appendices (watershed codes, escapement data, stream hydrographs).

Volume 2: Lower Fraser River Stream Inventory Atlas
(September 1996; reissued with Stream Name Maps, March 1998)*****
Contains 47 orthophoto maps (and accompanying stream name index maps) with TRIM overlay, showing fish presence/absence.
The atlas or individual maps can be purchased from: Archetype Print Ltd., #459-409 Granville Street, Vancouver, B.C., V6C 1T2, ph: 604-602-0282; fax: 604-602-0283.

Volume 3: Wild, Endangered, Threatened and Lost Streams of the Lower Fraser Valley – Summary Report, 1997 (1998)
A 40 page report on the classification of 657 streams in the Lower Fraser Valley as lost, endangered, threatened or wild. Includes classified streams map of the Lower Fraser Valley.

Volumes 1 and 3 are available from the Fisheries and Oceans Canada at the address below.

For further information please contact:

Habitat and Enhancement Branch
Fisheries and Oceans Canada
360 - 555 W. Hastings St.
Vancouver, B.C. V6B 5G3
fax: 604-666-0417

. . . / <u>Goals for Sustainable Fisheries</u> continued

4. Provide a net gain in productive capacity through proper habitat management.
Ecological limits control productive capacity of a stream system. Natural and self-sustaining production systems are preferred over semi-natural, artificial or non self-sustaining systems.

5. Maximize the value of commercial, sport and aboriginal fisheries.
All market and value added values are to be considered and measured in a way that permits comparison of competing users of the fisheries resources.

6. Maximize the non comsumptive values of the fisheries resource.
Intangible, cultural and social values associated with fishery resources are to be given due consideration in decision making.

7. Distribute fishery net benefits in a fair and equitable manner.
Local communities are to be involved in the decision making process pertaining to habitat conservation, enhancement, and restoration, and particularly who is to benefit and who pays.

*****<u>**Note:**</u> For more information on fish distribution, stream mapping, the Streamkeepers database and Urban Salmon Initiative, a Community Directory and Stream Survey Tracking System, see the Fish Habitat Inventory and Information Program on the Fisheries and Oceans Canada (Pacific Region) Internet site, at <http://habitat.pac.dfo.ca>.

USE OF THIS REPORT

While the **Lower Fraser Valley Streams Strategic Review** represents a compilation of research from a variety of written sources and individuals, and while many efforts have been made to verify this information, errors may still exist. In addition, this document has been in production for a number of years, and, while efforts were made to keep the contents current, some material may now be out of date.

This document is intended to review the condition of fish habitat, the type of fish stocks, and the impacts on fish and fish habitat of Lower Fraser Valley streams at a **strategic** level, providing an overview of these issues for those involved in watershed planning and restoration opportunities. The stream summaries contained in this document represent most of the known salmon bearing streams in the Lower Fraser Valley. However, the list contained in this document is not exhaustive; some streams, such as Annieville Creek (Fraser River South Shore tributary) were excluded because of lack of information on location, condition, and fish presence. More detailed information on specific features or issues on specific streams, or streams not included here, is generally available from local governments, local stewardship groups, local DFO and Ministry of Environment, Lands and Parks staff, consultants, individuals, etc.

Agencies, groups or individuals wishing to address management concerns regarding a given stream system should not use this document as the sole source of information – on-the-ground reconnaissance, interviews with agencies and individuals knowledgeable about the system, review of maps, etc., should be conducted. Resources for current information include local DFO staff (e.g. Community Advisors), local MELP staff, local community stream stewardship groups (e.g. Streamkeepers groups, local conservation groups), DFO and MELP's Internet mapping resources (described in text), and municipal and regional planning offices.

It should be noted that this report was originally prepared for publication in 1997. However, with the ending of the Fraser River Action Plan, the resources needed to publish this document were also reduced. While publication has been made possible in 1999, much of the content of this document reflects information available in 1997.

Conditions in local streams can change slowly or quickly, given natural events and human impacts. This document will need revisions over time, and subsequent editions will be produced as resources permit. Should you or your stream stewardship group wish to add information to the database on any stream, please direct your written comments to:

Lower Fraser Valley Stream Review
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360-555 W. Hastings St.
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ACKNOWLEDGEMENTS

The **Lower Fraser Valley Streams Strategic Review** was funded and produced by the Fraser River Action Plan (FRAP), Fisheries and Oceans Canada (DFO), under the federal Green Plan. This document is Volume 1 of the Lower Fraser Valley Stream Review series, which is produced in partnership by DFO and the BC Ministry of Environment, Lands and Parks (MELP).

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We are grateful to all of the following people who provided information for the **Lower Fraser Valley Streams Strategic Review***,* as well as the numerous individuals who provided verification of the information in this review.

FISHERIES AND OCEANS CANADA
Lou Boursma, Karen Calla, Scott Coultish, Maurice Coulter-Boisvert, Jim Elliott, Sam Gidora, Karen Hutton, Sam Gidora, Kon Johanson, Mark Johnson, Joe Kambietz, Glen Kostiuk, Dave Nanson, Jennifer Nener, Herb Redekopp, Bruce Reid

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STREAMKEEPERS, STEWARDSHIP GROUPS & INDIVIDUALS
Alouette River Management Society. Geoff Clayton, Ross Davies, Janice Jarvis
Burnaby Fish and Game Club. Herb Karras
Individuals. Peter Hulbert, Markus Kellerhals
Langley Environmental Partners Society. David Sam, Christina Engel, Marina Stjepovic
North Shore Streamkeepers. Karen Munro
North Shore Fish and Game Club. Alan Jonsson
Pacific Streamkeepers Federation. Zo Ann Morten
Port Moody Ecological Society. Alan Johnon, Dr. Jutta Rickers-Haunerland, Rick Simpson
Seymour Salmonic Society. Brian Smith
Vancouver Salmon and Stream Society. Mike Hollier
West Vancouver Streamkeepers. Paul Berlinguette, Fiona Wright

Thanks to all who attended the Stream Information Workshops in Winter 1997 (listed below).

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INTRODUCTION

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BACKGROUND - THE LOWER FRASER RIVER AND ITS STREAMS

The Fraser River supports the world's largest salmon runs, and is responsible for over 50% of all the salmon produced in B.C. This document focuses on a small area of the Fraser River Basin located downstream of Hope - the area known as the Lower Fraser Valley. Although the land base of the Lower Fraser Valley and the watersheds that drain into it represents less than 5% of the total area of the entire Fraser Basin, this area supports the production of approximately 80% of the Fraser River's chinook and chum, 65% of its coho, 80% of its pink and significant stocks of sockeye salmon (DFO, 1995, 1996). Historically about 150 of the river's 300 significant streams that supported runs of spawning salmon originated in or flowed directly through the Lower Fraser Valley.

The Lower Fraser Valley represents a scenic and very sensitive environmental setting. It is also home for over 55% of the province's population and it is the fastest growing region in North America. One of the biggest challenges to resource management agencies such as DFO is the protection and restoration of fish habitat in the Lower Fraser Valley in the face of this increasing development pressure.

Since the 1880's over 80% of foreshore wetlands, marshes and riparian forests in the Lower Fraser Valley have been logged, dyked, drained and converted to urban/agricultural uses. During a similar period over 700 km of productive stream habitat in what is now the Greater Vancouver Regional District (GVRD) have been relegated to storm sewers, culverted or paved over.

This document, one in a series prepared by the Fraser River Action Plan of the Department of Fisheries and Oceans, was produced to help reverse this trend.

PURPOSE OF A STRATEGIC REVIEW OF STREAMS IN THE LOWER FRASER VALLEY

Making informed decisions about habitat protection and enhancement priorities while ensuring the most effective and beneficial use of limited government resources requires up-to-date information on the status of fish habitat, population trends, watershed issues and conflicts, and restoration opportunities. The **Lower Fraser Valley Streams Strategic Review** is an overview of information on these issues in Lower Fraser Valley watersheds.

This document is a resource for individuals, organizations, local governments and resource management agencies involved in management and planning in the Lower Fraser Valley, as well as anyone interested in protecting or restoring the remaining fish habitats of the Lower Fraser Valley. It is intended to raise awareness of the plight of many of these watersheds and accelerate interest in improving stewardship of our fisheries resource.

This document is the first in a series which document the status of streams in the Lower Fraser Valley. Companion documents in this series include:

- **Lower Fraser River Stream Inventory Atlas** (reissued 1998)
- **Wild, Threatened, Endangered and Lost Streams of the of the Lower Fraser Valley - Summary Report, 1997 and Map** (1998), and
- **The Fraser Basin Strategic Water Quality Plan – Lower Fraser River** (1997).

Together these resources provide a useful compendium of information and management recommendations to guide anyone interested in furthering the protection and enhancement of fish habitat in the Lower Fraser Valley.

The **Lower Fraser Valley Streams Strategic Review** is synoptic in nature. As a result, additional information is required to priorize certain implementation activities. Specifically, restoration and enhancement activities need to be preceded by field investigations to assess feasibility, or to determine changes in stream status and condition since this review was completed. Many of the planning, regulatory and stewardship recommendations, on the other hand, could be implemented without delay.

METHODOLOGY

The data and information for the **Lower Fraser Valley Streams Strategic Review** was compiled from a variety of sources, including the FISS (Fish Information Stream Summary) and SEDS (Salmon Escapement Data Summary) databases managed by DFO, published consultant and government reports, federal, provincial and municipal map sets and dialogue with knowledgeable local residents and municipal staff. In addition, four large workshops (winter 1997) were held with government staff, the public and consultants, each workshop representing over 200 person years of experience on Lower Fraser Valley Streams. The information on trends and stream status was derived from the **Wild, Threatened, Endangered and Lost Streams of the Lower Fraser Valley - Summary Report** (DFO,1998). The following Website resources were also used: Fish Habitat Inventory and Information Program Database: http://habitat.pac.dfo.ca; Fisheries Inventory Section Database, Ministry of Environment, Lands and Parks' Resource Inventory Branch: http://www.env.gov.bc.ca/fsh/ids/dman/

REPORT ORGANIZATION

The geographic scope of the **Strategic Review** includes all significant fish bearing tributaries to the Fraser River downstream of Hope for which a watershed code, fish use information or other relevant data was available. Tributaries to Boundary Bay and Burrard Inlet for which similar information was available have also been included. For the purpose of presentation the review was separated into four major areas:

- Chapter 1- Georgia Strait tributaries - including Boundary Bay and Nooksack River tributaries

- Chapter 2 - tributaries on the south shore of the Fraser River
- Chapter 3 - tributaries on the north shore of the Fraser River
- Chapter 4 - Burrard Inlet tributaries

The individual stream summaries in this document were organized into four major sections, namely:

1) Physiography
2) Fisheries Resources
3) Activities and Land Use
4) Watershed Planning Issues

The Physiography section briefly summarizes the bio-physical characteristics of the stream, and includes available information on the drainage area, hydrology and channel stability.

The Fisheries Resources section provides information on fish stream access, stocks, restoration and enhancement opportunities and production potential.

The section entitled Activities and Land Use identifies significant land uses in the watershed, protected or 'designated' lands', potential land use impacts/conflicts in the watershed, and indicates which local and regional governments are responsible for land use planning in the watershed.

The last category - Watershed Planning Issues - summarizes management concerns and provides general prescriptions for protecting or restoring streams in the watershed.

Stream Status and Trend

The current condition of the streams and their watersheds has been assessed, and assigned a rating (determined as Status and Trend) based on a number of criteria, described below.

Status

The term Status indicates a stream's present condition. In a recent study coordinated by DFO, streams in the Lower Fraser Valley were categorized as endangered, threatened or wild based on the number of impact criteria that were satisfied. The impact criteria are as follows:

- significant loss of riparian vegetation along more than 50% of the fish frequented length of the stream,
- channelization, armourization, or dyking of over 50% of the fish frequented length of the stream,
- effective impermeable area (EIA) covering approximately 10%, or greater, of the stream's watershed[1],
- greater than 50% diversion of stream flow (i.e. diversion out of the system), or significant manipulation of flow,

[1] Effective impervious area (EIA) is a measure of the total area where water does not infiltrate into the soil and that is connected directly to the drainage network. EIA is a useful indicator of development activity, and provides a simple but effective method to predict the future quality of streams, based on measurable land use change. Research shows that once a watershed is covered by more than 10% EIA, irreversible changes in hydrology and channel morphology occur, causing a significant loss of fish habitat features.

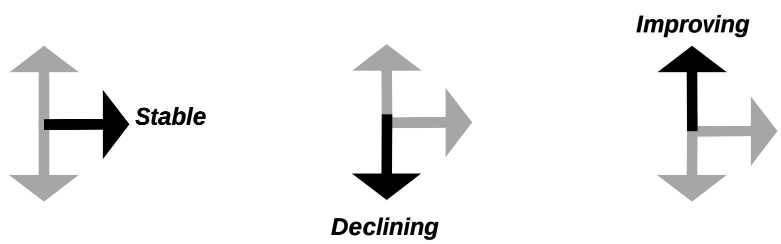
- significant water quality problems, i.e. temperature, water chemistry (including urban impacts; not including impacts from logging),
- logging has been extensive in the watershed, and impacts (direct or related) have been obvious,
- urbanization - settlement in the watershed has significantly altered the stream basin
- other impacts (i.e. agricultural/urban impacts, anthropogenic barriers, and cumulative effects of these impacts).

If none of the impact criteria were met, the stream was considered wild. Where one of the impact criteria were satisfied, the stream was considered threatened, and if two or more conditions existed, or there was significant risk or likelihood the condition would be met, the stream was classified as endangered. **The Wild, Threatened, Endangered and Lost Streams of the Lower Fraser Valley - Summary Report and Map** (Vol. 3 of the Lower Fraser River Stream Review series) presents the methodology and findings for this study in greater detail.)

Trend

The term Trend indicates the direction that the stream's condition is taking given the current and potential land uses and development activities in the watershed. One of three trends is given: Stable, Declining, and Improving. Trends were determined at the four workshops held in 1997.

Example:



References and Appendices

A list of references used to collect and verify information for this report has been included.

The appendices in this document include:

- Appendix 1: Stream Systems and Watershed Codes
- Appendix 2: Hydrographs (for watersheds where this information is available)
- Appendix 3: Escapement (for watersheds where this information is available)

Acronyms

GVRD	Greater Vancouver Regional District
DFO	Department of Fisheries and Oceans
ALR	Agricultural Land Reserve
MELP	Ministry of Environment, Lands and Parks
FVRD	Fraser Valley Regional District
SEP	Salmonid Enhancement Program (DFO)

OVERVIEW OF THE FISHERIES RESOURCE IN LOWER FRASER VALLEY STREAMS

Stock Management

Where possible DFO's goal is to restore all Fraser River salmon stocks to their full potential. The development of this multi-species management and enhancement plan is well underway. DFO is pursuing these stock management goals through the following strategies:

- Increasing escapement to spawning grounds through a risk averse approach to managing fishing times and opportunities for each stock.
- Increasing the habitat base through restoration and enhancement.
- Resource enhancement (including construction of spawning channels and small hatcheries and fishways).
- Enforcement of regulations pertaining to fishing activities.

Habitat Management

Habitat management activities of the Department of Fisheries and Oceans focus on protecting the habitat base that produces and sustains the wild salmon resource. Habitat managers of DFO apply the National Policy for the Management of Fish Habitat, and in particular DFO's "No Net Loss" working principle, to all development applications that have the potential to adversely affect fish habitat. Other habitat management activities of DFO include issuing authorizations (and requiring compensation) for approved alterations of habitat, participating in interagency referral and planning processes, enforcing the habitat provisions of the Fisheries Act, producing and disseminating habitat protection guidelines and stewardship materials to guide planners, engineers and developers, and implementing habitat restoration projects.

Under the Fraser River Action Plan (FRAP), DFO developed a series of Habitat Management Area (HMA) Plans for those parts of the Fraser River Basin which were either crown provincial lands or large private land holdings where provincial land use planning processes apply. Within the Lower Fraser Valley the approach was somewhat different as more than 55% of the province’s population is concentrated in this area and much of the land base is in small privately owned parcels. Land use and development planning in this area are also municipally managed. In the Lower Fraser Valley, FRAP supported a multi-agency initiative entitled Partners in Protecting Aquatic and Riparian Resources (PPARR). This initiative was aimed at improving planning and review processes for land and water use activities that could impact fish habitat. In addition FRAP produced a series of guidebooks, research papers and public information products (brochures, pamphlets and posters) on issues facing urban streams. These materials were delivered through workshops, seminars, media and community events in an attempt to engage communities and local governments in more proactive stewardship of urban streams.

Stewardship and Enhancement Activities

The Salmonid Enhancement Program (SEP) of DFO provides technical advice and financial support to about 10,000 volunteers working on enhancement and watershed stewardship projects throughout the province, many of whom are actively involved in stream habitat and stock enhancement activities in the Lower Fraser Valley. DFO's SEP and FRAP programs also initiated the Streamkeepers Program which trains and supports citizens in monitoring, protecting and improving fish habitat. In addition to the 26 government hatcheries, 60 spawning channels and 46 fishways the Department operates, it also creates and restores habitat in cooperation with other partners by improving water flows, stabilizing stream banks, reestablishing off channel habitats and planting estuary marshes. Various curriculum materials and classroom incubation programs developed by DFO and supported by Community Advisors have also provided hundreds of thousands of children in the lower Fraser Valley, as well as throughout B.C., (Grades K through 12) with opportunities to learn about salmon biology and participate in fishery enhancement projects in local streams. These stewardship efforts and those of the provincial Urban Salmon Habitat Program are encouraging greater community involvement with the resource and will hopefully give rise to generations with an enhanced appreciation of the resource and the need to protect the habitat base that produces it.

Land Use Planning and Fish Habitat Protection

Protection of the processes that create healthy stream habitat requires that land and water use planning be approached from a watershed perspective as changes in either affect both the quality and quantity of aquatic and riparian habitat throughout the entire drainage basin. The transition from forested lands to agricultural areas and subsequently to urban settlement areas with all of their associated infrastructure (i.e. roads, railways, sewer and water lines, landfills etc.) represent a host of significant impacts. These range from extensive vegetation removal throughout the watershed (including streamside areas), to erosion, slope destabilization, creation of impervious surfaces, increased runoff, pollution, dyking, culverting and diversions or impoundments for domestic water use and hydroelectric power production. These alterations to the watershed are individually significant and result in incremental or cumulative impacts that are extremely difficult to manage. This transition is occurring at an increasing rate in the Lower Fraser Valley and is putting enormous pressure on fish bearing watersheds.

Of greater concern is the fact that major land uses in the Lower Fraser Valley such as urban settlement, agriculture and forest harvesting are managed independently of each other. Land use planning and management in the Lower Fraser Valley is divided among a variety of provincial agencies, municipalities, regional districts and first nations. It is not integrated nor is it based on natural landscape units such as watersheds. There are also finite limits to growth and to the degree of change that a watershed can accommodate without irreversible damage. As a result of the disparate approach to planning in the absence of ecologically based planning units, the real ecological consequences of these cumulative modifications to the watershed are often overlooked or are not recognized. This approach to settlement planning must change if we are to avoid creating unsustainable expectations while significantly diminishing the productive capacity of the natural habitat base required to maintain a viable wild fish resource.

SPECIES HIGHLIGHTS

The streams and estuaries of the Lower Fraser Valley provide habitat for over 80 species of fish. Many of these species do not support a directed fishery but play a vital role in sustaining the ecology of the Fraser River and our local watercourses. Salmon and trout species that contribute to or support First Nations, commercial and recreational fisheries, generally receive the greatest attention and for that reason the life history of several of these species have been described briefly in the following section.

Sockeye

The Fraser River is one of the largest producers of sockeye salmon in the world. The Fraser River produces over 65% of BC's sockeye and these salmon account for half of the total Fraser River salmon catch. The largest spawning and rearing areas for these stocks in the Lower Fraser Valley include the Harrison and Pitt Lake systems, and the Chilliwack system including Cultus Lake.

Most sockeye in British Columbia spawn in late summer or fall in inlet streams to lakes. Young sockeye may remain in their fresh water nursery lakes more than one year, while others wait for the second or even third year to make their seaward migration.

Sockeye salmon return to their home streams to spawn as four or five year-old fish after two or three years at sea. They enter the Fraser River from May to October, with southern stocks tending to arrive later than those in the north.

Chinook

Chinook salmon stocks are widely distributed throughout the Lower Fraser Valley. While the Chilliwack River supports the largest spawning populations in the Lower Fraser Valley, spawning also occurs in Little Campbell, Nicomekl, and Serpentine Rivers, and further upstream in the Upper Pitt, Harrison and Coquihalla River systems. In addition, many of the smaller Lower Fraser Valley streams provide critical rearing habitat for chinook. The urban influence on chinook may be quite significant as juveniles from many upper Fraser River stocks move through and rear extensively in lower reaches of Fraser tributaries (including sloughs and estuarine channels) before migrating to the ocean.

After hatching, chinook remain in fresh water for varying lengths of time depending upon the genetic makeup of the specific stock and habitat factors such as water temperature. In southern areas most migrate to the ocean after three months in fresh water while a few stocks may remain in fresh water for up to one year.

The age of chinook adults returning to spawn varies from two to seven years. Many river systems have more than one stock of chinook; some rivers have spring, fall and winter runs.

Coho

Coho salmon may be the most vulnerable of salmon stocks in the lower Fraser Valley. The Fraser River watershed supports 187 recorded coho salmon stocks. About two-thirds of these spawn in the lower Fraser system below Hope.

Coho spawn and rear in the myriad of very small tributary streams in the Lower Fraser Valley, which are frequently unmapped and for which there is little inventory information. As a result these areas tend to be overlooked or ignored during land-use planning and development. Owing to their scattered spawning and rearing distribution, there is no clear understanding of coho population sizes or escapements to most Lower

Fraser Valley streams. It is known, however, that coho rear, as do juvenile chinook and steelhead, in accessible reaches of any natal tributary stream, as well as in sloughs and tidal channels of the Fraser River estuary. Sport and commercial coho fisheries in the Georgia Strait are of high value. The increasing pressures on habitat, impacts of fishing, and changing factors of ocean climate have resulted in DFO undertaking coho conservation and rebuilding initiatives in B.C. to rebuild wild coho stocks that contribute to these fisheries.

Lower Fraser coho spawn over an extended period from late October to late February. Juvenile coho generally spend one but occasionally two years rearing in fresh water after emergence. They then migrate to the ocean between April and July each year where they spend 2 to 3 years before returning to their natal streams to spawn.

Pink

The Fraser River supports the largest pink salmon stocks in the North Pacific basin south of Alaska. Spawning occurs in odd years in the Fraser River mainstem, Alouette River, Kanaka Creek, Nathan Creek, Silverdale Creek, Sumas River, Chilliwack River, Harrison River, Chehalis River, Morris Creek, Anderson Creek, Wahleach Creek, Mahood Creek, Ruby Creek, Silverhope Creek, and Coquihalla River systems.

A peculiarity of this species is its fixed, two-year life span. Young pink salmon migrate to the ocean soon after emerging from the gravel spawning beds and return to the same streams after about 18 months at sea. The Fraser River system has a predominately odd-year cycle of pink salmon.

Chum

The Fraser River supports the largest chum salmon populations in the province of British Columbia. Chum predominately spawn in the lower reaches of many Lower Fraser River tributaries between late September and late December. The four largest chum stocks of the Lower Fraser River are found in the Harrison, Chehalis, Chilliwack and Stave River systems; however chum are widely distributed throughout streams in the lower Fraser Valley. Chum emerge from gravel spawning beds in the spring as "fry" and move directly to estuaries where they rear before migrating to the sea. The migration to the estuary is often accomplished in a day or two. Most chum spend two or three summers at sea before returning to their home streams to spawn.

Steelhead

Steelhead are anadromous rainbow trout. Both steelhead and rainbow trout are distributed throughout the Lower Fraser Valley. These species spawn and rear in tributary as well as mainstem areas of streams in the Lower Fraser. Steelhead and rainbow trout are managed by the Province of British Columbia.

Young steelhead reside for one or two full years in fresh water before travelling to the sea as "smolts". This migration takes place in the spring. Normally, two or more summers are spent in the Pacific Ocean before the fish return to their spawning streams at the age of four or five years. After spawning, many adult steelhead trout return to the sea and some return to spawn a second time.

Cutthroat Trout

As is the case with rainbow trout, cutthroat trout have both anadromous and resident stocks. They spawn and rear in small streams, and are widely distributed, throughout the lower Fraser Valley. They also fall within provincial management jurisdiction.

Coastal cutthroat usually spawn from February to May. The young remain in fresh water for varying periods from one to five years. Cutthroat which migrate to sea often remain within estuaries, moving in and out with the tides. Coastal cutthroat usually spawn for the first time at three or four years of age, although some males become sexually mature at two years of age.

HYDROLOGIC REGIMES OF SALMON STREAMS IN THE LOWER FRASER VALLEY

Natural Hydrologic Regimes

The hydrologic regimes of salmon streams of the Lower Fraser Valley vary appreciably and are directly influenced by climate, surficial geology and land use. Annual precipitation and mean annual stream flows both tend to increase toward the North Shore and to the east, up the Fraser Valley. Mean annual precipitation in the Valley ranges from about 100 to 200 cm, and stream hydrographs closely parallel the precipitation cycle with the greatest flows occurring in November, December and January when the area is subjected to successive Pacific storms (see Appendix Hydrographs). Minimum flows, on the other hand, typically occur after several dry weeks in July, August and September. With the exception of several large watersheds such as the Pitt/Stave, Chilliwack and Harrison, the watersheds of salmon streams in the Lower Fraser Valley are generally small to moderate size and their 7 day summer low flows range from less than 10 to several hundred liters/second.

Surficial Geology Influences on Stream Hydrology

The surficial geology of the Lower Fraser Valley is primarily a legacy of glaciation, except for the recent alluvial deposits on the Fraser River floodplain. The till like glacio-marine and moraine deposits created by glaciation and subsequent weathering and erosion are relatively impermeable, whereas the glacio-fluvial deposits - the permeable gravels and sands laid down by flowing water - are permeable. The latter are unconfined aquifers, and watersheds with a significant portion of these outwash deposits generally tend to have higher summer base flows due to groundwater discharge, and smaller flood peaks due to groundwater storage (Rood, 1997).

Watersheds originating in higher elevations with greater relief (i.e. the north shore of the Fraser River and tributaries to Burrard Inlet) are typically underlain by glacio marine and moraine deposits and tend to be more flashy and responsive to precipitation events. Even small increases in peak flows in these systems as a result of development can significantly increase the frequency and magnitude of flood events as infiltration and groundwater storage capacity in these systems is natural limited.

Impact of Development Trends on Stream Hydrology

Many of the salmon bearing watersheds in the Lower Fraser Valley are being urbanized, which dramatically influences stream flows. Vegetation removal, impervious surfaces, filling and grading for creation of subdivisions, channel modifications and dyking, revetments and diversions all serve to increase flood peaks in small watersheds. Effective impermeable areas of greater than 15% in watersheds with naturally impervious soils alters the natural hydrology of streams by concentrating runoff into streams, thereby increasing peak flows, flood frequencies and magnitude and duration of high flows. Paving a significant portion of a watershed for roads, parking lots, curbs and driveways, and covering pervious surfaces with rooftops and buildings also decreases the area available for infiltration, eliminates natural stream recharge and reduces baseflows during naturally dry periods. These hydrologic changes initiate significant and irreversible changes in channel morphometry by downcutting channels, destablizing stream beds and accelerating erosion. About 20% of salmon streams in the Lower Fraser Valley which are tributary to the Fraser River have appreciably increased peak flows resulting from urbanization. A further 40% have an amount of impervious surface area where increases to peak flow regimes are presently occurring or will begin shortly with very little additional urban development. While effective impervious area has not been estimated for all rivers or streams included in this review the impact of imperviousness is becoming apparent in many other built out areas including areas on the North Shore.

Clearing, ditching and draining of agricultural land also increases peak flows in the wet season and lowers base flows in the summer and fall. This is further aggravated by water withdrawals for irrigation during the summer dry periods. The magnitude of the increased peak flows is not known for many watersheds; however, based on modelling in the Salmon River in Langley, it is estimated that mean annual (or “peak”) flows may be increased by 25 -100% in many watersheds where such agricultural practices occur. In many cases, the stream channels have not yet fully adjusted to the altered flow regimes. These changes simplify the physical structure of streams (i.e. depth, velocity, cover, substrate size and quality) and simplification of the biological communities follows. Irrigation extractions are particularly damaging because they generally occur during summer periods when stream flows are already at a minimum. Approximately 30% of the salmon streams that lie entirely within the Lower Fraser Valley may have more than 50% of their summer seven day low flow extracted for irrigation. Domestic water extractions from aquifers such as the Abbotsford and Hoppington aquifers may also have an impact by reducing groundwater contributions to stream flows which are often critical in the summer low flow periods. However, as groundwater extractions are not recorded or regulated this impact on stream flows cannot be estimated. Surface extractions from Lower Fraser Valley streams for potable water or other domestic uses is not generally considered significant except in community watersheds such as Norrish Creek, Elk Creek or Nelson Creek. The exceptions include several large systems (i.e. Coquitlam, Capilano, Seymour, Allouette, Stave) which have been impounded and are either managed as domestic water supply reservoirs for the GVRD or are controlled by BC Hydro for hydroelectric power generation. Maintenance of minimum instream flows for fish below these facilities is an ongoing concern and until recently this issue had not been a significant consideration in these systems.

THE FUTURE OF FISH HABITAT IN THE LOWER FRASER VALLEY

The amount and rate of population growth and urban development in the Lower Fraser Valley result in increasing pressures on fish habitat. Planning for habitat protection is needed at the strategic level in order to make serious progress toward maintaining viable fish habitat. In communities where land development is still occurring or about to occur, there is an opportunity to maintain healthy streams by implementing an ecosystem planning approach. We must consider the impacts of impervious areas, plan to concentrate development strategically instead of letting it sprawl, and protect natural watercourses (especially the headwaters). Without a watershed approach or the necessary level of stream protection, technical fixes such as sediment retention, stormwater detention and riparian zone protection alone will not be effective for protecting viable and productive streams in the long term. Where watersheds have been compromised by development, remaining fish and fish habitat must be protected to maintain biological abundance and genetic diversity, and social and quality of life values.

The following actions provide approaches to protecting streams and their fish habitat features in the face of the pressures of growth in the Lower Fraser Valley. They present proactive means of protecting fish habitat, involving the development of partnerships as well as habitat protection tools. They include measures that are already underway (undertaken by local governments, senior agencies, and community groups), as well as directions that need to be embraced in order to maintain fish habitat in a rapidly urbanizing river valley.

- Continue stream and wetland stewardship, educational, and partnership programs in order to create an appreciation of the vulnerability of fish habitat and what is needed to protect it.
- Improve cooperation between various parties to give habitat resources better protection and promote improved conservation legislation.
- Identify and priorize key watersheds for protection that have not yet been compromised by urban development.
- Implement a more thorough program of mapping of aquatic habitats to allow protection of these resources. Emphasis must be put on mapping key parts of watersheds that must be protected to ensure the survival of viable habitat in the urban landscape.
- Preserve adequate riparian areas along streams in order to protect fish habitat.
- Introduce direct purchase and tax incentives and disincentives to encourage conservation of the private lands in the floodplain, where most fish habitat is located.
- Implement a consistent approach in stream protection at the senior agency level. Regulatory change is required to create a consistent and common will to conserve fish habitat in settlement areas and especially on private lands. Most of this change is required at the jurisdictional level responsible for land and water use in British Columbia. A provincial habitat protection initiative could be very effective if it brings together the various acts dedicated to regulating activities often at odds with protection of fish and fish habitat (e.g. lands, water, agriculture and municipal legislation).

- Implement a consistent approach in stream protection at the municipal level. The Municipal Act contains provisions that can provide environmental protection but they are largely voluntary. This leads to a variety of approaches being used by municipalities to regulate land use around aquatic habitats. Since most streams and salmonids require similar protection, a more consistent approach is needed. For example, minimum stream protection standards within provincial and municipal legislation are required. An approach similar to that recently taken in the British Columbia Forest Practices Code (1996) to protect streams in public forest lands must be examined.
- Develop new legislation that embodies an aquatic ecosystem/watershed approach to protection of fish habitat.
- In that the Fish Protection Act (1997) (provincial legislation) was to be a proactive tool to protect streams, greater effort must be made to develop regulations that effectively protect riparian zones, reduce effective impermeable area, etc., in order to meet the intent of developing the legislation.
- Apply and enforce existing legislation to protect aquatic habitat more diligently and proactively.

Stream protection measures in the Lower Fraser Valley have improved over the past 20 years. However, streams continue to be degraded at an alarming rate due to the many and complex impacts of population growth, urban development, and settlement activities. Increasing numbers of wild stocks of salmonids, as well as other species of fish and wildlife, are declining and are facing extirpation. If aquatic habitats in settlement areas and the associated fishery resource are important to society and our quality of life, a bold approach to protecting and restoring aquatic habitats is needed. Planning for growth and land use must reflect this approach, in order to ensure that healthy and productive streams can be sustained.

References and Resources

References

Following is a selected list of references used in the research for the **Lower Fraser Valley Streams Strategic Review**, as well as resource material designed to be used in the stewardship of streams and fish habitat.

Burke Mountain Naturalists. April 1994. *Wildlife Inventory of the Shoreline Park System of Port Moody, BC*

Davies, Ross. April 1996. *Study of the Tributaries of the North and South Alouette Rivers*. Fraser River Action Plan, Urban

Chapter 1 – GEORGIA STRAIT/NOOKSACK RIVER TRIBUTARIES

Map 1 – Surrey/Abbotsford Area

Campbell River

TREND ***Stable***

Watershed Code: 900-0005-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0080
TRIM Map: 92G007 and 92G008

STATUS:

Endangered - Urbanization, channelization/dyking, riparian removal and poor water quality have degraded the Campbell River.

Physiography

Drainage Area

The area of the Campbell River (also known as Little Campbell River) watershed is 74.4 km^2. The Campbell River drains southwest from southern Langley into Semiahmoo Bay, south of White Rock. Its tributaries include McNalley, Fergus, Sam Hill, Jacobsen, and Jenkins Creeks, Latimer Pond and several unnamed tributaries. A list of tributaries (and watershed codes) to the Campbell River is provided in Appendix 1.

Stream Description

The Campbell River is approximately 28 km in length. The upper 10 km of the river flow through a wetland mosaic of fens, swamps, marsh, and open water. The meandering mid reach has excellent gravel deposits. The lower river becomes slough-like below 5 km, and is estuarine in the lower 1.5 km.

Hydrology

The mean annual flow of the Campbell River is 2.91 m^3/s. Summer base flows in the upper river (in an urban area) are maintained by groundwater discharge. In the middle reaches of the river, at Campbell Valley Regional Park, the river flows through a large wetland, where there is no clearly defined channel, and flow disperses through the park. Several sections of the midreach run dry in the summer partly due to losses to groundwater and subgravel flow, and to licensed withdrawals. The Campbell River system has been totally subscribed since 1958. The licensed 1996 water subscriptions approached 150% of the recommended maximum. Fergus Creek above 14th Ave. often dewaters during the summer.

Channel Stability Assessment (Preliminary)

The system has been destabilized by channelization. The above average range of flows in the mainstem increases instability, channel scouring and erosion. Fergus Creek has become extremely flashy.

Fisheries Resource

Fish Access

Anadromous fish have access to at least 26 km upstream (240th St.) on the Campbell River mainstem; to at least 1 km upstream of the mouth of McNalley Creek; to 14th Ave. on Fergus Creek (where there is an impassable culvert); to the headwaters of Sam Hill Creek; and to the 8th Ave. culvert on Jacobson Creek.

Fish Stocks

The Campbell River and its tributaries support runs of coho, chinook, chum, and pink salmon; steelhead, cutthroat, and rainbow trout; brassy minnow, pumpkinseed, pacific lamprey, western brook lamprey, three-spine stickleback, brown bullhead, flathead chub, and prickly sculpin. The Nooksack dace and Salish sucker (on the Provincial endangered species list) are no longer reported in this system. Detailed data on the Campbell River from many studies are available in the FISS database.

Restoration/Enhancement

The Semiahmoo Fish and Game Club runs a counting fence as well as a coho and chinook hatchery on the system. While there were substantial releases of fry into the Campbell River between 1984 and 1987, currently only smolts are released. The Semiahmoo Fish and Game Club dredged several sections of the river and constructed a side channel 17.2 km upstream in 1993 to improve the water flow for fish. Additional enhancement activities by the Semiahmoo Fish and Game Club include the reconstruction of a section of Fergus Creek to replace a concrete flume in 1983 and the installation of a fishway near the mouth in 1984. Some instream and bank habitat improvement works were conducted in McNalley Creek from 1979-1983 and a fishway was installed in 1982. Beaver dams have been cleared from most of the tributaries, and installation of stop logs and spawning gravel placement has occurred in Jacobson and Jenkins Creeks. The placement of boulders and large substrate in the riffles, and anchored root wads in debris pools would improve rearing habitat potential in the system.

Fish Production

Very productive spawning and rearing habitat exists along the mainstem and lower reaches of the tributaries. Good rearing potential exists in the middle reaches (Campbell River Regional Park wetlands); however, this is offset by low flows during the summer.

Activities and Land Use

Agriculture

Approximately 64% of the watershed is in agricultural use.

Mining

Gravel pits, both active and abandoned, are common in the drainage area.

Forestry

There has been a significant removal of riparian and upland forest for urban development.

Secondary Industry/Commercial

These land uses are not prevalent in the watershed, comprising only 1.2% of the total drainage area. Commercial development is largely limited to that which supports residential development (i.e. retail).

Linear Development

Highway 99 crosses the river approximately 2.2 km upstream from the mouth of the river. The Burlington Northern Railway crosses at the mouth. BC Hydro transmission lines cross the river approximately 4.2 km upstream. The rest of the basin supports a network of rural streets.

Urban Development

This system is experiencing heavy pressure from development, although the effective impervious area is only 3.94% of the watershed at present. The threat is greatest for the Campbell River mainstem and the Fergus Creek tributary. Several golf courses have been developed in the watershed; riparian areas, natural drainage and water quality have been impacted. Single family development occupies 28.5% of the drainage area.

Government

The Campbell River flows through the City of Surrey and the Township of Langley (Greater Vancouver Regional District).

Designated Lands

The Semiahmoo Indian Reserve is located at the mouth of Campbell River. A large proportion of the watershed (excluding the mouth of the river) is in the ALR. The river flows through Campbell Valley Regional Park (GVRD).

Watershed Planning Issues

Management Concerns

- The river is oversubscribed for water withdrawals. Negotiations between the provincial Water Management Branch and various users for maintenance flows is ongoing. Seasonal low flows in small tributaries and poor adult escapement are viewed as primary limiting factors for cutthroat production.
- Numerous beaver dams frequently impede passage to headwaters and spawning areas. The 10th Ave. culvert causes difficult passage for coho on McNalley Creek, as does a culvert on Sam Hill Creek.
- McNalley Creek is a good producer of coho but is limited by gravel availability above the culvert. Lack of gravels is characteristic of most tributaries in this system.
- Recent re-ditching in Stokes Pit area has degraded habitat and fish access.
- Instream cover is deficient and riparian vegetation continues to be removed for agriculture and urban development in the watershed.
- On October 17, 1989 and July 9, 1990 there were breaks in the District of Surrey water supply mains adjacent to Highway 99, which resulted in chloramine being discharged into the headwaters of Fergus Creek. A study done on the health of Fergus Creek three years later indicated that it had not recovered as fully as would be expected. It is believed that other factors, such as reduced water quality caused by nearby urbanization are impeding the recovery of the creek.
- Nitrate contamination from septic fields has been documented.
- The First Nations fishery at the mouth is a harvest management consideration.

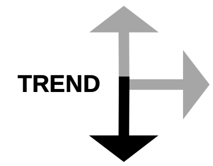
- As development in the watershed continues, the risk increases of altering the hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Riparian areas should be revegetated and where necessary fenced to eliminate cattle trampling or foot traffic.
- A water management plan is required that would include a reduction in water withdrawals.
- Septic fields need to be inspected and standards enforced.
- Gravel placement in the tributaries and culvert improvements could be pursued as enhancement projects.
- Culverted portions of the streams should be daylighted.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- Municipal policies, bylaws or development permit area designations which provide stormwater management, prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

For Campbell River hydrograph, see Appendix 2.
For escapement information on the Campbell River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Nicomekl River



Declining

Watershed Code : 900-0043-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0100
TRIM Map: 92G006, 92G007, 92G008, 92G017 and 92018

STATUS:

Endangered - The Nicomekl and its tributaries have been impacted by agriculture and urbanization (poor water quality, riparian removal, channelization/dyking, increasing effective impermeable surface area).

Physiography

Drainage Area

The Nicomekl River drains southwest from central Langley into Mud Bay at Blackie Spit (Surrey). The total watershed encompasses an area of 175.2 km^2. The tributaries to the Nicomekl River include Chantrell, Elgin, Mackereth, Erickson, Anderson, Murray, Logan and Fraser Creeks. A list of the gazetted tributaries (and watershed codes) to the Nicomekl River are provided in Appendix 1.

Stream Description

The Nicomekl River (33 km) originates in the Township of Langley (the major headwater tributaries are Anderson, Murray and Trigg Creeks). The upper reaches of the system flow across a gently sloping plateau draining agricultural and residential land. The Nicomekl continues down across a lowland area for the remaining 21 km. It is slough-like as it meanders across the floodplain. Gravel deposits are confined to the upper reaches of the main tributaries and mainstem, as well as to parts of lower tributaries.

Hydrology

The mean annual flow of the Nicomekl River is 3.47 m^3/s. A sea dam prevents saltwater from flowing upstream at high tide. Best and McInnis Creeks, which form the headwaters of the system, are spring (groundwater) fed. Summer base flows in the upper tributaries are maintained by springs near the drainage divide with the Salmon River system. High summer base flows on Erickson Creek are maintained by groundwater discharge, mostly into ditches. Most of the tributaries have sections that dry during the summer. Fraser Creek is very flashy.

Channel Stability Assessment (Preliminary)

Accelerated urban development has destabilized runoff patterns causing reduced flows, erosion, and scouring of the banks during high flows. The stability of the main channel has been further altered by channelization. Anderson Creek is experiencing incision below 32nd Ave. possibly due to the removal of large organic debris in the 1970's; bank erosion is also a problem. Chantrell Creek has been dredged for flood control, and a large community detention pond for stormwater has been constructed on Chantrell Creek at 136th and 24th Ave. Murray Creek is subject to erosional problems related to a golf course on the system.

Fisheries Resource

Fish Access

Anadromous fish have access up to an impassable culvert on Chantrell Creek (0.3 km from its confluence); an impassable culvert at Crescent Road on Elgin Creek; an impassable culvert under the King George Highway on Mackereth Creek; an impassable culvert at 32nd Ave. on Kensington Creek; to the headwaters of Erickson, Murray and Anderson Creeks; to at least 66th St. on Logan Creek; and to at least 232nd St. on Best Creek. There is a corrugated steel culvert on 232nd St., just south of 46th, but fish have access above it.

Fish Stocks

The Nicomekl River and its tributaries support runs of coho, chinook, chum, and pink salmon; cutthroat, steelhead, and rainbow trout; as well as redsided shiners, three-spine stickleback, western brook lamprey, brown bullhead, carp, and sculpins. The last known bed of native Pacific oysters in North America is located at the mouth of the river.

Restoration/Enhancement

Two 2.4 metre Archimedes screws were installed for fish passage in the pump station at the mouth of Erickson Creek, and a private fishway has been constructed 4 km further upstream. A fishway at 200th St. on Anderson Creek needs maintenance and the culvert at 224th St., south of 56th Ave., is now passable. All obstructions, including culverts on Chantrell Creek between the Nicomekl and 24th Ave., are slated for modification to allow fish passage.

The Nicomekl Enhancement Society operates a small hatchery near Hopington and a new hatchery opened in September 1993 at 232nd St. and 52nd Ave. In addition, 100 tonnes of spawning gravel were placed in the creek between the hatchery and 52nd Ave. Another hatchery operated on Murray Creek near 48th Avenue from 1982-86. Stream blockages created by undersized or undercut culverts in many of the tributaries limit or impede anadromous fish access and limit enhancement potential. The Steveston High School hatchery has been releasing chinook fry into the Nicomekl since 1989.

- Riparian planting (cottonwood, red osier dogwood, willow) has been completed along several kilometres of the mainstem and tributaries (in the Langley area).
- Coho and cutthroat trout are stocked in the headwaters of Chantrell Creek.
- Weirs Creek has been partially enhanced.
- Logan Creek and the 56th Ave. Ditch have good restoration potential.

Fish Production

A fry release of approximately 52,000 (coho and chinook) fish was conducted between 1984 and 1986. A provincial stocking program for steelhead and cutthroat (out of the Little Campbell River Hatchery and the Semiahmoo Fish and Game Club Hatchery) was discontinued in 1998. Spawning in the mainstem is confined to the section which flows north parallel to 232nd St. between 60th Ave. and Fraser Highway. Spawning occurs in the headwaters, tributaries, and canals in the watershed where adequate water is available. The tributaries generally have good fisheries potential but this is limited by low summer flows and limited spawning gravel. Fisheries potential in the middle reaches of Anderson Creek is limited by low flows, but good spawning and rearing habitats are located above and below this area. In fact, the highest densities of juvenile coho were found in the upper reaches. Logan Creek's only spawning habitat is a section 200 m long located approximately 200 m below 200th St.

Activities and Land Use

Agriculture

Agricultural activities are dominant and occur in over 69% of the watershed area. Agriculture is prevalent in the lower mainstem as well as in the upper reaches of Murray Creek. There has been extensive stream bank vegetation removal on Best Creek (and other headwater tributaries) for agricultural development.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development, especially in the headwaters of the river.

Secondary Industry/Commercial

Industrial areas are encroaching on Logan Creek. Approximately 3.6 % of the Nicomekl drainage area is classified as industrial or commercial.

Linear Development

The Nicomekl River is crossed by the Burlington Northern Railway (near the mouth), a gas pipeline, Highways 99 and 99A, BC Hydro transmission lines (5 km upstream), and additional transmission lines at the municipal boundary. Many arterial roads cross the mainstem and numerous rural streets cross the tributaries. The river is dyked from the Surrey-Langley border to the mouth.

Urban Development

The upper reaches of the river system have been subjected to very rapid urban development. Murray, Morgan, Anderson, Chantrell, and Logan Creeks are experiencing significant urban development and residential encroachment. The effective impermeable area of the watershed is presently only 6%; however, it is rapidly increasing. Several golf courses have been developed along Murray, Anderson, and Mackereth Creeks, in addition to those along the Nicomekl River itself.

The portion of the Nicomekl floodplain located in the City of Langley was purchased by the municipality years ago, before the majority of urban development occurred. Thus urban encroachment on this portion of the mainstem is minimal.

An airport is located on the east bank of the mainstem, north of the Fraser Highway. Years ago the airport had planned to culvert part of the river to create an additional runway, but this no longer seems a threat.

Government

The Nicomekl River flows through the City of Surrey, the City Langley, and the Township of Langley (Greater Vancouver Regional District). Dyking in the lower reaches of the Nicomekl River falls under the jurisdiction of the Surrey Dyking District. The area between the Nicomekl River and the Serpentine River is the responsibility of the Mud Bay Dyking District. The Fraser River Estuary Management Program oversees development applications in the tidal portion of the river.

Designated Lands

High Knoll, Brookswood, Hunter, Langley City, Portage, Dogwood, McLeod, and several other municipal parks are located within the drainage area. The Nicomekl mainstem flows through the ALR, while most of the headwaters are in urban areas.

Watershed Planning Issues

Management Concerns

- The sea dam that prevents saltwater from flowing upstream at high tide restricts flows, which leads to reduced access to the river for fish during summer low flows, water stagnation and fish kills in the lower reaches.
- Frequent fish kills occur in the fall because non-point source pollutants, such as manure and pesticides which have accumulated on land during the summer, are dumped or washed into the mainstem with the onset of fall rains. Newlands Creek has high ammonia and fecal coliform counts; it has experienced several fish kills from runoff originating on mushroom, pig and dairy farms. Low dissolved oxygen levels in the fall have caused several fish kills.
- The Ministry of Environment, Lands and Parks water quality objectives are often not met; for example, sewage discharges occur in the lower reaches of the mainstem. There are also water quality concerns regarding spills and non-point source discharges to tributaries flowing through industrial areas (Logan Creek).
- Flooding of settlement lands near the City of Langley is a municipal concern.
- Recent accelerated urban development has destabilized runoff patterns. Rearing potential is limited by changes in hydrology due to urban storm runoff.
- Lack of water, partially due to licensed water withdrawal, conflicts with salmonid production by creating extreme summer low flows. Upstream reaches of the tributaries are often dewatered in summer.
- Stream bank clearing and livestock access has exacerbated stream bank erosion problems in Anderson, Murray, and Best Creeks and in the lower Nicomekl mainstem.
- Agricultural land is being converted into residential use.
- As development in the watershed intensifies, there is an increased risk of altering hydrology and water quality from stormwater runoff, contaminant discharges, unauthorized stream works, bank alterations and riparian vegetation removal.

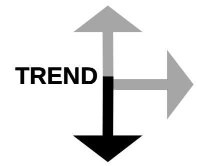
Management Prescriptions

- Stormwater management plans are needed. The City of Langley is completing a master drainage plan. The Township of Langley has finished a master drainage plan for the upper Nicomekl River (for the portion of the Nicomekl River in Langley).
- Detention ponds and/or diversion with erosion protection need to be reviewed for Elgin, Anderson, and Mackereth Creeks.
- Consistent riparian setbacks need to be established and protected in the long term.
- Habitat restoration including riparian planting and gravel placement is necessary.

- Flapgates and pumps that presently block safe fish migration should be replaced with fish friendly structures.
- Creeks affected by agriculture, such as Anderson and Murray, require enhancement measures such as fencing, bank replanting, and erosion stabilization. Such habitat improvements applied to both the tributaries and the mainstem would likely lead to increased fish production.
- Education and stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- Municipal policies, bylaws or development permit area designations which provide stormwater management, prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

For Nicomekl River hydrograph, see Appendix 2.
For escapement information on the Nicomekl River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Serpentine River



Declining

Watershed Code : 900-0055-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0200
TRIM Map: 92G006, 92G007 and 92G017

STATUS:

Endangered - The Serpentine River and its tributaries have been impacted by riparian removal, channelization/dyking, agriculture, urbanization (many tributaries have >15% effective impervious surface area), and water quality problems.

Physiography

Drainage Area

The Serpentine (Tynehead) River watershed encompasses 154.2 km^2. The river drains southwest through Surrey into the northwest corner of Mud Bay. Some of the more significant tributaries include Hyland, Mahood (Bear), and Latimer Creeks. Damsite, Enver, Quibble and King Creeks are significant tributaries of Mahood Creek. There are at least ten unnamed creeks that are tributary to the Serpentine River. A list of gazetted names (and watershed codes) to the Serpentine River is provided in Appendix 1.

Stream Description

The headwaters of the Serpentine River are located at Guildford Mall (the library virtually sits on top of the old river channel). The Serpentine River is approximately 27 km long; it develops through marshy terrain in north Surrey and then flows across a moderately sloping plateau. The lower 22 km of the river flows in ditches and dyked channels through a lowland agricultural area and a wetland complex in the Serpentine Fen Wildlife Management Area. The stream exits into Mud Bay through an estuarine marsh/mudflat complex.

Hydrology

The mean annual flow of the Serpentine River is 6.23 m^3/s. The headwaters of the mainstem and several of its tributaries originate in heavily populated suburban areas. The system is flashy and has poor water quality due to urban runoff and large impervious areas. Irrigation in the lower reaches imposes a considerable demand on summer low flows resulting in low velocities and water temperatures often exceeding 23^{o}C. Flood gates at the mouth of the system prevents saltwater from flowing upstream at high tide. Mahood and Tynehead Creeks are particularly flashy systems due to storm runoff. They also experience low flows in the summer, and flooding with erosion in winter. Hyland Creek’s main channel has almost no flow in summer. The flood gates can impound water and restricts juvenile and adult migration under certain flow and tidal conditions.

Channel Stability Assessment (Preliminary)

The channel stability has been reduced by agricultural developments and urbanization. The lower reaches are dredged regularly by the dyking and drainage authority. Riparian removal, channelization, and water extraction for irrigation have destabilized flow patterns, resulting in bank erosion, scouring, sedimentation, and depressed summer flows. Riparian leavestrips throughout much of the drainage are minimal as much of the drainage system was developed prior to the development of current leavestrip requirements and standard approval conditions. Encroachments into approved leavestrip areas are also common.

Fisheries Resource

Fish Access

Fish access is limited to the Serpentine River by flood gates at the mouth. Access is provided when sufficient hydraulic head is available to open the gates. Anadromous fish access is restricted by several impassable culverts along the Serpentine River to intersection of 154A St. and 106th Ave., to the King George Highway on Hyland and Quibble Creeks, and to 200th St. on Latimer Creek. Anadromous fish have access to the headwaters of Mahood, King, Enver, Lay, and Damsite Creeks.

Fish Stocks

The Serpentine River and its tributaries support runs of coho and chinook salmon; cutthroat, steelhead, and rainbow trout; three-spine stickleback, prickly sculpin, and western brook lamprey.

Restoration/Enhancement

The Serpentine Enhancement Society operates the Tynehead Hatchery, which produces coho, chinook and chum salmon. The City of Surrey has undertaken a program of enhancing Hyland Creek, including side channels, instream habitat creation, and riparian area planting. Bank protection, gravel placement, debris removal, bridging and weir placement were conducted on Hyland Creek, mainly as compensation for diversion activities. King Creek has had a culvert replaced with a reconstructed channel to compensate for a culvert elsewhere. A clean-up program was conducted on Latimer Creek. Fencing and riparian revegetation are occurring throughout the system on an opportunistic basis.

Specific enhancement projects include: stream complexing at 152nd St. on the Serpentine River along the north side of 64th Ave; a constructed wetland in Sullivan Park (152nd and 62 Ave.) to improve water quality and reduce peak flows; aeration on the Serpentine River (near the Tynehead Hatchery) to increase dissolved oxygen levels; and boulder placement and habitat compensation on Bear Creek.

There are many other opportunities for enhancement on the Serpentine River and its tributaries; however, the hydrological implications of urban development could undermine these.

Fish Production

The headwaters of the Serpentine River provide the only suitable spawning habitat in the mainstem; good habitat is found throughout Tynehead Park. Latimer Creek and several of its tributaries have high rearing potential; however rearing habitat is limited by a lack of riparian vegetation and dyking in the lower reaches, which have simplified the system. An unnamed tributary of Latimer Creek provides excellent spawning substrate. Lay Creek has limited spawning and rearing habitat through most of its length. Spawning in Mahood Creek occurs between 128th St. and 150th St., and fish have been observed throughout the system.

Activities and Land Use

Agriculture

Agriculture is primarily located on the lower mainstem floodplain and is scattered throughout the upland tributaries. Irrigation in the lower reaches imposes a considerable demand on summer low flows. Leachate from corn silage has a high dissolved oxygen demand and produces very depressed dissolved oxygen concentrations. Over-fertilization is suspected to be a problem; there are water quality problems because of manure/fertilizer/pesticide handling and management. Intensification of agricultural activities is of concern.

Mining

None.

Forestry

Urban development and concurrent land clearing is occurring throughout the mid and upper reaches of the system.

Secondary Industry/Commercial

A total of 7.4% of the watershed is classified as industrial or commercial, the majority of which is located along Hyland Creek. The industrial and commercial area adjacent to Hyland Creek is expected to increase by 20%. Chemical spills and runoff from industrial sites into Hyland Creek, including spills from a plastics manufacturing plant, have resulted in large numbers of fish kills and reduced water quality. The potential for similar spills exists for Quibble Creek. Lay Creek has experienced significant commercial development. The upper reaches of Mahood Creek are within industrially zoned land. There are two golf courses along the lower reaches of Mahood Creek.

Linear Development

The mainstem is dyked on one and/or both sides between the mouth and 1.5 km above the crossing of Highway 15. The Burlington Northern Railway crosses the mouth; Highway 99 and BC Hydro transmission lines cross 1 km upstream. Other transmission lines cross the river at 168th St. Linear development along Mahood Creek will increase with construction of a new highway. Another concern is the proposed highway alignment that is to transect the Serpentine Valley from the Serpentine Wildlife Management area to Hwy. 1 near Harvie Rd.

Urban Development

The Serpentine River continues to experience considerable residential development in the headwaters making its upper reaches the most urbanized of the large streams within the Fraser Delta Habitat Management Area. The drainages of Mahood, Hyland, Bear, Damsite, Enver, King, Quibble, and Lay Creeks are almost completely urbanized. Floodproofing is extensive from the mouth up to 88th Avenue. There are plans to dyke up to 168th Street. The upper reaches of the Serpentine River (which lie within the Township of Langley) have just begun to develop (mostly commercial development). The upper headwaters of Latimer Creek are on the verge of intensive urban development. An estimated 13% of the entire Serpentine River watershed is covered by effective impermeable area. The EIA of the Mahood Creek watershed already exceeds 23%.

Government

The Serpentine River flows within the City of Surrey, with the headwaters of Latimer Creek extending into the Township of Langley (Greater Vancouver Regional District). Surrey holds restrictive covenants (to top of bank - 5 m minimum to 50 m maximum) on private properties bordering watercourses. The dyking activities are under the jurisdiction of the Surrey Dyking District, the Mud Bay Dyking District (between the Nicomekl River and the Serpentine River), and the Colebrook Dyking District (north of the Serpentine River). The tidal portions of the river fall within Fraser River Estuary Management Program boundaries.

Designated Lands

The Serpentine Fen Wildlife Management Area, managed by the Ministry of Environment, Lands, and Parks, occupies 78 ha on the lower river. Quibble Creek flows through Bear Creek Provincial Park. Green Timbers Urban Forest is located at the headwaters of King and Damsite Creeks. The upper reaches of the Serpentine River flow through Tynehead GVRD Regional Park from 161st St. to 168th St., between 102nd Ave. and 96th Ave. Frank Hurt, a small municipal park, is located along Bear Creek at 138th St. (east). Other parks on the Serpentine system include Hyland Park (on Hyland Creek), Bothwell Park (on the Serpentine River), Fleetwood Park, and a number of small parks in the headwaters of Mahood Creek.

The majority of the mainstem and the land surrounding lower Latimer Creek is within the Agricultural Land Reserve (ALR).

Watershed Planning Issues

Management Concerns

- Impoundment of summer low flows by the sea dam, located at the mouth of the river, combined with summer irrigation demand and high temperatures, leads to oxygen depletion in the lower reaches, subsequent fish kills and impaired habitat for coho and trout.
- Hyland Creek has a number of culverts which partially impede or prevent fish passage.
- Mahood Creek has serious coliform and leachate problems.
- Latimer Creek has limited habitat because of agricultural drainage, high temperatures, and low dissolved oxygen.
- Urban encroachment and industrial runoff/toxic (chemical) spills are ongoing concerns. Sediment control during development is a serious problem, as is the release of contaminated water from exposed aggregate driveways.
- Stormwater management is generally not adequate; flows are extremely flashy and summer flows are low. Drainage is currently directed to community ponds serving large areas and released generally from one storm outfall, leaving long stretches of creek without adequate baseflow.
- Increased dyking and floodproofing are degrading fish habitat.
- Agricultural runoff from fields degrades water quality and has caused fish kills.
- Culverts which eliminate gravel recruitment to downstream spawning areas is a concern.
- Widespread urban development concerns include siltation, runoff, and loss of riparian habitat.
- The poaching of returning chinook and coho at the mouth of the Serpentine River has become a problem.

Management Prescriptions

- A comprehensive stormwater management plan for the Serpentine System, including stormwater treatment, is required. Baseflow maintenance during low flow periods is essential. There should be a moratorium on water licenses.

- The comprehensive watercourse map produced by the City of Surrey needs to be used by the Community Development Department to guide settlement planning.
- Adherence to the *Land Development Guidelines* is needed to ensure environmentally responsible development.
- Riparian areas should be restored; this is particularly important in agricultural areas. Hardened banks should be minimized, and impassable culverts modified.
- Change dyking policy to allow shrubs, etc., on dyke slopes.
- Floodgates at the mouth of the river should be modified to reduce the head required to open the gates and reduce impoundment of the lower river.
- Instream cover and hydraulic diversity should be increased with boulders and root wads or other structures in areas with limited cover and complexity.
- An educational program regarding water conservation is needed.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Education and stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For Serpentine River hydrograph, see Appendix 2.
For escapement information on the Serpentine River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Eugene Brook

TREND → *Stable*

Watershed Code : 900-0072-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G006

STATUS:
Threatened - Portions of Eugene Brook have been channelized and/or dyked.

Physiography

Drainage Area

Eugene Brook drains the southernmost 1.5 km of Surrey and a small portion of Delta along the Delta/Surrey municipal boundary, and enters Mud Bay at 112th St.

Stream Description

Eugene Brook is one of several wetland systems that drain into Mud Bay. The lower reaches flow through abandoned field habitat; the upper half is in a ravine. The wetland area is almost 700 ha in size and is made up of 96% estuarine water and 4% estuarine low marsh.

Channel Stability Assessment (Preliminary)

The system is relatively stable. It is largely confined in ditches.

Hydrology

Portions of Eugene Brook become completely dry during the summer. A stormwater management plan has been developed to protect the ravine area of the creek.

Fisheries Resource

Fish Access

Fish access is unrestricted to the headwaters when there is flow. Pump stations at either end pose partial barriers to fish.

Fish Stocks

Eugene Brook and its unnamed tributaries support runs of coho salmon, cutthroat trout, brown bullhead, three-spined stickleback, and carp.

Restoration/Enhancement

There is a proposal to divert flows from the Colebrook system to Eugene Brook, north of the Serpentine River, to improve spawning and rearing habitat. The proposal would also divert the lower reaches through a forested area where fish habitat features could be established. There are many other enhancement opportunities providing flows can be sustained.

Fish Production

Coho spawn in Eugene Brook.

Activities and Land Use

Agriculture

Agriculture is the dominant land use within the watershed.

Mining

There is an active gravel pit in the watershed.

Forestry

While there is no commercial forest harvesting in the watershed, land has been cleared to accommodate agricultural and residential development.

Secondary Industry/Commercial

There is no secondary industry and very little commercial activity.

Linear Development

The stream and/or its tributaries are crossed in several locations by Highways 10, 91, and 99, and by the Burlington Northern and British Columbia railways.

Urban Development

Residential development is increasing in the upper watershed.

Government

Eugene Brook is within the City of Surrey and the District of Delta (Greater Vancouver Regional District).

Designated Lands

The land surrounding Eugene Brook is entirely within the ALR.

Watershed Planning Issues

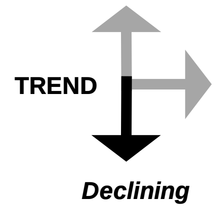
Management Concerns

- The gravel pit may create some siltation and water quality problems.
- Sewage spills into the creek are a concern. The GVRD has proposals to upgrade the sewage system.
- Pump stations create partial barriers to fish movement.
- At certain times, the large amount of agricultural activity in the basin exacerbates erosion and run-off concerns, which affects water quality.
- The potential development of the upper watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, authorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Partial barriers to fish should be addressed, and the flow augmented.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- In new subdivisions, build ditches instead of culverts, and no ditches wherever possible.
- A comprehensive water and land use plan could contribute considerably to restoration of this stream.

Nooksack River
Tributaries



Watershed Code : 970-0468-various
RAB Code: 90-0040 and 90-0050
TRIM Map: 92G008 and 92G009

STATUS:

Endangered - The Nooksack River tributaries (Canadian side) have been channelized/dyked, denuded of riparian vegetation, and have poor water quality.

Physiography

Drainage Area

Canadian tributaries of the Nooksack River include Bertrand Creek and its tributary McNair Creek, Cave Creek and its tributaries, Howes and Bori Creeks, Fishtrap Creek and its tributaries Pepin Creek and Enn's Brook. A list of the Canadian tributaries (and watershed codes) to the Nooksack River is provided in Appendix 1. The total watershed area of the Nooksack River tributaries is unavailable. The system drains southwest from Langley and Abbotsford through northern Washington State.

Stream Description

The Nooksack River tributaries originate in the Central Fraser Valley uplands and are part of a floodplain forest system. The wetland area of Bertrand Creek is approximately 20.8 ha and is classified as 90% stream swamp and 10% stream water. The wetland area of Pepin Creek is approximately 131 ha and is classified as 50% floodplain swamp and 50% stream water. Cave Creek is small and ditch-like.

Hydrology

Flows in the Nooksack River tributaries are affected by agriculture and development (low summer flows, high winter flows). The upper reaches of Enn's Brook and East Fishtrap Creeks have experienced high summer temperatures. Howes Creek has been diverted and sections of the creek dry completely during the summer. Bertrand Creek is a very flashy system. Pepin Creek is fed by a local aquifer; water depth and temperature are good throughout the tributary.

Channel Stability Assessment (Preliminary)

Gravel pits on Pepin Creek are increasing sedimentation in the tributary. Erosion on Enn's Brook and East Fishtrap Creeks has increased due to land clearing and construction. Fishtrap and Bertrand Creeks have been widened and deepened for flood control. There has also been extensive riparian vegetation removal, alteration of natural stream morphology, and bed destabilization. Erosion is increasing throughout the system.

Fisheries Resource

Fish Access

Anadromous fish have access to the headwaters of Pepin Creek, McNair Creek, and Howes Creek; to the Fraser Highway in the right branch of Fishtrap Creek; to 264th Street on Bertrand Creek; up to a culvert at Simpson Road on Waechter Creek; and up to the Blueridge Drive culvert on Enn's Brook. Coho salmon and cutthrout trout have access to a small pond off of East Fishtrap Creek north of MacLure Road.

Fish Stocks

Tributaries of the Nooksack River support runs of coho salmon; cutthroat, steelhead, and rainbow trout; as well as prickly sculpin, three-spine stickleback, and western brook lamprey; and endangered stocks of Salish sucker and Nooksack dace.

Restoration/Enhancement

Riparian areas have been planted along a portion of Fishtrap Creek by the Environmental Youth Team. An Abbotsford stormwater detention project upstream of the TransCanada Highway (Hwy. 1) to the headwaters has created good wetland habitat. However, the non-hydrological benefits to salmonids have not been determined. Several approved diversions on West Enn's Brook were compensated for spawning and rearing habitat restoration packages. The Bertrand Creek riparian zone was re-planted and cleaned up in the summer of 1994 along its entire length. Marsh bench replanting has been conducted on Bertrand Creek for biofiltration purposes. Regulations prohibiting Salish sucker retention have been recommended for the Nooksack system.

Fish Production

Bertrand Creek has excellent spawning and rearing habitat in the lower reaches. The reaches along the mainstem of Cave Creek are very productive rearing areas when flows are adequate. West Enn's Brook has good spawning potential to the headwaters but stream diversions in the past have reduced headwater spawning. Rearing has been observed up to Canary Crescent. Spawning and rearing have been observed in Pepin Creek up to Bradner Road. Salish suckers spawn in the upper headwaters of Pepin Creek. Pepin Creek provides excellent salmonid rearing habitat, and is the least disturbed of the international streams. Howes Creek provides overwintering habitat for coho and cutthroat trout. Waechter Creek provides spawning and rearing habitat up to Simpson Road.

Activities and Land Use

Agriculture

Agriculture is the primary land use adjacent to Waechter and Cave creeks. The stream banks along Bertrand Creek have been virtually denuded of riparian vegetation.

Mining

There are several gravel pits in the watershed. Gravel removal and related activities are increasing erosion and sedimentation in Pepin Creek.

Forestry

Forestry is not present as an industry, but substantial deforestation for development has occurred.

Secondary Industry/Commercial

There is light industry in the mid reaches of East Fishtrap Creek. An auto mall is located along upper Fishtrap Creek. Three composting facilities operate within the watershed. An asphalt plant (north of Huntington Rd. and west of Lefeuvre, which is gone now) emitted a perpetual oil release into Pepin Creek. Leachate flows into a tributary of Pepin Creek from a composting plant (north of Huntington Rd. and west of Lefeuvre). There was a large oil spill into Bertrand Creek (just west of 272nd) in the early 1980s.

Linear Development

The TransCanada Highway (Hwy. 1) and a gas pipeline cross several of the Nooksack tributaries near the town of Clearbrook. BC Hydro transmission lines cross Bertrand and Howes Creeks. A number of roads cross the creek, including Highway 13.

Urban Development

There is substantial development around McNair Creek and in the headwaters of Pepin Creek and Fishtrap Creek. Development on Bertrand Creek is extremely close to the stream and there is little vegetation remaining along the stream. There is some urban development on Waechter Creek. Enn's Brook has been diverted in several locations in order to facilitate development, which has caused significant habitat damage.

Government

The Canadian tributaries of the Nooksack River are located in the Township of Langley (Greater Vancouver Regional District) and the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

The headwaters of Bertrand Creek originate within the CFS Aldergrove property. The Aldergrove sewage treatment plant is located on Bertrand Creek. Fishtrap Creek drains a portion of Abbotsford Airport, and Pepin Creek flows adjacent to the Matsqui Indian Reserve #4. Pepin Creek flows through Aldergrove Lake Regional Park. Most of the Nooksack tributary watersheds are within the ALR (the headwaters of Bertrand and Fishtrap Creeks are in urban areas).

Watershed Planning Issues

Management Concerns

- Fishtrap Creek has been proposed as a flood control pilot project (0 Ave. to Huntington Rd.) which would necessitate removal of vegetation and widening and deepening of the channel.
- Municipal pressure to improve storm drainage in Bertrand and Fishtrap Creeks is an ongoing issue.
- Substantial development is occurring in the headwaters of the Nooksack tributaries, including development such as the auto mall at Mt. Lehman (Fishtrap Creek).

- Concerns over water quality in the Abbotsford aquifer from related agriculture activities have an international context.
- Present practices of continued land development will affect salmonid habitat and the survival of the endangered Salish sucker and Nooksack dace.
- The fish produced in the Nooksack River tributaries are exposed to a substantial sport and commercial fishery in Bellingham Bay. Efforts to improve channel capacity downstream of the Canada/US border, including the partial channel obstructions near Lynden, Washington, do not seem to be pursued with equal vigour.
- There is a proposal to open a new gravel pit in the Pepin Creek Ravine between Simpson and Huntington Roads.
- Municipal sewage and residential runoff enter Bertrand Creek. A composting operation north of Huntington Road and west of Lefeuvre Road is reported to be releasing leachate into a tributary that flows into Pepin Creek.
- A wetland on East Fishtrap Creek, downstream of the TransCanada Highway (Hwy. 1), requires protection.
- Low summer flows are exacerbated by development and groundwater withdrawal.
- Due to riparian removal, there is a lack of cold water refuges for fish.
- The intensive development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

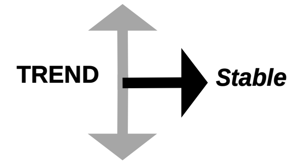
- The denuded riparian areas should be planted; the enclosed sections of the headwaters daylighted, and fences installed to prevent cattle from trampling stream banks.
- Any re-development of the Canadian Armed Forces Base should be closely monitored as it has the potential to affect several small tributaries and a large wetland that are virtually untouched at present. Should any re-development of the base take place, much of the crown land should be set aside to protect key headwater functions of several tributary streams.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are urgently required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

Chapter 2 – Fraser River South Shore Tributaries

<u>Maps</u> .... <u>Page</u>

Map 2 – Richmond/Delta Area

Delta/Richmond Sloughs



Watershed Code: 100-various (Fraser River tributaries)
TRIM Map: 92G005, 92G006, 92G015 and 92G016

STATUS:

Endangered - The sloughs in the Delta/Richmond area have been highly impacted by channelization, riparian removal, and have poor water quality. These sloughs are generally cut off from direct connection to the Fraser River or the Strait of Georgia by the dyking system.

Physiography

Drainage Area

The Delta/Richmond Sloughs drain the Fraser River delta. The sloughs flow through agricultural and urban areas before discharging into the Fraser River or the Strait of Georgia. The sloughs that form major drainage corridors for lands behind dykes in Delta and Richmond include London Slough, Tamboline Slough, Cohilukthan Slough, Crescent Slough, Tilbury Slough, Gilmour Slough, Ewen Slough, Deas Slough, Woodward Slough, Bath Slough, and No. 7 Road Slough.

Slough Description

The sloughs flow through the lower Fraser River delta. Historically, the area supported extensive estuarine wetlands. Over the last 130 years the area has been dyked, drained and filled to accommodate agricultural and urban developments. Intensive land use practices led to extensive riparian vegetation removal and have resulted in poor water quality. Recently the area has been impacted by rapid urbanization. Many of the sloughs now flow through residential and commercial areas. The majority of the remaining sloughs have been channelized and dyked.

Hydrology

The flow regime of these sloughs has been severely modified and most often act as storm drainage channels. Pump houses, flapgates, etc., have been installed to control the flow in many of the sloughs. The urbanization of the local area has resulted in a high effective impermeable area that adds to the degradation of the sloughs. The combination of low flows and riparian vegetation removal has elevated the summer water temperature in many of the sloughs. Some sloughs such as Oliver Slough drain water from highland areas.

Channel Stability Assessment (Preliminary)

The majority of the sloughs have been channelized and dyked, or are behind dykes. Therefore they are very stable channels. The local dyking authorities maintain the sloughs to reduce the risk of flooding. Large portions of many sloughs have been buried and flow though culverts, under city streets.

Fisheries Resource

Fish Access

Anadromous fish access to most of the sloughs is restricted by pump houses and flap gate structures. Juvenile salmonids can enter the sloughs when they are flooded for agricultural purposes during the summer growing season. Non-anadromous fish have been reported throughout many of the sloughs.

Fish Stocks

The sloughs that form major drainage corridors for lands behind dykes in Delta and Richmond include London Slough, Tamboline Slough, Cohilukthan Slough, Crescent Slough, Tilbury Slough, Gilmour Slough, Ewen Slough, Deas Slough, Woodward Slough, Bath Slough, and No. 7 Road Slough. These sloughs support non-anadromous fish species, including carp, stickleback, suckers, and brown bullhead. Juvenile salmonids utilize accessible portions of the sloughs during high flows in the mainstem. Coho salmon and cutthroat trout have been reported in the 112th Street ditch, a tributary to Oliver Slough. Adult coho and cutthroat were observed at the Oliver pump station in 1996. Cutthroat trout, juvenile salmon, sticklebacks, and sculpins have been observed in Tilbury Slough. Juvenile chinook, in particular Harrison stock, utilize all the sloughs when accessible.

Restoration/Enhancement

The City of Richmond has assessed the sloughs for fish and wildlife values. Modifying backflooding techniques to avoid trapping salmonids has been identified as an enhancement and protection opportunity. The west arm of London Slough enters the Reifel Bird Sanctuary, where it is protected from development. Oliver Slough has potential for upgrading, restoration and enhancement. A Richmond Youth Group is currently completing enhancement projects on Bath Slough.

Fish Production

Salmonid fish production in these cut off sloughs is minimal. In some cases fish may enter these sloughs and not survive. In certain sloughs such as Oliver Slough some production potential with restoration is a real possibility.

Activities and Land Use

Agriculture

Historically agriculture was the primary land use in this area. Although it still occupies large portions of the area, it has been replaced elsewhere within the region by residential and commercial developments.

Mining

There is limited peat mining in certain areas.

Forestry

While there is no commercial forest harvesting in the area, land has been cleared to accommodate agricultural, commercial waste disposal and residential developments.

Secondary Industry/Commercial

There are several industrial parks located within the sloughs and commercial development has been rapidly increasing. The industrial activities include sewage treatment plants, cement plants, chemical plants, landfills, shipyards, and pulp and paper mills. Peat has been commercially removed from areas along the sloughs.

Linear Development

The sloughs are crossed by numerous roads, highways, railways, and hydro transmission corridors.

Urban Development

Many of the sloughs drain through highly developed urban areas and act as a collector system for stormwater from the various drainage systems.

Government

The sloughs are located in the City of Richmond and the District of Delta (Greater Vancouver Regional District).

Designated Lands

The majority of the remaining agricultural land in this area is located within the Agricultural Land Reserve. Cohilukthan, Woodward, No. 7 Road, and Crescent Sloughs are located in the ALR. There are many conservation areas and parks including the Alaksen National Wildlife Area, Deas Island Regional Park, Reifel Bird Sanctuary, and Ladner Harbour Park. Gunn and Rose Islands have been purchased and will be protected by the Canadian Wildlife Service.

Management Concerns

- Fish access can be restricted or juvenile salmonids can become trapped when water levels drop.
- Water quality of the sloughs is a concern, as they are not adequately flushed and can accumulate non-point source contaminants which drain directly to the Fraser River.
- Fish are often killed by irrigation pumps.
- Delta has plans to create an irrigation supply system that would withdraw water from Oliver Creek.
- There is a dump located near Crescent Slough.
- Many of the sloughs have severe water quality problems.

Management Prescriptions

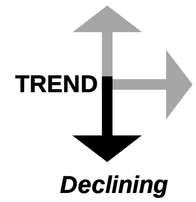
- The drop structure upstream of the railway bridge on Oliver Creek should be improved.
- Previous restoration works in Tilbury Slough (i.e. channelization behind the dyke, debris boom at the mouth) need to be monitored and remedial works undertaken as necessary.
- A thorough review of all the flapgates and pump stations in the sloughs should be completed to identify problems and suggest enhancement opportunities.

- A comprehensive signage, fencing, and public awareness program is required to inform residents of the value of these sloughs as fish habitat and to address littering, trespass, and vandalism issues.
- Non-point sources of pollution (i.e. road runoff, agricultural runoff, pesticides, etc.) need to be curtailed and agricultural/commercial stewardship programs which emphasize education are required.
- Restoration is the priority on most of these sloughs.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 3 – Delta/Surrey Area

Cougar Canyon Creek



Watershed Code : 100-0145-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0160
TRIM Map: 92G016

STATUS:

Endangered - Cougar Canyon Creek has been channelized, the water quality is poor, and much of the riparian vegetation has been removed. The watershed has 21% effective impermeable area.

Physiography

Drainage Area

The total watershed area of Cougar Canyon Creek and its unnamed tributary is 7.4 km^2. The creek originates at Strawberry Hill, west of Newton, and drains northwest from Surrey through Delta into City Reach (on the Fraser River) at the Alex Fraser Bridge. It is reported that the stream flowed south through Burns Bog and into Boundary Bay prior to diversion to the north with the building of the Burlington North Railroad.

Stream Description

Cougar Canyon Creek drains through a residential area with significant effective impervious area. The upper reaches of the stream flow within a ravine between Strawberry and Sunshine Hills, eventually entering a long ditch through which the stream flows until it enters the Fraser River.

Hydrology

The estimated mean annual flow of Cougar Canyon Creek is 0.26 m^3/s. Cougar Canyon Creek lies within a highly developed residential area, with an extensive instream stormwater detention system. Urban development has increased the impervious area and promoted flood events which have caused erosion and bedload movement in the stream. This has damaged a community fish incubator downstream.

Channel Stability Assessment (Preliminary)

The stream is eroding the banks and valley walls of the ravine through which it flows. The lower slopes of the ravine were stabilized with gambions that have not been maintained, and are no longer functional. There are substantial gravel deposits and sedimentation at the mouth of the stream and at the railroad culverts which requires periodic dredging.

Fisheries Resource

Fish Access

Anadromous fish access is restricted to 72nd Avenue by an impassable culvert. A floodgate at the mouth restricts access under some tides and streamflows.

Fish Stocks

Cougar Canyon Creek and its unnamed tributary support stocks of coho, chum and chinook salmon; and rainbow and cutthroat trout.

Restoration/Enhancement

The Cougar Canyon Enhancement Society has operated a small (50,000 eggs) coho incubator for several years which is located approximately 200 m downstream of 112th St. A series of ongoing stream clean-ups commenced in 1986. In 1988, the flap gate near the mouth of the stream was modified to improve fish passage. The Boy Scouts have adopted a trail system in the ravine.

There are several enhancement opportunities downstream of the railway, which need to be further investigated. The possibility of moving the entire stream to establish it in a forested area near Burns Bog and to recreate some natural features is being examined.

Fish Production

The current and potential fish production of Cougar Canyon Creek is not fully known. However, it has been determined that spawning occurs from 2.5 km to 4.5 km upstream of the mouth and that rearing occurs between the mouth and 4.5 km upstream. The contribution of the incubator to production in the system is not known.

Activities and Land Use

Agriculture

A peat farm/plant used to operate within the drainage basin, but has been dismantled.

Mining

Peat mining occurs in Burns Bog.

Forestry

While there is no commercial forest harvesting in the watershed, parcels continue to be cleared to accommodate additional development.

Secondary Industry/Commercial

A lumber mill is located near the mouth; in the 1970s the mill deposited large volumes of woodwaste along the banks of the creek, which severely degraded water quality. An industrial park is located in the watershed under the Alex Fraser Bridge. 9.4 % of the drainage area is classified as commercial or industrial. Commercial development is expected to increase in the Surrey headwaters.

Linear Development

The lower reaches, which are used by salmon, are paralleled by two sewer trunk lines and the Burlington Northern Railway, which crosses the creek further upstream. At its mouth, the stream is crossed by the elevated Alex Fraser Bridge - Highway 91 (constructed 1985-87). The upper reaches are transected by numerous residential streets and thoroughfares.

Urban Development

The stream drains a residential area in Surrey, and a dense residential and commercial area in Delta. The Surrey portion of the watershed has been developing rapidly over the last few years. The effective impermeable area of the Cougar Canyon Creek watershed is high at 20.8% and has caused significant damage to fish habitat. To facilitate drainage, Delta removed riparian vegetation from the ditched portions of the stream in the 1980s. The municipality was advised not to do this again, since this was a violation of the Fisheries Act.

Government

Cougar Canyon Creek is in the District of Delta with headwaters in the City of Surrey (Greater Vancouver Regional District).

Designated Lands

The Delta Nature Reserve, Cougar Canyon Park, Gunderson Park, Chalmers Park, and several other small municipal parks lie within or adjacent to the watershed.

Watershed Planning Issues

Management Concerns

- Channelization and over development of the watershed accompanied by ineffective mitigation measures have largely compromised and destroyed this creek as a viable salmonid stream. However, options are available for restoration.
- Water quality is a major concern. Sewer lines are reported to leak, spill and overflow into the creek. Proposed work to upgrade sewer lines could seriously affect the creek, but if done properly could benefit the creek in the long term. The stormwater drainage from residential and commercial areas in the headwaters, and leachate from the lumber mill, degrade the water quality. The water temperature in the stream is often above the lethal range for fish.
- Annual dredging of a portion of the stream alongside the railway eliminates gravel recruitment and riparian vegetation.
- A floodgate at the mouth restricts access under certain tidal and streamflow conditions.
- Two debris traps where the creek reaches the railroad may be of concern.
- Delta municipality plans to construct a road on top of the two main sewer lines which parallel the stream, a development which could affect the stream.

- Additional development in the Surrey portion of the watershed will increase the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal. A recent large stormwater discharge was located downstream of the existing stormwater detention pond complex.

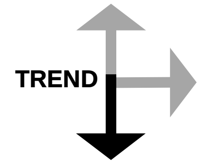
Management Prescriptions

- A water management plan for the watershed is required. It should require better stormwater detention and encourage natural infiltration to reduce peak flows, augment baseflows, and reduce non-point source pollutant introduction into the system from roads, parking lots, and other impermeable surfaces.
- A serious examination into relocating the lower reaches of the stream into its old channel should be undertaken.
- Riparian re-planting and complexing of the stream should be considered.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Restoration is a priority on this system.

For Cougar Canyon Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

McAdam Creek

Watershed Code : 100-0158-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G016



Declining

STATUS:

Endangered - McAdam Creek has been channelized and impacted by urbanization.

Physiography

Drainage Area

The watershed area of McAdam (Howell) Creek is unavailable. The creek flows northwest through north Delta entering the Fraser River at the opening to Gunderson Slough, 1.7 km upstream of the Alex Fraser Bridge.

Stream Description

McAdam Creek is approximately 1.6 km long. A comprehensive inventory of this stream has not been completed.

Hydrology

The large amount of effective impervious area in the watershed has led to an increase in stormwater flows, causing McAdam Creek to become flashy. Stormwater flows also contribute to streambank erosion.

Channel Stability Assessment

No geomorphological data is available. Due to surrounding development, no off channel habitat remains. McAdam Creek runs through a ravine, which still retains riparian vegetation.

Fisheries Resource

Fish Access

Extent of fish distribution in the system is not known.

Fish Stocks

Rearing coho salmon and cutthroat trout are found in McAdam Creek.

Restoration/Enhancement

No specific enhancement opportunities have been identified.

Fish Production

There is current potential production of coho and cutthroat.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Over the years, forest cover has been cleared for urban development.

Secondary Industry/Commercial

A lumber mill is located on Gunderson Slough.

Linear Development

The Burlington Northern Railway crosses the mouth of the stream; River Road and several local streets cross the stream.

Urban Development

McAdam Creek flows through a highly developed residential area.

Government

McAdam Creek is in the District of Delta (Greater Vancouver Regional District).

Designated Lands

None.

Watershed Planning Issues

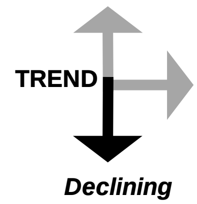
Management Concerns

- The intensive development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges, bank alterations and riparian removal.

Management Prescriptions

- A survey to better evaluate fish habitat and options to restore the stream is needed.
- Stormwater detention and infiltration is a priority on this system to naturalize streamflows and ameliorate non-point source pollutant introduction from urban runoff.
- Extensive channelization has limited fish production potential, and off channel habitat creation opportunities should be explored.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values (through storm drain marking, etc.) of this system are required.
- Municipal policies, bylaws or development permit area designations which provide stormwater management plans, prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas are required.

Collings Creek



Watershed Code: 100-unavailable Fraser River tributary
RAB Code: Unavailable
TRIM Map: 92G016

STATUS:

Endangered - Collings Creek has been channelized and impacted by urbanization.

Physiography

Drainage Area

The watershed area of Collings (White) Creek and its unnamed tributary is unknown. The creek flows north through Delta entering City Reach (Gunderson Slough) approximately 1.8 km upstream of the Alex Fraser Bridge at Collings Road.

Stream Description

Collings Creek is approximately 1.4 km long. A comprehensive inventory of this stream has not been completed.

Hydrology

The large amount of effective impervious area in the watershed has led to an increase in stormwater flows, causing Collings Creek to become flashy. Stormwater flows also contribute to streambank erosion.

Channel Stability Assessment

No geomorphological data are available. Due to surrounding development, no off-stream habitat remains. Part of Collings Creek runs through a ravine, which still retains riparian vegetation.

Fisheries Resource

Fish Access

The extent of fish distribution in the system is not known.

Fish Stocks

Collings Creek and its unnamed tributary support stocks of coho salmon and cutthroat trout.

Restoration/Enhancement

No specific enhancement opportunities have been identified.

Fish Production

There is current potential production of coho salmon and cutthroat trout.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Over the years, forest cover has been cleared for urban development.

Secondary Industry/Commercial

A lumber mill is located on Gunderson Slough across from the mouth of Collings Creek.

Linear Development

The Burlington Northern Railway crosses at the mouth of Collings Creek; River Road and a number of local streets cross the mid to upper reaches.

Urban Development

Collings Creek flows through a highly developed residential area.

Government

Collings Creek is in the District of Delta (Greater Vancouver Regional District).

Designated Lands

None.

Watershed Planning Issues

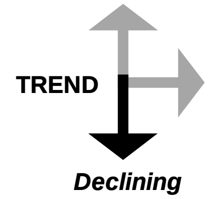
Management Concerns

- The intensive development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges, bank alterations and riparian removal.

Management Prescriptions

- A survey to better evaluate fish habitat and options to restore the stream is needed.
- Stormwater detention and infiltration is a priority on this system to maintain natural streamflows and ameliorate non-point source pollutant introduction from urban runoff.
- Extensive channelization has limited fish production potential, and off channel habitat creation opportunities should be explored.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values (through storm drain marking, etc.) of this system are required.
- Municipal policies, bylaws or development permit area designations which provide stormwater management plans, prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas are required.

Knudson Creek



Watershed Code: 100-unavailable Fraser River tributary
RAB Code: Unavailable
TRIM Map: 92G016

STATUS:

Endangered - Knudson Creek has been channelized and impacted by urbanization.

Physiography

Drainage Area

The total watershed area of Knudson Creek is unknown. The creek enters the Fraser River at Gunderson Slough, approximately 2.8 km upstream of the Alex Fraser Bridge.

Stream Description

Knudson Creek is 0.9 km in length. A comprehensive study of the stream has not been conducted.

Hydrology

The large amount of effective impervious area in the watershed has led to an increase in stormwater flows, causing Knudson Creek to become flashy. Stormwater flows also contribute to streambank erosion.

Channel Stability Assessment

No geomorphological data are available. Due to surrounding development, no off-stream habitat remains. Part of the creek runs through a ravine, which still retains riparian vegetation.

Fisheries Resource

Fish Access

The culvert at the headwaters under River Road poses a 1 m high barrier to fish migration.

Fish Stocks

Knudson Creek supports runs of coho salmon and cutthroat trout. There are unconfirmed reports of rainbow trout, stickleback, and sculpin in the system.

Restoration/Enhancement

Improvements to the River Road culvert would provide access to more fish habitat.

Fish Production

There is current potential production of coho and cutthroat.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Over the years, forest cover has been cleared for urban development.

Secondary Industry/Commercial

There is some light/medium industry near the mouth of Knudson Creek. There have been significant water quality problems in Gunderson Slough over the years from industry and boat marina discharges. There is a metal and pole treatment plant in the area.

Linear Development

The Burlington Northern Railway crosses at the mouth of Knudson Creek; River Road and a number of local streets cross the mid to upper reaches.

Urban Development

The mid to upper portions of Knudson Creek that flow through a ravine are surrounded by urban residential areas.

Government

Knudson Creek is the District of Delta (Greater Vancouver Regional District).

Designated Lands

Several small municipal parks are located along Knudson Creek.

Watershed Planning Issues

Management Concerns

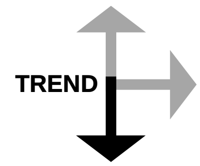
- The culvert at the headwaters of Knudson Creek under River Road poses a 1 m high barrier to fish migration. Removal of this culvert would provide access to upstream habitat.

- The intensive development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges, bank alterations and riparian removal.

Management Prescriptions

- Stormwater detention and infiltration is a priority on the Knudson Creek system to maintain natural streamflows and ameliorate non-point source pollutant introduction from urban runoff.
- Extensive channelization has limited fish production potential, and off channel habitat creation opportunities should be explored.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values (through storm drain marking, etc.) of this system are required.
- Municipal policies, bylaws or development permit area designations which provide stormwater management plans, prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas are required.

Manson Canal



Declining

(Hanson Ditch)

Watershed Code : 100-0185-000-000-000-000-000-000-000-000-000-000
Scott Creek (west tributary): 100-0185-448-000-000-000-000-000-000-000-000-000
Robson Creek (east tributary): 100-0185-489-000-000-000-000-000-000-000-000-000
RAB Codes: Unavailable
TRIM Map: 92G016

STATUS:

Endangered - The Manson Canal watershed has been heavily impacted by urbanization (poor water quality, riparian removal, high effective impermeable area). Two tributaries have been eliminated.

Physiography

Drainage Area

The total watershed area of Manson Canal (Hanson Ditch) is 4.8 km^2. This includes the tributary Scott Creek and excludes the tributary Robson Creek. Scott Creek is a western tributary to Manson Canal. Robson Creek was originally a separate creek entering the Fraser River at the top of Annieville Channel. It is now an eastern tributary of Manson Canal. Manson Canal flows northwest as a south shore tributary to the Fraser River, entering the Fraser approximately 1 km upstream of Shoal Point.

Stream Description

The small stream is groundwater fed. The lower reaches of the stream were channelized and enhancement work was done during construction of the Alex Fraser Bridge. Robson Creek has been ditched and culverted.

Hydrology

The estimated mean annual flow of Scott Creek is 0.17 m^3/s. Winter low flows, and runoff associated with urban development are of significant concern.

Channel Stability Assessment (Preliminary)

Manson Canal and the portion of Scott Creek on the Fraser River floodplain have been channelized; however it is considered a relatively stable system.

Fisheries Resource

Fish Access

Anadromous fish access is impeded but not prevented by the pump station on Manson Canal. Fish have access upstream to 124th St.

Fish Stocks

Manson Canal and its tributaries support stocks of coho salmon; steelhead and cutthroat trout; suckers, chub, and stickleback.

Restoration/Enhancement

Anadromous fish access was improved during highway work for the Alex Fraser Bridge. Additional highway works, including better designed culverts, are improving fish access.

Fish Production

There is current potential production of coho salmon and cutthroat trout.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Over the years, land has been cleared of trees for urban development.

Secondary Industry/Commercial

Industrial growth is increasing along the lower 4 km of Manson Canal. A lumber mill and several auto wreckers are present on the former flood plain. In the 1970s and early 1980s the area was filled with woodwaste causing significant leachate problems.

Linear Development

The Canadian National and Burlington Northern railways cross the stream about 350 m upstream from the mouth. Scott Road and River Road, as well as several local streets, cross the system. A new route, the South Fraser Perimeter Road, is proposed for this area.

Urban Development

Extensive residential development is occurring within the watershed. The Eagle Ridge development converted two tributaries into storm drains. The effective impermeable area of the Scott Creek (west tributary of Manson Canal) drainage is 38%.

Government

Manson Canal is in the City of Surrey (Greater Vancouver Regional District). The Surrey Department of Public Works operates a pump house on Manson Canal.

Designated Lands

None.

Watershed Planning Issues

Management Concerns

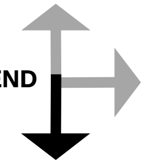
- When operating, the Manson pump station is of the type that will kill migrating fish. The pump does not run frequently; however it does impede fish passage.
- Poor water quality from urban development and wood waste landfilling (leachate) threaten Manson Canal. There is hogfuel to a depth of 8 feet covering much of the area near the stream.
- The proposed South Fraser Perimeter Road is to go through this area; compensation works will likely accompany this development.
- The intensive development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- A serious evaluation of the feasibility of collecting hillside water from tributary streams and feeding them into a restored and protected channel should be undertaken.
- Restoration is the priority for the Manson Canal system.
- The Manson pump station should be made fish friendly.
- The problems of both non-point sources and point-source leachate need to be addressed.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values (through storm drain marking, etc.) of this system are required.
- Municipal policies, bylaws or development permit area designations which provide stormwater management plans, prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas are required.

For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Barker Creek

TREND

Declining

Watershed Code: 100-0219-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G026

STATUS:

Endangered - Barker Creek has been channelized and impacted by urbanization.

Physiography

Drainage Area

The total watershed area of Barker (Bolivar) Creek is unknown. The creek flows north through Surrey to the Fraser River entering Queens Reach at Sapperton Channel.

Stream Description

The stream is groundwater fed and enters a wetland area which is characterized as 98% stream water and 2% tidal freshwater marsh.

Hydrology

No hydrological data are available.

Channel Stability Assessment

No geomorphological data are available.

Fisheries Resource

Fish Access

Anadromous fish access is possible to the culvert at 114th Ave; beyond this point a series of impassable culverts restrict access. Flap gates (which are part of the pump station at the mouth of the river) prevent fish passage when closed.

Fish Stocks

Barker Creek supports stocks of coho salmon, cutthroat trout, and peamouth chub.

Restoration/Enhancement

Limited enhancement opportunities exist without the removal or modification of the culverts at (and beyond) 114th Street. Valuable fish habitat has been identified upstream of these barriers.

Fish Production

No information on fish production is available.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, land has been cleared to accommodate residential and commercial developments.

Secondary Industry/Commercial

The lowermost 0.6 km is developed as railyards with some associated light industry and commercial activity. A lumber mill is located slightly downstream of the creek's mouth.

Linear Development

A Canadian National Railway yard parallels the creek from the mouth to 3.0 km upstream. The railway crosses the creek twice. Highway 1A/99A crosses the creek 1.3 km upstream and King Road crosses 0.2km from the mouth.

Urban Development

Most of the stream, including the headwaters, is located within a large high density residential development.

Government

Barker Creek is in the City of Surrey (Greater Vancouver Regional District).

Designated Lands

Barker Creek flows near Bolivar Park and drains two other small municipal parks.

Watershed Planning Issues

Management Concerns

- Surrey has proposed to infill the upper ravine area for development. This will be compensated by the modification of the 114th Ave. culvert and provision of public access to areas upstream of 114th Ave.

- Maintenance of water quality is a concern.
- The intensive development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- A serious inventory and examination of restoration options available for this and Manson Canal should be undertaken. If possible, these streams should be combined into a viable single stream.
- An inventory of potential habitat in the upper reaches of the stream and compensation options is needed before works occur. An environmental assessment of downstream impacts is also required.
- Enhancement efforts should concentrate on recreating features lost by channelization and dyking.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

Southslope Creek

TREND

Declining

Watershed Code: 100-unavailable Fraser River tributary
RAB Code: Unavailable
TRIM Map: 92G026

STATUS:

Endangered - Southslope Creek has been channelized and impacted by urbanization.

Physiography

Drainage Area

The total watershed area of Southslope Creek is unknown. The creek is a south shore tributary of the Fraser River entering Queens Reach approximately 0.5 km upstream of Sapperton Bar at the foot of 138th St.

Stream Description

The creek (approximately 1.1 km long) is groundwater fed. It flows through a wetland area which is characterized as 98% stream water and 2% tidal freshwater marsh.

Hydrology

No hydrological data are available.

Channel Stability Assessment

No geomorphological data are available.

Fisheries Resource

Fish Access

Anadromous fish access is restricted past 114th Ave. by an impassable culvert.

Fish Stocks

Southslope Creek and its unnamed tributary support stocks of coho salmon, cutthroat trout, three-spine stickleback, and lamprey.

Restoration/Enhancement

No specific enhancement opportunities have been identified. While there are only 150 m of stream located above the culvert at 114th Ave., it would be worthwhile to modify the culvert to allow fish passage.

Fish Production

Fish have been documented throughout the system; however specific spawning and rearing areas have not been identified.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, land has been cleared to accommodate residential, industrial and commercial developments.

Secondary Industry/Commercial

Industrial and commercial development is located along the waterfront adjacent to the rail yards.

Linear Development

The mouth of the stream is crossed by the Canadian National Railway.

Urban Development

The headwaters of the stream are located within a well developed residential area in north Surrey.

Government

Southslope Creek is in the City of Surrey (Greater Vancouver Regional District).

Designated Lands

The stream drains the eastern portion of Bolivar Park.

Watershed Planning Issues

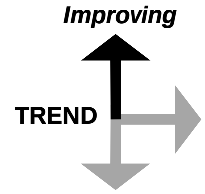
Management Concerns

- Maintenance of water quality is a major concern.
- The system has been “simplified” by extensive channelization and dyking.
- The impact of development on groundwater recharge is a significant concern.

- The intensive development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Hydrological and geomorphological studies of the stream and its tributary are necessary in order to identify limiting factors, impacts, and feasible remedial measures on this system.
- Groundwater recharge areas in this drainage must be identified and protected to maintain baseflows in the system.
- Riparian vegetation should be re-established on residential lots in the headwaters of the system.
- Culvert modification at 114th Ave. should be explored.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.



Bonaccord Creek

Watershed Code: 100-0242-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0170
TRIM Map: 92G026

STATUS:

Endangered - Bonaccord Creek is channelized, has water quality problems, and the riparian vegetation has been removed. The watershed has an effective impermeable surface area of 23%.

Physiography

Drainage Area

The total watershed area of Bonaccord (Port Mann) Creek is 5.3 km^2. The stream flows north and enters the Fraser River at the Port Mann Bridge.

Stream Description

The small stream (2 km) is channelized (including a 1400 ft. culvert in the west branch) and has a very narrow leave strip. The stream varies from low gradient (mouth to 1.5 km) to a steep ravine (upper 0.5 km). The stream is divided into two branches, east and west, that merge 0.5 km upstream from the mouth. There is a tributary to Bonaccord Creek - Landfill Ditch - that drains a landfill.

Hydrology

The estimated mean annual flow of the Bonaccord Creek is 0.18 m^3/s. The creek has relatively stable flows considering that it is an urbanized watershed with a large impervious area.

Channel Stability Assessment (Preliminary)

Channelization and riparian removal has increased erosion and decreased channel stability.

Fisheries Resource

Fish Access

Anadromous fish access have access to the headwaters in the east branch of the creek. The left branch is blocked at the confluence by a long (1400 ft.) culvert. Another culvert and an impassable dam are located further upstream. The culvert at the mouth of the stream under the rail yards is a potential barrier.

Fish Stocks

Bonaccord Creek supports coho and chum salmon; rainbow trout in the right branch; and cutthroat trout in both branches.

Restoration/Enhancement

The possibility of restoring access to the left branch should be assessed. The tributary provides good fish habitat because of the groundwater inflow. An old timber dam (1 km upstream of mouth) created a large pool that is used by resident cutthroat. The dam is not believed to be a barrier to fish migration.

A stewardship group is working on developing a spawning channel near the mouth of the creek.

Fish Production

Chum and coho spawning has been observed under the Port Mann Bridge and rearing has been reported from the mouth to 1.5 km upstream. The habitat above the impassable dam on the left branch of Bonaccord Creek would provide suitable fish habitat if it was accessible.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate residential development.

Secondary Industry/Commercial

The commercial activity associated with residential development occupies 8.4% of the watershed area. A small amount of secondary industry is present along the lower reaches, within the rail yards and under the Port Mann Bridge. A large domestic landfill has been under operation along the bottom of the creek for many years.

Linear Development

The lower portion of the stream is located in a Canadian National Railways yard. The elevated Port Mann Bridge passes over the mouth of the stream.

Urban Development

There has been substantial urban development in the headwaters, and much of the basin has been developed for single family homes. The effective impermeable area of the Bonaccord Creek watershed is 23%.

Government

Bonaccord Creek is the City of Surrey (Greater Vancouver Regional District).

Designated Lands

A sanitary landfill is located on the east bank of the right branch, to the east of the Port Mann Bridge, and is scheduled to close in November 1997. Despite the past landfill leachate discharge problem, the leachate is now collected and treated. A trailer park and campsite are located on the west bank. Invergary Park provides a protective buffer to much of the stream. The two branches also pass through small parks.

Watershed Planning Issues

Management Concerns

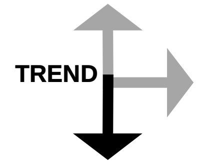
- Maintenance of water quality given the intensity of development in the watershed is the prime concern.
- There is a potential passage problem (i.e. a long culvert under the CN Railyard) in the lower reaches of the system.
- The west branch is blocked at the confluence by a long culvert.
- The intensive development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- The removal of obstructions on the west branch would increase access to productive fish habitat in the system.
- Stormwater management plans including stormdrain marking programs, and improved retention/detention facilities are required to improve water quality and quantity in the system.
- The 1400 ft. culvert at the bottom end could be baffled to allow fish passage.
- Landfill Ditch should be diverted away from Bonaccord Creek; this would reduce water quality concerns and eliminate point sources of contaminants.
- Stewardship programs which focus on landowner contracts and education are required.
- Enhancement activities should only be entertained after ongoing and constant threats to habitat quality are addressed.

For Bonaccord Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Galerius Creek



Declining

Watershed Code: 100-unavailable Fraser River tributary
RAB Code: 00-0220
TRIM Map: 92G027

STATUS:

Endangered - Galerius Creek has been channelized and impacted by urbanization.

Physiography

Drainage Area

The total watershed area of Galerius Creek is unavailable. The creek flows northwest and enters the Fraser River at Douglas Island.

Stream Description

The creek, approximately 2.2 km long, has been subject to ditching and diversion by the Canadian National Railway. Galerius Creek discharges into an inland shallow wetland at its confluence with the Fraser River.

Hydrology

The summer 7-day average low flow is 8% of the mean annual flow. No other hydrologic data are available.

Channel Stability Assessment (Preliminary)

The creek has been substantially channelized and ditched.

Fisheries Resource

Fish Access

Anadromous fish generally have access to the headwaters, depending upon the number of beaver dams present and channelization or ditching and activities by the Canadian National Railway.

Fish Stocks

Galerius Creek supports coho and chinook salmon and stickleback.

Restoration/Enhancement

Marsh transplants at the mouth and restoration of spawning habitat were completed in 1985 as compensation on the west branch.

Fish Production

The spawning and rearing habitat is considered to be reasonably good, with the majority of spawning occurring in the west branch. Good rearing habitat is found in the channelized ditch paralleling the Canadian National Railway. Fraser River chinook fry have been found rearing in this creek upstream of the railroad.

Activities and Land Use

Agriculture

Most of the land within the drainage area is agricultural or undeveloped.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development.

Secondary Industry/Commercial

Commercial development is largely limited to that which supports residential development (i.e. retail).

Linear Development

The Canadian National Railway parallels most of the creek and the CN intermodal yard filled in part of the watershed on its north side.

Urban Development

There is some residential development on the west branch of Galerius Creek. Effective impermeable area covers 3% of this watershed.

Government

Galerius Creek is in the City of Surrey (Greater Vancouver Regional District).

Designated Lands

None.

Watershed Planning Issues

Management Concerns

- There may be access problems created by the Canadian National Railway ditching and diversions.

- Beaver dams are scattered throughout the system and exacerbate access concerns.

Management Prescriptions

- Stewardship initiatives are required by the Canadian National Railway to address non-point source contamination, stream channel alterations, and fish passage.
- Municipal policies, bylaws or development permit area designations which provide stormwater management plans, prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas are required.
- The west branch, where restoration has recently occurred, is a protection priority.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

Centre Creek

TREND ***Stable***

Declining Watershed Code: 100-0290-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0230
TRIM Map: 92G017 and 92G027

STATUS:

Threatened - Centre Creek has been degraded by the development of the CN intermodal yard.

Physiography

Drainage Area

Centre (West Barnston) Creek (Bloomfield Brook) watershed drains much of Surrey Bend and occupies an area of 4.4 km^2. The creek flows through Surrey and joins the Fraser River, 300 m downstream of Parsons Channel.

Stream Description

Centre Creek flows through Surrey Bend Regional Park, established in 1997. This regional park is one of the largest undyked areas of floodplain on the lower Fraser River. It has remained more or less in its natural state despite strong development pressures. Undulating topography in this area produces a complex of habitat types ranging from moist to wet floodplain forest (swamp), fens, creeks, and ponds. The creek also flows through a CN Rail intermodal yard.

Hydrology

The mean annual discharge of Centre Creek is 0.06 m^3/s.

Channel Stability Assessment (Preliminary)

Spawning gravels have been placed throughout the system to enhance spawning and compensate for impacts from the fill and construction of the CN intermodal yard.

Fisheries Resource

Fish Access

Anadromous fish have access to the headwaters of Centre Creek; however, they must pass through a 300 m culvert under the CN yards.

Fish Stocks

Centre Creek and its unnamed tributaries support stocks of coho, chum, and chinook salmon; cutthroat trout, three spine stickleback, black crappie, brown bullhead, long nose dace, leopard dace, starry flounder, prickly sculpin, carp, large scale sucker, redside shiner, northern squawfish, peamouth chub, and brassy minnow. There are also unconfirmed reports of rainbow trout in the system.

Restoration/Enhancement

Spawning gravels have been placed throughout the system including a 40 m reach approximately 180 m upstream of the Canadian National Railroad crossing.

Fish Production

The major spawning location in the watershed is in the 40 metre enhanced section of gravel, 180 m upstream of the railway. Spawning also occurs in the upper reaches of the stream.

Activities and Land Use

Agriculture

Mink and poultry farm wastes entered the tributary and caused water quality concerns in the eastern headwaters in the 1980s.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate residential and industrial developments.

Secondary Industry/Commercial

The watershed is becoming very industrialized.

Linear Development

Historically the CN railroad cut off the headwaters and south Surrey Bend from the flood plain north and necessitated a 300 m long culvert. The GVRD sewer line through the area altered flows in the area. The only hydroline connection was a bridge on Centre Creek. In 1985/86 CN began filling a large section of the area for an intermodal yard. The yard crosses Centre Creek approximately 1.2 km upstream of the mouth.

Urban Development

The headwaters of Centre Creek originate in a residential area of north Surrey. Development pressures are increasing within the watershed. The effective impermeable area in this watershed is 3%.

Government

Centre Creek is in the City of Surrey (Greater Vancouver Regional District).

Designated Lands

The portion of the watershed below the Canadian National Railway is now a park—Surrey Bend Regional Park—and is the only large remaining natural undeveloped wetland on the lower Fraser River.

Watershed Planning Issues

Management Concerns

- North Surrey is rapidly developing with additional growth predicted in the future.
- The development of the intermodal yard has permanently altered portions of the system and its hydrology.
- The potential development of the headwaters of the Centre Creek watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Restoration is the priority for this system above the CN intermodal yard in Surrey Bend.
- The Canadian National Railway should be encouraged to initiate a corporate stewardship program for Centre Creek that would focus on rehabilitating channelized sections of the system, improving water quality and passage, and reestablishing riparian vegetation.
- Municipal policies, bylaws or development permit area designations which provide stormwater management plans, prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas are required.

For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Unnamed Tributaries of the Fraser River, South Bank, Parsons Channel

Lee Horne Brook (ungazetted name)
Watershed Code: 100-0311-000-000-000-000-000-000-000-000-000-000

Unnamed Tributary
Watershed Code: 100-0312-000-000-000-000-000-000-000-000-000-000
RAB Codes: Unavailable
TRIM Map: 92G017

STATUS:

Threatened - Both creeks are impacted by urbanization in the watershed.

Lee Horne Brook and an unnamed fish bearing stream enter the Fraser River between Centre Creek and Yorkson Creek.

Lee Horne Brook (92G/2 465) is approximately 2 km long, and enters Parsons Channel between 182A and 186th Streets. Cutthroat trout are present in this stream, but fish access is blocked 20 m upstream from the Fraser River by the Canadian National Railway crossing.

An unnamed stream (92G/2 467) is 1.3 km long and has a tributary that is 0.9 km long. The stream flows into Parsons Channel slightly east of 186th Street. The stream contains cutthroat trout.

Yorkson Creek

Watershed Code: 100-0333-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0260
TRIM Map: 92G017

TREND

Declining

STATUS:

Endangered - Yorkson Creek has suffered many impacts associated with agriculture and the local increase in urbanization (poor water quality, change in hydrological regime, infilling of upper reaches).

Physiography

Drainage Area

The total watershed area of Yorkson (Jenkins, Telegraph Trail) Creek is 17.9 km^2. The creek flows north into the Fraser River upstream of, and opposite to, Mann Point on Barnston Island.

Stream Description

Yorkson Creek is a small, low gradient stream approximately 7 km in length. The creek drains the Fraser Lowlands in Langley. It flows through a small, densely vegetated gully for the upper 4 km, then across an area of low lying farmland. There are three small tributaries--Munday (West Munday), East Munday, and Stenburg--in the lower 3 km.

Hydrology

The mainstem has a mean annual discharge of 0.146 m^3/s. The stream has become flashy and increased flooding has occurred as a result of inadequate stormwater detention storage in some urban developments in the watershed. Extreme low flows are reported in Munday and East Munday Creeks.

Channel Stability Assessment (Preliminary)

The channel is being destabilized by urban development and increased effective impervious area in the watershed. The effective impervious area in the watershed is already approaching 10%.

Fisheries Resource

Fish Access

Anadromous fish have access along Yorkson and Munday Creeks to impassable culverts at the TransCanada Highway (Hwy. 1), and to the headwaters of East Munday and Stenburg Creeks. There is a fish friendly screw pump at the mouth of Yorkson Creek.

Fish Stocks

Yorkson Creek and its tributaries support stocks of coho, chum, and pink salmon; cutthroat trout, brown bullhead, sculpins, and stickleback.

Restoration/Enhancement

The Township of Langley designated green belts along all watercourses in 1978. The culverts at 88th Ave. were made passable in 1993, and in 1985/86 Walnut Grove residents cleaned a reach near 96th Avenue. Anadromous fish access to the upper tributaries has been improved by the addition of fish baffles in several culverts. Langley and the Department of Fisheries and Oceans have developed recent neighbourhood concept plans including those for Walnut Grove Stage 9 that establish improved setbacks from the creek in order to limit the impact of urban development on fish habitats. The Yorkson Creek Incubation Project ran an incubation box (chum) that was closed in 1993. The Township of Langley installed a fish friendly screw pump at the mouth of Yorkson Creek in the summer of 1994. The creek was stocked with 50,000 late run chum from Inch Creek in 1991.

Fish Production

The mainstem has good rearing potential, but it is limited by extreme low flows and high summer water temperatures. Production is further limited by subdivision construction and activation of the pump station. Coho rearing and spawning occurs in the ditches. Rearing potential between the railway and 93rd St. is good, but due to low water velocity and poor substrate, spawning is not possible. The section of stream between 93rd St. and 86th St. offers good rearing potential and fair spawning potential. The stream is near maximum attainable cutthroat levels. Munday Creek is similar to Yorkson Creek in terms of spawning and rearing potential, while East Munday has good spawning and rearing habitat throughout.

Activities and Land Use

Agriculture

Historically, the primary land use in the Yorkson drainage was agriculture. The agricultural land base is rapidly being converted to residential subdivisions; however 57% of the drainage area is still farming/vacant land. The several cranberry farms that remain have hog fuel dykes that contribute to the degradation of water quality. There are also several poultry farms located in the watershed that raise water quality concerns.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate residential development.

Secondary Industry/Commercial

Approximately 2.1% of the drainage area is industrial or commercial. This is primarily located north of 100th Ave., in the lower reaches of the stream. There is a lime plant and a cranberry processing facility in the lower reaches of the watershed (encroaching on the floodplain).

Linear Development

The Canadian National Railway crosses Yorkson Creek approximately 2.3 km upstream. The TransCanada Highway (Hwy.1) crosses 6.5 km upstream from the mouth. The basin also hosts a network of rural streets and roads.

Urban Development

The primary land use in the watershed is residential. 29% of the watershed has been developed as single family residential while 11.2% is multifamily residential. Hobby farms, located in the headwaters, are expected to be converted to residential subdivisions as property values increase. 10% effective impermeable area indicates extensive urban development, which is mostly located south of 96 Ave. in the Walnut Grove area. The earlier phases of the Walnut Grove residential development are encroaching significantly into the riparian zone. In Walnut Grove Stage 9, minimum 15 - 30 m setbacks have been established. It is anticipated that the pressures of urban development will increase throughout the watershed.

Government

Yorkson Creek is in the Township of Langley (Greater Vancouver Regional District).

Designated Lands

The Katzie Indian Reserve is located at the mouth of Yorkson Creek, the site of a traditional net fishery. West Langley Park and several other small municipal parks lie within the watershed.

Watershed Planning Issues

Management Concerns

- There are inadequate natural areas remaining to maintain a hydrologic regime and habitat base for healthy fish populations.
- Recreational/livestock access to the streams is a significant concern.
- The pump station at the mouth of this stream is in operation in May and June during the period of downstream juvenile migration.
- Extensive urban development in Walnut Grove has degraded ground water quality and elevated iron levels. There are also significant concerns associated with poor erosion control.
- Sediment from construction sites (where construction is occurring) has been entering storm drains and smothering spawning gravel (on the mainstem and in several tributaries).
- Numerous beaver dams obstruct passage in the lower reaches of the tributaries.
- The greatest limiting factor for cutthroat production is the limited juvenile nursery space.
- High summer water temperatures and extreme low flows in summer in upper reaches may limit fish production.
- The East Munday wetland is being filled.
- Water quality continues to be negatively further affected by residential development in the headwaters and agricultural/industrial activities in the lower reaches (increased sedimentation, effluents, swimming pool water drained into the creek, etc.).

- New development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Fisheries protection needs to be better integrated with development planning.
- Gravel placement above 93A St. and improved protection of streamside vegetation are required.
- Access management plans are required for all watercourses, which emphasize sensitive trail design compatible with protection of leave areas.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

For Yorkson Creek hydrograph, see Appendix 2.
For escapement information on Yorkson Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 4 – Langley/Abbotsford Area

Unnamed Tributaries
of the Fraser River, South Bank, Derby Reach

Two ungazetted fish bearing streams flow into the Fraser River between Yorkson Creek and the Salmon River.

Unnamed Creek

Watershed Code: 100-0354-000-000-000-000-000-000-000-000-000-000
RAB Codes: Unavailable
TRIM Map: 92G017

STATUS:

Endangered - The creek is impacted by agriculture and has been channelized.

An unnamed tributary, 92G/2 452, (approximately 2 km long) enters the Fraser River between Derby Reach and Yorkson Creeks. The lower reaches have been channelized and the mid reaches pass through the Agricultural Land Reserve (ALR). The stream is known to support chum and coho salmon, and cutthroat trout.

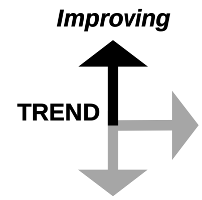
Derby Reach Creek

(ungazetted name)
Watershed Code: 100-0372-000-000-000-000-000-000-000-000-000-000
RAB Codes: Unavailable
TRIM Map: 92G017

STATUS:

Threatened - Derby Reach Creek has been impacted by adjacent activities in the watershed (e.g. clearing of land, agriculture, etc.).

Stream 92G/2 464, commonly known as Derby Reach Creek (approximately 2.0 km in length), enters the Fraser River downstream of the Salmon River, directly opposite Kanaka Creek. The creek is located within Derby Reach Regional Park and has intermittent flow. It is a coho bearing stream.



Salmon River

Watershed Code: 100-0388-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0300
TRIM Map: 92G008, 92G017 and 92G018

STATUS:

Endangered - The Salmon River has been channelized and dyked, riparian vegetation has been removed along a number of tributaries, and water quality in some reaches is poor.

Physiography

Drainage Area

The total watershed area of the Salmon (Deleeuw) River is 76.9 km^2, about 25% of the surface area of Langley. The major tributaries include Davidson (Ditch), Coghlan, Union, and Tyre creeks. There are also a number of unnamed tributaries. A list of tributaries (and their watershed codes) to the Salmon River is provided in Appendix 1. The river flows north-northwest to the Fraser River entering the Fraser River near the west end of McMillan Island.

Stream Description

The Salmon River and its main tributary, Coghlan Creek, originate in a low lying agricultural area. A small portion of the upper reaches originate in Abbotsford. The river flows in a northwesterly direction through the area north of Aldergrove and the Salmon River Uplands before flowing north through the Fort Langley floodplain. It enters the Fraser River just west of Fort Langley. The river is approximately 33 km in length. The upper tributaries are marshy and flow through shallow valleys. The mid reaches of the river flow across gently sloping terrain in a protected meandering channel. The stream has excellent gravel deposits between kms 10 and 22. The gradient decreases in the final 10 km as the deep channel cuts a series of tortuous meanders through meadowland.

Hydrology

The dyke dams up flows at the mouth of the Salmon River when the Fraser River is at high flow and/or high tide. Pumps must be used to remove water, and kill 30% of the young salmon each spring. New "fish friendly" screw pumps were installed in the spring of 1998.

The mean annual discharge of the Salmon River is 1.44 m^3/s. The two year/seven day low flow is 0.163 m^3/s with a flood discharge of 16.7 m^3/s. The one hundred year/seven day low flow is 0.110 m^3/s with a flood discharge of 56.0 m^3/s. Flooding has been reported along the lower and upper reaches. Summer flows are low throughout most of the system. Several large irrigation licenses along the lower reaches of the river account for a significant portion of the summer low flows. Water extraction is responsible for the annual drying of Coghlan Creek. Streamwater temperatures of $27^{o}C$ near the mouth and $22^{o}C$ in the headwaters have been recorded. The average water temperature in July and August is approximately $20^{o}C$. A groundwater contribution from the Hopington Aquifer moderates stream temperatures to a maximum of $19^{o}C$ and an average of 16 ^{o}C in the middle reach of the river.

Channel Stability Assessment (Preliminary)

The entrances to several side channels are well above the main channel due to incision along sections of the main channel. The headwaters of several creeks, such as Davidson Creek (Ditch), are in moderately steep ravines of glaciomarine material resulting in unstable slopes. Encroachment by property owners is common and has reduced the stability of the river channel. Stormwater runoff is resulting in scouring of gravel and development has caused some sedimentation.

Fisheries Resource

Fish Access

Anadromous fish have access as far as Highway 13 on the mainstem (although the culvert at 248th St. is impassable at low flows) and to the headwaters of Coghlan, Davidson, and Union Creeks.

Fish Stocks

The Salmon River and its tributaries support stocks of coho and sockeye salmon; cutthroat, steelhead and rainbow trout; stickleback, western brook lamprey, starry flounder, peamouth chub, northern squawfish, prickly sculpins, brassy minnow, pacific lamprey, and largescale sucker. The headwaters of the Salmon River are the only location within the Fraser Basin known to support the endangered Salish sucker. The only other location where the Salish sucker has been found in BC is in tributaries of the Nooksack River. The lower reaches of Salmon River also act as non-natal rearing habitat for Fraser River chinook juveniles.

Restoration/Enhancement

Enhancement and stocking of the Salmon River have been discouraged since it was designated an "Index Stream" in 1993 (see Management Prescriptions below). However, the occasional fishway to bypass low water obstructions has been constructed (e.g. at the 64th Ave. bridge and 248th St.). Streamside vegetation was planted in 1993 and 1994.

The Salmon River Watershed Management Program has advocated and supported the installation of fish-friendly screw pumps at the outlet of the river - these have recently been installed. MELP has identified cutthroat enhancement opportunities (i.e. stocking) in the headwaters of Salmon River and Coghlan Creek. There has been some stream clearing completed in Union Creek and boulder placements have occurred in Coghlan Creek.

Additional stream improvement activities include weirs to improve fish passage, berm construction to stop bank erosion, and log jam and beaver dam removal. Through the Township of Langley's 1992 Environmentally Sensitive Areas mapping project, ESAs on the mainstem were mapped.

Fish Production

The rearing potential is excellent in the Salmon River mainstem. Rearing areas in the mid and upper reaches are protected and summer flows are stable. Good spawning and rearing habitat is found in the mid mainstem, near 256th St. The upper reaches of the Salmon River have no spawning gravel, possibly as a result of urban development affecting gravel recruitment. Coghlan Creek accounts for a large percentage of the Salmon River escapement due to its abundant spawning and rearing habitat. Davidson Creek has a very low gradient and numerous beaver dams. It has good spawning gravel and good potential rearing habitat. In addition, an unnamed stream (access to 68th Ave. and 232nd St.) also has good rearing potential (low gradient and meanders). Prior to 1998 (when new fish friendly pumps were installed), 30% of fish were killed by the old pumps.

Activities and Land Use

Agriculture

Over 75% of the Salmon River drainage area is agricultural land, while <1% is in intensive commercial agriculture (i.e. greenhouses). There are many poultry, produce, and cattle farms located along the main channel and the tributaries (farming occurs along 55% of the river length). Farmland encroaches on the flood plain. Berry farming is intensive on Coghlan Creek.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate residential development.

Secondary Industry/Commercial

There is very little industry or commercial development in the basin - less than 1% of the drainage area. The Vancouver Zoological Centre is located in the Upper Salmon River and has been a source of several significant water quality and riparian impacts in that area.

Linear Development

The Salmon River is crossed by the Canadian National and Southern British Columbia railways, as well as the TransCanada Highway and an underground natural gas pipeline. The trestle under the BC Hydro railway crossing was changed to a culvert in 1983. The basin hosts a network of rural roads. The bridge crossing at 64th Ave. affects fish production by creating unstable gravel bars.

Urban Development

There is substantial low density residential development in and around the watershed. While the effective impervious surface area of the watershed is only slightly >2%, urban development is found along 12% of the stream length. Major proposals would bring this figure up to 45% if approved. Coghlan Creek is surrounded by rural residential development. An equestrian center and several equine racetracks are also present in the watershed. The development of a golf course near the mouth of the Salmon River and construction of another course further upstream have resulted in considerable encroachment into the floodplain. Many schools are present throughout the watershed, including Trinity Western University.

Government

The Salmon River watershed is predominately located within the Township of Langley (Greater Vancouver Regional District); however its headwaters are in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

The headwaters drain a portion of the CFS Aldergrove property. Williams Park is located at the confluence of the Salmon River and Coghlan Creek. Most of the Salmon River (>90%) and its tributaries are located within the ALR.

Watershed Planning Issues

Management Concerns

- Proposals to enhance the drainage of agricultural lands in the lower floodplain would further increase the already rapid response to rainfall events. Direct agricultural drainage into the system, lack of stormwater retention, loss of flood channels, and floodplain modifications make the system particularly susceptible to flooding.
- Septic tank leakage and nitrogen waste from farms cause water quality concerns.
- The original drainage pumps have recently been replaced with fish friendly screw pumps. (The old, unmodified drainage pumps at the mouth of Salmon River, which operate during downstream smolt migration in May and June, caused, on average, 30% smolt mortality.)
- The lack of habitat complexity in small tributaries and insufficient adult escapement directly limit cutthroat production in the Salmon River.
- Urban development along the stream has modified bedload and gravel recruitment, and introduced fines.
- The development of a golf course within the floodplain of the mainstem has disrupted drainage patterns and associated habitat, and exacerbates water quality problems.
- Ditch maintenance is a major source of erosion and habitat impact in the watershed.
- More frequent flooding is leading to increased gravel scour and bank erosion.
- Passage problems at the 64th Ave. bridge prevent access to upstream spawning areas, and during low flows can result in spawning areas downstream becoming oversaturated.
- A culvert at 248th St. is impassable at low flows.
- Beaver dams are scattered in the upper reaches and may limit juvenile access to good rearing areas.
- Irrigation and water withdrawal result in summer low flows.
- Extreme low flows in headwater reaches can completely dewater sections in some summers.
- The existing and potential development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Replanting riparian vegetation and constructing fences along the agricultural lands in the lower reaches would help to stabilize eroding banks.
- Davidson Ditch was put into a large new canal in 1995. Restoration work should be monitored.

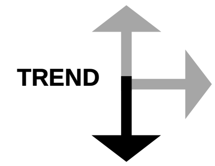
- The many miles of riparian planting along the mainstem and tributaries should be monitored.
- An effective water management plan which would address stormwater management in urban areas as well as drainage issues on the floodplain is urgently required.
- Habitat complexity should be increased in the minor tributaries.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

DFO has designated the Salmon River as an "Index Stream". As such, the Salmon River is considered indicative of general trends in status of coho stocks in the lower mainland that exhibit a similar marine distribution. In 1993, the Salmon River watershed was established as a "demonstration watershed" by the Fraser Basin Management Board for the purpose of developing techniques for sustainability in the lower mainland. The Salmon River Watershed Management Partnership, a multi-agency/sector steering group (including representatives from DFO, Ministry of Agriculture, Fisheries & Food, Langley Environmental Partners, Matsqui/Langley Soil Conservation Group, Westwater Research Centre, MELP, Fraser Basin Management Board and Township of Langley), oversees this initiative. There is more information about the Salmon River watershed, due to the years of study, than most other watersheds in B.C. This watershed can therefore be managed taking advantage of all the river and watershed data.

For Salmon River hydrograph, see Appendix 2.
For escapement information on the Salmon River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

West Creek

Watershed Code: 100-0416-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0330
TRIM Map: 92G008 and 92G018



Declining

STATUS:

Endangered - Channelization, riparian removal, and agricultural encroachment have impacted West Creek.

Physiography

Drainage Area

The West Creek watershed occupies 14.5 km^2 . The creek flows northwest joining the Fraser River just east of McMillan Island.

Stream Description

West Creek originates in a low lying marshy area and is approximately 8 km in length, and has a number of small tributaries. The creek flows through a densely wooded gully between km 4.6 and 2.5, where it has a rapids/pool formation with scattered gravel deposits. At 2.5 km, the creek flows onto the Fraser River floodplain where it meanders through farmland, becoming slough-like in the lower 200 m.

Hydrology

The mean annual discharge of West Creek is 0.416 m^3/s. The two year/seven day low flow is 0.019 m^3/s while the flood is 7.4 m^3/s. The one hundred year/seven day low flow is 0.012 m^3/s and the flood is 19.3 m^3/s. Low flows limit fish usage of the upper reaches. West Creek experiences a larger than average range of flow. The stream is partially fed by groundwater sources that are very important in maintaining summer flows. Heavy rains cause sudden high flows. Beaver dams retaining water in the headwater area of West Creek were cleared when the development of the industrial area (Gloucester Estates) began a few years ago. This affected the availability of water to the creek; summer flows have been reduced by 50% and large sections don't flow anymore.

Channel Stability Assessment (Preliminary)

The wide range between low and peak flow in the stream creates great potential for scour and erosion. Channel stability is also affected by farmland reclamation activities that are occurring on the floodplain.

Fisheries Resource

Fish Access

Anadromous fish have access to the headwaters of West Creek; however the upper reaches experience very low flows in summer and are often completely dry.

Fish Stocks

West Creek supports stocks of coho, chinook, chum salmon; cutthroat and steelhead trout; three-spine stickleback, brown bullhead, lampreys, and prickly sculpin. There are unconfirmed reports of pink salmon, largescale sucker, peamouth chub, and carp.

Restoration/Enhancement

Every year, 150,000 chum from the Chehalis hatchery are put into West Creek through DFO's Public Involvement Program. Debris around the pipeline crossing and beaver dams in the upper reaches have been removed to improve fish passage. The West Creek Watershed Protection Group (WCWPG) holds an annual Easter Sunday Salmon Fry release. In 1993 they held the third annual event at 6028 - 272nd St. Some restoration is occurring in the headwaters, which were severely damaged during the development of the industrial area (Gloucester Estates). The wetland habitat in this area continues to be impacted as development continues. The Langley Environmental Partners Society has planted over 1200 native shrubs and trees in the West and Palmateer (East) Creek watersheds over the past few years.

Fish Production

West Creek provides habitat (at its lower end) for immigrant juvenile salmon from the Fraser River. Excellent spawning habitat is located between west end of 84th Ave. and 264th St. Fish production in the upper reaches of the stream is limited by low summer flows. A low pool to riffle ratio and low summer flows are cited as the main limiting factors for coho production.

Activities and Land Use

Agriculture

Livestock, produce, and hobby farms are common throughout the watershed. 82% of the watershed is agricultural. Farmers have reclaimed a significant portion of the floodplain. Unauthorized stream channelization has occurred from 84th Ave. to 80th Ave. There are many fur farms (e.g. mink) located in the drainage area.

Mining

A gravel pit operates in the lower reaches.

Forestry

Land has been cleared in the headwater area as the industrial estate area develops.

Secondary Industry/Commercial

The area surrounding the upper reaches, above 272nd St., and south of the BC Hydro Railway, has been rezoned for heavy industrial development. Development of the Gloucester Estates industrial area began a few years ago – land was cleared and ditched, and a canal system was created to drain the land. Although the area is actively being developed, some wetland habitat still exists in the area.

Linear Development

The Trans Mountain pipeline crosses the creek just south of 80th Ave., and the Canadian National Railway crosses at the mouth. Local streets and the TransCanada Highway cross the stream.

Urban Development

There is limited low density residential development in the watershed. The drainage basin is generally rural (<1% EIA).

Government

West Creek is in the Township of Langley (Greater Vancouver Regional District).

Designated Lands

The lower reaches of West Creek are in the Agricultural Land Reserve. The creek passes through Ponder Park.

Watershed Planning Issues

Management Concerns

- Removal of riparian vegetation in the lower reaches is accelerating bank erosion.
- Water withdrawals for agriculture significantly aggravate summer low flows.
- Upstream reaches do dry out during the summer. Less water is available now to these reaches with the removal of beaver dams in the headwater area through the development of Gloucester Estates industrial area. Continued development activity and ditching is reducing remaining wetlands in the headwater area.
- Concerns have been identified about effluent from West Creek Trout Farm, and non-point discharges from mink farms in the watershed.
- A combination of beaver dams and culverts causes passage problems at 272nd St.
- Unauthorized stream channelization has occurred between 80th Ave. and 84th Ave.
- Reclamation of floodplain near the stream by farmers is resulting in a loss of fish habitat.

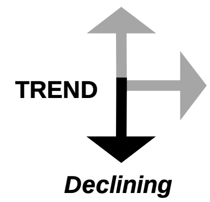
Management Prescriptions

- Development of groundwater-fed spawning channels for chum may be appropriate in lower reaches where pool creation could be explored in upstream areas.

- In that the Gloucester Estates development has proceeded without proper assessment of environmental impacts, and without plans to prevent damage to the stream, an enhanced restoration and protection plan must be addressed for this property.
- Runoff must be controlled for the development at 72nd Ave. and 256th St., as this is the most important section of the system for coho production.
- A moratorium on water licenses and flow agreements that provide minimum instream flows for fish is needed in order to maintain adequate summer flows. Water monitoring and channel improvements are required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Education and stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For West Creek hydrograph, see Appendix 2.
For escapement information on West Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Palmateer Creek



Watershed Code: 100-0418-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0340
TRIM Map: 92G018

STATUS:

Endangered - Palmateer Creek has been degraded by riparian removal, channelization, and has some water quality problems.

Physiography

Drainage Area

The total watershed area of Palmateer (Williams, East, Armstrong) Creek is unknown. The creek flows northwest to join the Fraser River, with a confluence about 2 km west of McMillan Island.

Stream Description

The stream is partially fed by excellent headwater springs, but heavy irrigation demands decrease the stream volume. The stream has an active floodplain, and is an area of valuable marsh habitat.

Hydrology

The mean annual discharge of Palmateer Creek is not available. Sections of the creek become dry due to the heavy irrigation demands (e.g. the 0.4 km dry section above 256th St.).

Channel Stability Assessment (Preliminary)

Little information regarding stability is available, but there has been heavy siltation in the past from gravel pits in the drainage area.

Fisheries Resource

Fish Access

Anadromous fish have access along Palmateer Creek to 256th street.

Fish Stocks

Palmateer Creek and its unnamed tributary support stocks of chum (spawning in the lower reaches) salmon (chinook have been sighted), as well as rainbow and cutthroat trout.

Restoration/Enhancement

The McLellan Incubation Project operates an incubation box for chum at the mouth of Palmateer Creek which produced 50,000 chum (late Inch Creek chum) annually; however, this project has been discontinued in the past few years. A headwaters spring source could be utilized in combination with gravel and ponds from abandoned gravel pits to restore the system. The Langley Environmental Partners Society has planted over 1200 native shrubs and trees in the West and Palmateer (East) Creek watersheds over the past few years.

Fish Production

No information on fish production is available.

Activities and Land Use

Agriculture

Agricultural activities, including turf farming, dominate over 90% of the stream's length.

Mining

Extensive gravel mining operations in the watershed have resulted in sediment discharges to Palmateer Creek. However most of the leases have expired and conditions are improving.

Forestry

While there is no commercial forest harvesting in the watershed, land has been cleared for agriculture.

Secondary Industry/Commercial

Some light industry is located near the mouth of the creek. A composting facility operates within the watershed.

Linear Development

The Canadian National Railway and a major road cross near the mouth.

Urban Development

There is very little urban development in the watershed.

Government

Palmateer Creek is the Township of Langley (Greater Vancouver Regional District).

Designated Lands

The Palmateer Creek watershed is within the Agricultural Land Reserve.

Watershed Planning Issues

Management Concerns

- Heavy irrigation demands occur near the headwater springs (80th Ave).
- There are water quality problems (from hogfuel, landfill, and a composting facility in the ALR), including serious low dissolved oxygen problems.

Management Prescriptions

- Some of the problems created by the gravel pit operations in the past still need to be addressed.
- The problem of excessive water withdrawals for irrigation needs to be addressed.
- A program to replant riparian vegetation must be advanced.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

Nathan Creek

TREND ***Stable***

Watershed Code: 100-0437-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0360
TRIM Map: 92G008 and 92G018

STATUS:

Endangered - Channelization, riparian removal, urban development and agricultural encroachment have impacted Nathan Creek.

Physiography

Drainage Area

The watershed area of Nathan (Beaver) Creek is 33.8 km^2. The creek flows north-northwest joining the Fraser River approximately 2 km west of Crescent Island.

Stream Description

Nathan Creek is approximately 15 km in length. It originates on a gently sloping plateau and is well protected throughout the upper reaches by a dense second growth forest which also provides good instream cover. A progressive narrowing and deepening of the stream valley occurs, and by 6.9 km the stream type is characterized by rapids/riffle as it flows through a deep gully. At 3.5 km, the gully ends and the creek flows across farmland in a channelized and dyked stream bed. The lower 1.8 km is slough-like. Nathan Slough was originally a side channel of Nathan Creek; however it was cut by putting the main channel into a dyked canal to enhance agricultural operations.

Hydrology

The estimated mean annual discharge of the stream is 1.17 m^3/s. Springs and groundwater maintain moderately high base flows and suitable temperatures during the summer, though low flows in the upper tributaries may limit production. The presence of beaver dams impounds water and helps offset the flashy nature of the stream. The lower reaches are poorly drained and subject to flooding.

Channel Stability Assessment (Preliminary)

The lower two kilometers of the stream have been straightened and channelized, and subjected to the regular removal of vegetation by the agricultural industry. Regular dredging of gravels has become necessary to maintain the channelled sections to reduce flooding. Excavations by farmers have produced pools along the lower reach of the stream. The upper reaches have a high erosion potential.

Fisheries Resource

Fish Access

Anadromous fish have access to the headwaters, although beaver dams and culverts may impede their passage.

Fish Stocks

Nathan Creek and its unnamed tributaries support stocks of coho, pink, and steelhead salmon; cutthroat, steelhead and rainbow trout; peamouth chub, three-spine stickleback, sculpins, and lamprey. Chum and sockeye salmon fry have been found in the stream. Chinook salmon fry utilize Nathan Creek as a non-natal rearing stream.

Restoration/Enhancement

The stream provides a substantial amount of rearing habitat. The Abbotsford Hatchery uses Nathan Creek as a donor stream for steelhead broodstock. Three impassable culverts were made passable in 1986. A private citizen removed a dam on a tributary in 1985. Removing beaver dams upstream of 272nd St. would improve spawning and migration potential; however the impact of removing these dams on flow regulation needs to be addressed.

Re-establishment of a chum stock in the lower reaches should be explored. Riparian vegetation should be re-established, and irrigation intake screens should be checked. Fencing is required to keep cattle out of the stream.

Fish Production

There is approximately 6.5 km of good spawning substrate for coho salmon in the system. The rearing potential is also good due to the extensive instream debris and well protected pools. The upper reaches are important fish habitat, but low flows limit production. Dredging between 80th Ave. and 272nd St. has degraded spawning and rearing habitat. A quarter of a million chum fry are released annually into the stream from the Inch Creek hatchery. There is a good population of sea-run cutthroat trout. MELP has assessed the system as productive but underutilized.

Activities and Land Use

Agriculture

Agriculture occurs along approximately 45% of the stream length, mostly in the lower 3.5 km. Farms are encroaching on stream banks, causing water quality problems (bank trampling by livestock, agricultural runoff, channelization) and riparian vegetation removal.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, land has been cleared to accommodate agricultural and residential development.

Secondary Industry/Commercial

The land immediately to the west of the upper headwaters is zoned industrial (300 acres). A small industrial area is located on the west side of the headwaters; a lumberyard and a scrap wood burner are located at the mouth of the stream.

Linear Development

The lowest 3.4 km of the east bank of the stream is dyked to protect agricultural land. The Canadian National Railway crosses close to the mouth, and the Southern Railway of BC crosses the creek 7.8 km upstream. A BC Hydro line crosses the creek 2.2 km upstream, and an oil pipeline crosses at approximately 4.4 km upstream. A number of roads cross the mainstem and tributaries.

Urban Development

Runoff and domestic water withdrawals from residential development on Lefeuvre Road (280th St.) may affect two coho tributaries. There is scattered residential development in the headwaters. The effective impermeable area of the Nathan Creek watershed is 0.5%.

Government

Nathan Creek is in the City of Abbotsford (Fraser Valley Regional District) and the Township of Langley (Greater Vancouver Regional District).

Designated Lands

Much of the Nathan Creek watershed is in the ALR.

Watershed Planning Issues

Management Concerns

- Encroachment of agriculture on the stream, channelization and dyking of the stream in the floodplain, filling of the floodplain, and bank protection works have degraded the stream and fish habitat.
- Summer low flows in some tributaries as well as the mainstem are a problem; residents are involved in relocating stranded fish.
- Irrigation demands from agriculture have been identified as a factor limiting fish production.
- Agricultural runoff and removal of riparian vegetation have led to water quality problems and high summer water temperature in the lower reaches.
- Dredging at 80th Ave. and 272nd St. for flood control is an ongoing concern and has negatively affected spawning and rearing habitat.
- A residential area on Lefeuvre Road (280th St.) has the potential to adversely affect two coho tributaries.
- Beaver dams and culverts in upstream areas may impede migration.

Management Prescriptions

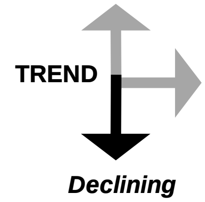
- Since urban development has not had a significant impact on this watershed, restoration has high potential for success.
- A water management plan is required on this system to address urban runoff and agricultural water withdrawal impacts.

- Returning chum salmon have not been observed since 1965 and the possibility of re-establishing this stock should be investigated.
- A high level of protection should be afforded this system.
- Farming activities need to be set back from banks which need to be stabilized, revegetated, and fenced.
- Dredging and channelization impacts on the lower reaches could be mitigated by adoption of better ditch maintenance practices (e.g. *Ditches, Fish and Fish Habitat,* Draft, DFO, 1997).
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For Nathan Creek hydrograph, see Appendix 2.
For escapement information on Nathan Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Nathan Slough

Watershed Code: 100-0452-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0367
TRIM Map: 92G018



STATUS:

Endangered - Nathan Slough has been severely impacted and almost destroyed (realignment, ditching, riparian removal).

Physiography

Drainage Area

The total drainage area of Nathan Slough and its tributary Benson Canal is unknown. This slough is a south shore tributary of the Fraser River entering Enterprise Channel at the west end of Crescent Island.

Slough Description

Nathan Slough (approximately 6.3 ha) was once a channel of Nathan Creek, but it is no longer connected to the main channel. It is composed of organic and alluvial deposits and has a permanently high water table. The slough is 75% stream water and 25% floodplain marsh. The slough has been severely degraded; it is lost above 88th Ave. Benson Canal has been substantially channelized and straightened and is now an agricultural drainage ditch. The riparian zone of Benson Canal is 95% denuded of vegetation.

Hydrology

No hydrologic data are available.

Channel Stability Assessment (Preliminary)

No channel stability information is available.

Fisheries Resource

Fish Access

No information on anadromous fish access is available. There is no comprehensive inventory information available for Nathan Slough.

Fish Stocks

Anadromous fish are expected to utilize the lower reaches of Nathan Slough. Significant habitat alienation has occurred since Nathan Creek and Benson Canal were isolated from Nathan Slough.

Restoration/Enhancement

No specific enhancement opportunities have been identified for Nathan Slough.

Fish Production

The lower reaches provide good rearing habitat for chinook salmon.

Activities and Land Use

Agriculture

Agriculture is main land use surrounding Nathan Slough.

Mining

There is no active mining; historically there were several gravel pits in the area.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate agricultural developments.

Secondary Industry/Commercial

None.

Linear Development

Nathan Slough is crossed by the Canadian National Railway 0.8 km from the mouth. A pump station is located near the railway crossing. There is a dam at the mouth. River Road crosses near the mouth of the slough.

Urban Development

Some small rural roads and residences are located in the area.

Government

Nathan Slough is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

Nathan Slough is entirely in the ALR.

Watershed Planning Issues

Management Concerns

- Nathan Slough has been heavily impacted through ditching, channel realignment, removal of riparian vegetation.
- There are severe water quality problems, including high ammonia concentrations, fecal coliform counts, low dissolved oxygen levels, and high nutrient concentration.

Management Prescriptions

- The system has been so severely impacted that a major restoration plan which addresses fish passage, flows, water quality, lack of instream complexing, riparian establishment, and channelization would be required to restore fish habitat capabilities in Nathan Slough.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Camson Creek

TREND

Declining

Watershed Code: 100-0497-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G018 and 92G019

STATUS:

Endangered - Camson Creek has been impacted by agriculture (poor water quality and riparian removal).

Physiography

Drainage Area

The watershed area of Camson Creek is unknown. The creek flows northeast into the Fraser River approximately 1.6 km downstream of Matsqui Island.

Stream Description

Camson Creek is about 2 km long and flows through a gently sloping ravine into the Fraser River. The riparian area has been removed from most of the south side of the stream; a riparian corridor remains along most of the north and west side of the stream. There are two small tributaries located on the north side of the stream.

Hydrology

No hydrological data are available.

Channel Stability Assessment

No geomorphological data are available.

Fisheries Resource

Fish Access

No information is available.

Fish Stocks

There is no data available on fish stocks in Camson Creek.

Restoration/Enhancement

No specific enhancement opportunities have been identified.

Fish Production

No information on fish production is available.

Activities and Land Use

Agriculture

There is some low intensity farming in the upper portion of the watershed; riparian areas have been reduced due to this activity.

Mining

None.

Forestry

Land has been cleared to accommodate agriculture and residential development.

Secondary Industry/Commercial

None.

Linear Development

The Canadian National Railway crosses the stream near the mouth.

Urban Development

There is some light residential development in the watershed.

Government

Camson Creek is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

The Camson Creek watershed is in the ALR.

Watershed Planning Issues

Management Concerns

- Agricultural runoff is degrading water quality.

Management Prescriptions

- Stewardship initiatives should be implemented with farmers.
- Fish use or potential fish use of the system needs to be assessed.
- If there is fish use or potential use, enhancement efforts could include bank stabilization, gravel introduction, pool creation, and riparian vegetation restoration.

Hanna Creek

TREND **Stable**

Watershed Code: 100-0501-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0425
TRIM Map: 92G018 and 92G019

STATUS:

Endangered - Agricultural practices and encroaching development have impacted Hanna Creek (poor water quality, riparian removal, etc.).

Physiography

Drainage Area

The Hanna Creek watershed occupies an area of 8.1 km^2. The creek flows north-northwest joining the Fraser River approximately 1 km downstream of Matsqui Island.

Stream Description

Hanna Creek is approximately 3.45 km in length. The upper reaches are entrenched in deep clay ravines. The lower reaches flow through a wetland. A riparian corridor exists along most of the mainstem; there is less riparian area on the east side of the stream and in the headwaters. The wetland area (3.3 ha) is classified as 90% wetland marsh and 10% stream water.

Hydrology

The estimated mean annual discharge of Hanna Creek is 0.28 m^3/s. The range of flow in the system is similar to the original average, but winter low flows are a severe problem. The lowest reaches of the system are marshy and provide excellent fish habitat.

Channel Stability Assessment (Preliminary)

There is little human modification of the channel, except along McTavish Road. A poorly constructed road crossing, built to provide access to a new subdivision, has damaged tributaries and riparian habitats. A large proportion of the stream flows through areas of clay bank; fortunately however, the range of flow does not promote substantial erosion or scour. The ravines are very susceptible to erosion.

Fisheries Resource

Fish Access

Anadromous fish have access to the headwaters of the mainstem; however, beaver dams are scattered throughout the system and large well anchored dams may limit access to good rearing areas.

Fish Stocks

The known fish stocks include coho, chum, pink and sockeye salmon, cutthroat trout, and carp.

Restoration/Enhancement

No specific enhancement opportunities have been identified.

Fish Production

The creek provides excellent spawning habitat for cutthroat, coho and carp (up to Mt. Lehman). The lower reaches provide good habitat (they have never been dredged). The other fish species migrate from the Fraser River to rear in the wetland.

Activities and Land Use

Agriculture

Farming is the primary land use in the watershed. Water quality is impacted by pig farming activity.

Mining

None.

Forestry

Land has been cleared to accommodate agriculture and residential development.

Secondary Industry/Commercial

A small percentage of the watershed is classified as industrial or commercial.

Linear Development

The mouth of the stream is crossed by the Canadian National Railway, which is presently upgrading the line. The drainage area is crossed by a number of rural streets.

Urban Development

There is some residential development in the watershed. The effective impermeable area of the Hanna Creek watershed is 0.6%.

Government

Hanna Creek is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

The lower section of the creek is owned by the Regional District. It will be incorporated into the foreshore park that is being developed east of 272nd street. Hanna Creek currently drains a small municipal park to the east of the stream. The Hanna Creek watershed is in the ALR.

Watershed Planning Issues

Management Concerns

- Upgrading the Canadian National Railway line at the mouth may pose a concern.
- Poor agricultural practices have resulted in high nutrient loading issues, and ammonia releases have resulted in many fish kills.

Management Prescriptions

- Maintenance of the ravine in a forested state is essential.
- Riparian fencing is required.
- A community stewardship program in the watershed should be encouraged.

For Hanna Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Tones Creek

TREND → *Stable*

Watershed Code: 100-0522-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0433
TRIM Map: 92G019

STATUS:

Endangered - Tones Creek has been impacted by agricultural activities (poor water quality, riparian removal, etc.).

Physiography

Drainage Area

The watershed area of Tones Creek is unknown. The creek flows northeast joining the Fraser River at Matsqui Island.

Stream Description

Tones Creek is 1.3 km long, and flows through a small ravine. There is little gravel in the system and the substrate is predominantly clay.

Hydrology

No hydrological data are available.

Channel Stability Assessment

No data are available.

Fisheries Resource

Fish Access

Anadromous fish have access to the lower 1.3 km.

Fish Stocks

Tones Creek supports stocks of coho and cutthroat.

Restoration/Enhancement

No specific restoration/enhancement opportunities have been identified.

Fish Production

No information on fish production is available.

Activities and Land Use

Agriculture

The headwaters of Tones Creek are used for agriculture. Water quality is occasionally impacted by hog farm activity.

Mining

None.

Forestry

Land has been cleared to accommodate agriculture and residential development.

Secondary Industry/Commercial

None.

Linear Development

The Canadian National Railway crosses the mouth of the stream.

Urban Development

There is some low density residential development in the watershed.

Government

Tones Creek is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

There is a small municipal park in the watershed. The Tones Creek watershed is in the ALR.

Watershed Planning Issues

Management Concerns

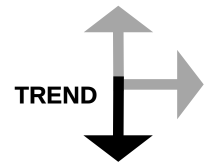
- Agricultural activities continue to impact water quality.

Management Prescriptions

- Forested parts of the stream should be protected.
- Codes of practice for pig manure management should be strictly enforced. Setback fencing to restrict livestock access to stream, and riparian planting should be encouraged.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

Coligny Creek

Watershed Code: 100-unavailable Fraser River tributary
RAB Code: 00-0438
TRIM Map: 92G019



Declining

STATUS:

Endangered - Coligny Creek is affected by agriculture (i.e. riparian removal), and some impacts associated with urbanization.

Physiography

Drainage Area

The Coligny Creek watershed occupies 3.6 km^2. The stream flows northeast merging into the Fraser River near the southeast corner of Matsqui Island.

Stream Description

Coligny Creek is a small slow moving creek originating in the Mount Lehman highlands. Natural flow problems exist in the upper reaches of this system.

Hydrology

The estimated mean annual flow of Coligny Creek is 0.12 m^3/s. The headwater flows are very low in summer, frequently stranding fish in pools. There are many recorded incidents of fish dying from the elevated temperatures in the isolated pools.

Channel Stability Assessment (Preliminary)

Sections of the creek have been straightened and channelized.

Fisheries Resource

Fish Access

Anadromous fish have access to an impassable culvert near Olund and Harris roads. The private road culvert is hanging, with no jump pool.

Fish Stocks

Coligny Creek supports stocks of coho salmon and cutthroat trout.

Restoration/Enhancement

Several attempts at operating a small hatchery have failed due to lack of a suitable groundwater source. In 1994, the Matsqui Indian Band cleaned the channel, improved fish access, and started construction of another hatchery. The hatchery has since ceased operation.

Fish Production

The stream generally has good potential for fish production, but is limited by low flows in the upper reaches during summer.

Activities and Land Use

Agriculture

Agriculture is the major land use in the watershed.

Mining

None.

Forestry

Land has been cleared to accommodate agriculture and residential development.

Secondary Industry/Commercial

None.

Linear Development

The Canadian National Railway crosses the stream at the mouth and the BC Hydro Railway crosses several tributaries further upstream. A pipeline also crosses the channel approximately 1.4 km upstream.

Urban Development

There is some relatively light residential development in the watershed. The effective impermeable area of the Coligny Creek watershed is 0.6%.

Government

Coligny Creek is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

The lower portion of the creek flows through Matsqui Indian Reserve #2. The rest of the Coligny Creek watershed is in the ALR.

Watershed Planning Issues

Management Concerns

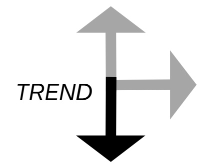
- Large sections of the creek have been denuded of riparian vegetation, which contributes to elevated summer water temperatures.
- Productivity is limited by low summer flows.

Management Prescriptions

- Remaining forest lands adjacent to the stream must be protected and denuded areas should be planted and protected by setback fencing.
- The possibilities of augmenting summer low flows on Coligny Creek should be investigated.
- The impassable culvert at Harris and Olund roads could be improved although it may be difficult and expensive to upgrade.

For Coligny Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

McLennan Creek



Declining

Watershed Code: 100-0536-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0440
TRIM Map: 92G009 and 92G019

STATUS:

Endangered - The McLennan Creek system has water quality problems, has been channelized, and much of the riparian vegetation has been removed.

Physiography

Drainage Area

McLennan Creek drains an area of 30.9 km^2. The tributaries Gifford Slough and Downes Creek have drainage areas of 14.4 km^2 and 6.4 km^2 respectively. McLennan Creek flows northeast and enters the Fraser River at the south corner of Matsqui Island. Downes Creek flows northeast into Gifford Slough about 3 km upstream of the slough. Gifford Slough flows northwest, joining McLennan Creek about 2 km upstream of its mouth.

Creek Description

In its lower reaches, McLennan Creek meanders over flat terrain through a marshy area before it enters the Fraser River. Gifford Slough has been straightened and channelized in the lower reaches and the riparian vegetation has been completely removed. Stream velocity is very slow during the summer in the lower reaches. The wetland is classified as 50% oxbow water and 50% floodplain marsh. There is a pump at the mouth of the stream.

Hydrology

The estimated mean annual flow of McLennan Creek is 1.07 m^3/s. Downes Creek and Gifford Slough have mean annual flows of 0.22 m^3/s and 0.50 m^3/s respectively. Downes Creek has an excellent supply of groundwater. In summer, the lower reaches of the creek experience low flows. Water is pumped out of the system at various locations for irrigation purposes. The combination of low stream flows and velocity and high temperature aggravates the low dissolved oxygen in the lower reaches of McLennan Creek.

Channel Stability Assessment (Preliminary)

There has been extensive riparian vegetation removal along Gifford Slough and it has been dredged, straightened, and channelized. The physical integrity of McLennan Creek and Downes Creek has not been substantially altered, and the stream channels remain in a close to natural state.

Fisheries Resource

Fish Access

Anadromous fish have access throughout McLennan Creek. The culvert on Gifford Slough at Downes Road and Mt. Lehman is difficult, but not impassable. The headwaters of Downes Creek at Downes Road and Clearbrook Road are dammed and the culvert under Clearbrook Road is probably impassable.

Fish Stocks

McLennan Creek and its tributaries support stocks of coho and chum salmon; steelhead, rainbow and cutthroat trout; three-spined stickleback, brown bullhead, sculpins, lampreys, and redside shiner.

Restoration/Enhancement

An inceptor was installed to prevent leachate from an old landfill site from reaching the creek. A fish screen has been installed in the lead pump to divert fish away from the flood pumps at the mouth of the creek and divert fish into a fish-friendly bypass. Sediment build up on the stream bottom permits fish access under the screen which results in increased fish mortality in the main pumps. Ecoworks (a local enhancement group) installed 73 m of fencing along McLennan Creek in order to exclude cattle (1996). Stewardship groups have also planted thousands of trees in the Matsqui Slough system, and are conducting stream cleaning and fencing programs.

Fish Production

A rainbow trout fish farm once operated in the headwaters of Downes Creek but is now closed. Spawning occurs on Downes Creek from 200 m downstream of the east crossing of Downes Road to the west crossing of Downes Road. Fish spawn in McLennan Creek from Bates Road to Mt. Lehman Road. No information is available for Gifford Slough.

Activities and Land Use

Agriculture

Agriculture accounts for the land use on 75% of the stream system. Farming activities contribute to water quality problems (hog farming, cattle operations, etc.). Water withdrawals for irrigation are common; however, an ARDSA community irrigation project expanding the ditch network along Matsqui Slough, Gifford Slough, and Clayburn Creek to distribute water pumped from the Fraser River was completed in the early 1990s. Livestock damage to stream banks and riparian areas is common.

Mining

Gravel mining (Matsqui pits) caused severe sedimentation of the Douglas Creek headwaters in the early 1980s that resulted in a Fisheries Act prosecution. The pit areas have now been developed for housing.

Forestry

Land has been cleared to accommodate gravel pits, agricultural and residential development.

Secondary Industry/Commercial

There is a frozen food plant in the headwaters of McLennan Creek. A sawmill is located just downstream of the mouth of McLennan Creek. Hogfuel and wood chip storage areas have contributed leacheates to the creek for over 15 years.

Linear Development

The Canadian National Railway, the Southern Railway of BC and a BC Hydro railway cross Gifford Slough. BC Hydro transmission lines transect the watershed; a pipeline crosses Gifford Slough; and the watershed is traversed by numerous roads networks including Gladwin Road, Downes Road, Mt. Lehman Road and Harris Road.

Urban Development

Downes Creek started to receive significant urban impacts in the early 1980s when gravel pits and adjacent lands were being converted to subdivisions. Sewage bypasses were built; a poorly designed storm discharge gave rise to a Fisheries Act prosecution, and drainage from the connected gravel pit severely sedimented Downes Creek. The upper reaches of Downes Creek are now contained in storm sewers, and are being developed. Hobby farms and rural residential homes are being developed along McLennan Creek. The municipality is interested in annual dredging to improve drainage and reduce overbank flooding. An estimated 25% of the watershed is urbanized. The effective impermeable areas of the McLennan Creek, Gifford Slough, and Downes Creek watersheds are, respectively, 1.7%, 2.8%, and 6%.

Government

McLennan Creek is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

The lower reach of McLennan Creek flows through Matsqui Indian Reserve #2. Parts of the Downes Creek ravine are owned by the City of Abbotsford. The lower to mid reaches of McLennan Creek watershed are in the ALR.

Watershed Planning Issues

Management Concerns

- The existing and potential development in the watershed increases the risk of additional altering of hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.
- Riparian vegetation loss and streambank impacts are significant in the agricultural areas.
- Agricultural activity has degraded the water in Gifford Slough, leading to high nutrient concentrations, high fecal coliform counts, and a high level of biochemical oxygen demand and low dissolved oxygen levels.
- Urban development has had a significant impact on the headwaters, especially on Downes Creek.
- Annual dredging of Gifford Slough has been proposed by the municipality.

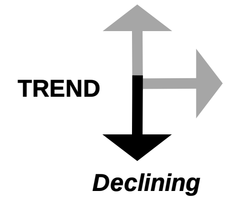
- The culverts at Downes Road on both Downes and McLennan Creeks impede upstream access, and irrigation dams in upstream reaches may impede coho access.
- The area's water supply is treated with chloramines.

Management Prescriptions

- Stewardship initiatives should be implemented with farmers, including fencing, Best Management Practices for maintaining water quality, etc.
- Stormwater management for urban development should be a priority.
- The headwaters of this system need to be protected from the impacts of further urban development.
- Restoration efforts could include bank stabilization, gravel introduction, pool creation, and riparian vegetation restoration.

For McLennan Creek and Gifford Slough hydrographs, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Matsqui Slough



Watershed Code: 100-0543-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0460
TRIM Map: 92G009 and 92G019

STATUS:

Endangered - Matsqui Slough has been severely impacted by agriculture (poor water quality and riparian removal); several tributaries are impacted by urbanization (channelizing, culverting, high effective impervious area).

Physiography

Drainage Area

Matsqui Slough has a total drainage area of 69.3 km^2. Its tributaries include Clayburn, Page, Caleb, Willband, Stoney, and Poignant Creeks. The major tributaries--Clayburn, Willband, and Stoney Creeks--have drainage areas of 46.6 km^2, 13.5 km^2, and 7.6 km^2, respectively. A list of tributaries (and watershed codes) is included in Appendix 1. Matsqui Slough flows northwest entering the Fraser River at the east end of Matsqui Island.

Slough Description

The Matsqui Slough/Page Creek wetland area is approximately 37 ha in size. The wetland is classified as 50% oxbow water and 50% floodplain marsh. The lower reaches of the slough have been channelized and straightened; the riparian vegetation has been removed. A number of the tributaries of Matsqui Slough originate in steeper terrain (such as Page, Clayburn and Stoney, which originate on Sumas Mountain).

Hydrology

The estimated mean annual discharge of Matsqui Slough is 2.40 m^3/s. All channels maintain adequate flows during the late summer for trout production except Poignant Creek which is critically low. Some parts of the system experience summer extreme low flows and high water temperatures. Flood peaks have increased on Stoney Creek due to urban development with ineffective stormwater detention, which also leads to increased erosion. Sections of the system have been straightened and channelized.

Channel Stability Assessment (Preliminary)

Matsqui Slough has been channelized, straightened, and most of its riparian vegetation removed. It is subjected to periodic dredging. Clayburn and Willband Creeks have also been channelized and dredged. The coarse gravel substrate of Stoney Creek has been impacted by erosion, and the headwater tributaries have been altered. The chronic siltation problems of this stream have led to the need for dredging. Clayburn Creek is currently unstable.

Fisheries Resource

Fish Access

Anadromous fish have access: to the first 7.25 km on Clayburn Creek, where there is an impassable falls; to the headwaters of Stoney Creek; to an impassable 1500 foot culvert on Willband Creek; to Becharrell Road on Page Creek; and to McKee Road on the left branch of Stoney Creek. Culverts block access to the right branch of Stoney Creek.

Fish Stocks

Matsqui Slough and its tributaries support stocks of coho, chinook and chum salmon; rainbow, steelhead, and cutthroat trout; stickleback, redside shiner, prickly sculpin, and lampreys. Chum salmon are not found in the headwaters of Clayburn Creek.

Restoration/Enhancement

Mortalities of coho smolts passing through the Matsqui Slough (Gladwin) Pump Station have been reduced from 70% to 5% with the installation of a screen on the lead pump. It directs fish away from irrigation pump intakes into a fish-friendly bypass system. Sediment build up on the stream bottom allows fish access to the main pumps which results in fish mortality. The Big Brothers organization in Abbotsford ran the Ravine Park hatchery on the banks of Willband Creek, which produced coho for approximately 8 years. A new hatchery is scheduled for 1997 at Abbotsford Senior Secondary School. Mill Lake is routinely stocked with trout. In 1982, Stoney Creek was enhanced through replanting of streamside vegetation, bank stabilization, gravel introduction, pool creation, and resolution of water withdrawal problems. Community groups have been actively planting, fencing, and collecting garbage along Matsqui Slough and Sumas River. Ecoworks has completed three revegetation projects along Page Creek, and conducted a stream clean-up in Stoney, Clayburn, Willband, and Upper Willband Creeks (1996).

Fish Production

All tributaries (except Poignant Creek) maintain adequate flows for trout production. There is heavy coho spawning throughout Stoney Creek, sometimes comprising half of the Clayburn escapement. Chum spawning has been observed in an unnamed tributary flowing along Becharrell Rd. and west to Clayburn Creek. The spawning and rearing potential on Clayburn Creek between Clayburn Road and Wright Road is reduced due to the removal of streamside cover and channelization. Spawning and rearing potential is limited by channelization from Stoney Creek's confluence with Clayburn, upstream to Bateman Ave. The wetlands on Willband Creek are excellent for rearing but urban water use and water quality from stormwater runoff are concerns. Page Creek is predominantly used for rearing although there is limited spawning in one tributary.

Activities and Land Use

Agriculture

The floodplain along the lower reaches of Matsqui Slough, and the areas surrounding Page Creek and the lower reaches of Willband Creek, are predominantly in agricultural use. Runoff from pig and berry farms is contributing to water quality degradation in these systems.

Mining

A gravel pit is located within the Willband Creek drainage.

Forestry

Land has been cleared to accommodate agriculture and urban development.

Secondary Industry/Commercial

The amounts of industrial/commercial land in the sub-basins are as follows: Matsqui Slough, 3.1%; Clayburn Creek, 4.7%; Willband Creek, 15.3%; and Stoney Creek, 0.8%.

Linear Development

The Canadian National Railway crosses Matsqui Slough and Page Creek. The Canadian Pacific Railway also crosses Matsqui Slough. A pipeline and service road parallels Stoney Creek. Clayburn Creek is dyked in the lower reaches and crossed by an oil pipeline. The Southern Railway of BC and Canadian Pacific railways and Highway 11 cross Willband Creek. Willband Creek and a tributary are crossed by transmission lines.

Urban Development

Extensive urban development has occurred on Willband Creek; over one quarter of the developed area has been converted to impermeable surfaces. Stoney Creek and Clayburn Creek have experienced significant urban development. The urbanization pressure will increase along Clayburn, Poignant, and Stoney Creeks over the next ten years as development in the Straiton area proceeds. Since these creeks flow through steep terrain and have a high gradient, they will be more impacted by the infrastructure that goes along with urban development, such as storm sewers. 26% effective impervious area on Willband Creek indicates extensive urban development. Willband Creek is culverted for 1500 ft. There is an old sewage lagoon, which was subsequently used as a sanitary landfill (now capped), as well as a substation, on Willband Creek.

The effective impermeable areas are as follows: Matsqui Slough—6.18%; Clayburn Creek—9.02%; Willband Creek—25.83%; Stoney Creek—8.04%.

Government

Matsqui Slough is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

Willband Creek passes through Ravine Park. A new park, Willband Creek Park, is being created on a 36 ha property on the corner of Highway 11 and Bateman Road. This park is designed as a stormwater detention area but will include multi-use trails, boardwalks, and interpretive areas for wildlife viewing. Fish access to the detention areas will be restricted and fish passage issues in Willband Creek are to be addressed in the design plans. A small part of Stoney Creek flows through Bateman Park. Matsqui Slough flows through Matsqui Trail Regional Park. Page Creek flows through a Department of National Defense Communication Site. The lower reaches and mid reaches of Matsqui Slough are in the ALR. Indian Reserve Sahhacum #1 is located on Willband Creek.

Watershed Planning Issues

Management Concerns

- Agricultural leachates and occasional raw sewage discharge from a sanitary sewer are degrading water quality. Matsqui Regional District was prosecuted for a sewage discharge into Willband Creek in 1986. Page Creek has serious water quality problems due to agricultural activities.
- Riparian removal on sections of the system has resulted in increased summer water temperatures.
- Extremely low dissolved oxygen concentrations at the mouth of Matsqui Slough in the fall form an environmental barrier to returning adult salmonids and may prevent them from reaching their spawning grounds.
- Annual dredging of Matsqui Slough has been proposed by the municipality.
- Large water withdrawals in Clayburn Creek for irrigation contribute to extreme low flows that affect migration and decrease survival of fish in upper reaches.
- Subdivisions in headwaters of Stoney Creek have caused extensive erosion, and damaged spawning and rearing habitat through removal of riparian vegetation, alteration of banks and siltation.
- Terraforming hill sides for subdivision development in the upper right branch of Stoney Creek has resulted in chronic downstream siltation in both Stoney and Clayburn Creeks.
- Willband Creek has one permitted discharge of stormwater effluent from a bulk petroleum storage facility.
- A 1700 foot culvert under downtown Abbotsford blocks migration access to upper Willband Creek.
- An old sewage lagoon on Willband Creek was used as a landfill in the 1970s and subsequently capped without a leachate collection system installed. MELP staff indicate that ammonia and coliform levels were elevated downstream from the site; MELP data indicate that the influence of this site on Willband Creek has declined.
- Urbanization in the watershed (for example, on the Clayburn system) increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

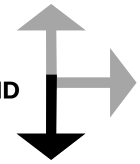
- Comprehensive stormwater management planning for urbanizing areas in the watershed must be a high priority.
- The headwaters and all wetlands in the drainage basin must be mapped and protected, should the stream's fish population have any real chance of survival.
- Restoration efforts should include bank stabilization, gravel introduction, pool creation, and riparian vegetation restoration.
- The stewardship initiatives such as those carried out by community groups in the Abbotsford area need to continue, with a focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system.

- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required. Special consideration of a sediment control bylaw, riparian protection and stormwater management with reduce impervious area is urgently needed.

For Matsqui Slough hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Wades Creek

TREND



Declining

Watershed Code: 100-0623-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0550
TRIM Map: 92G020

STATUS:

Endangered - Wades Creek has been degraded by logging and extensive riparian vegetation removal.

Physiography

Drainage Area

Wades Creek and its tributary Chadsey (Cox) Creek, have a total drainage area of 9.2 km^2. Wades Creek flows northwest, entering the Fraser River opposite the southwest tip of Strawberry Island.

Stream Description

Wades and Chadsey Creeks are mountain-fed streams, with headwaters originating in the upper elevations of the Sumas Mountain. The lower reaches of Wades Creek flow into a wetland. The wetland area (approximately 28 ha) is classified as 95% stream fen and 5% stream water.

Hydrology

The estimated mean annual flow of Wades Creek is 0.22 m^3/s. Snowmelt can be an important part of the hydrologic regime and significantly elevates flows in the early part of the spring. The creek is very flashy. Flows are typically low in the summer and reaches may dewater in certain months.

Channel Stability Assessment (Preliminary)

Slopes in the watershed are unstable and debris flows into the channel are common. This has resulted in increased sedimentation in Wades and Chadsey Creeks. A landslide caused by poor road drainage has severely reduced the productivity of Chadsey Creek.

Fisheries Resource

Fish Access

Anadromous fish have access throughout Wades Creek, but rearing habitat is limited by low flow. In fact, Wades Creek flows underground most summers. Anadromous fish access into Chadsey Creek is limited by stream dewatering during the summer low flows.

Fish Stocks

Wades Creek and its tributary support small runs of coho, cutthroat and chum salmon; and cutthroat trout (sea-run and resident).

Restoration/Enhancement

MELP stocks Chadsey Lake with 2,000 rainbow trout every three years. Opportunities to restore reaches damaged by landslides should be assessed.

Fish Production

Spawning and rearing of coho and chum occurs in the lower reaches of Wades Creek, upstream of the railway crossing. The stream generally has the potential for good fish production, but this is limited by the dewatering of upper reaches during the summer and sedimentation during the winter. Chadsey Lake supports a population of introduced goldfish. The rainbow trout in Chadsey Lake are also introduced.

Activities and Land Use

Agriculture

There is some agricultural activity in the Wades Creek watershed.

Mining

A large gravel quarry is located 400 m upstream of the mouth, and has impacted the stream in the past.

Forestry

Most of the Wades Creek watershed has been logged in the past, and many areas are being logged again. Silviculture and reforestation are now occurring.

Secondary Industry/Commercial

A barge loading facility is located near the mouth of the stream to serve the gravel quarry.

Linear Development

A Canadian National Railway line, logging roads, and a service road cross Wades Creek adjacent to the gravel pit operation.

Urban Development

Urban development is expected to spread to this area over the next decade.

Government

Wades Creek is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

Portions of the watershed are within the Chilliwack Provincial Forest. The headwaters are located in Sumas Mountain Regional Park. The lower portion of the Wades Creek watershed is in the ALR.

Watershed Planning Issues

Management Concerns

- Remaining fish stocks are in decline.
- Agricultural activities may be impacting streamflow (irrigation withdrawals consume as much as 35% of the naturalized summer 7-day low flow).
- Industrial activity (gravel removal), forest removal and land conversion are concerns for the watershed.
- Potential development in the Wades Creek watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

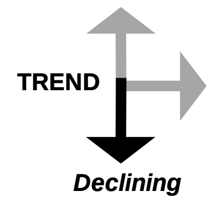
Management Prescriptions

- This watershed has minimal urban and agricultural development. A watershed management plan should be put in place to restore and protect the key watershed processes before development pressures take over.
- Restoration activities should include riparian restoration and sediment control.
- Riparian areas must be protected from future residential development and watershed considerations addressed.

For Wades Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 5 – Lower Chilliwack River

Sumas River



Watershed Code: 100-0657-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0600
TRIM Map: 92G009, 92G010 and 92G020

STATUS:

Endangered - The river has poor water quality, little riparian vegetation, and has been extensively channelized/dyked.

Physiography

Drainage Area

The Sumas River watershed covers an area of 1284.5 km^2. Its major tributaries are Miller Slough, Vedder River (and Canal), Sumas Lake Creek, Lonzo (Marshall) Creek, and Saar Creek. A list of tributaries (and watershed codes) to the Sumas River is provided in Appendix 1. The Sumas River is a south shore tributary of the Fraser River. Flowing northeast from its headwaters in the United States, the Sumas River curves around Sumas Mountain to flow northwest, entering the Fraser River at the eastern side of Sumas Mountain. The Chilliwack River flows into the Vedder River, which flows into the Sumas River.

Stream Description

The lower reaches of the Sumas River form a wetland of approximately 128 ha. The wetland is classified as 95% oxbow water and 5% floodplain marsh. The upper reaches of the Sumas drains a wetland of approximately 80 ha: 60% floodplain marsh and 40% stream water.

Hydrology

The mean annual flow of the Sumas River is 15.21 m^3/s. Its tributaries Lonzo and Kilgard Creeks have mean annual flows of 1.31 and 0.07 m^3/s, respectively. Flood management on the Sumas system is a significant international issue with major downstream (Canadian) implications. The Nooksack River on the US side on occasion has broken through its dykes and allowed flood waters to innundate the Sumas River area.

Channel Stability Assessment (Preliminary)

Landfilling and encroachment on the floodplain have reduced the wetted width of Lonzo Creek. The headwaters of Lonzo Creek have been radically altered. Saar Creek is frequently dredged. Arnold Slough has several sediment traps that require ongoing maintenance. The District of Chilliwack also conducts maintenance dredging on McGillivary Slough.

Fisheries Resource

Fish Access

Anadromous fish have access throughout the Sumas River and its tributaries. A fish ladder was constructed in lower Kilgard Creek in the 1990's.

Fish Stocks

The Sumas River and its tributaries support significant populations of coho, pink, chum, and chinook salmon; steelhead and sea-run cutthroat trout; white sturgeon; black crappie, carp, lampreys, whitefish, northern squawfish, suckers, brown bullhead, sculpins, and three-spine stickleback. Inventory and stock assessments on this and other lower mainland systems are no longer routinely conducted.

Restoration/Enhancement

MELP runs the Fraser Valley Trout Hatchery on Lonzo Creek and operates a counting fence on the system. Lack of quality rearing habitats and inadequate adult escapements are the major factors limiting sea-run cutthroat trout production. Cutthroat fry stocking in upper Sumas tributaries, as well as habitat complexing, were identified as enhancement options. A side channel was constructed as CN mitigation on Lonzo Creek at Riverside Road. The City of Abbotsford conducted a cleanup of Lonzo Creek, and gravel placement for coho spawning on Lonzo Creek has been undertaken. MELP has identified further enhancement options for Lonzo Creek. A channel enhancement project was completed in the upper 100 m of Lonzo Creek. A local community group has been improving habitat in Gill Creek. Ecoworks has revegetated two sections of the Sumas River, and installed fencing along a 540 m section to exclude cattle from the river. Ecoworks also revegetated a portion of Saar Creek, and completed a clean-up of Lonzo Creek (1996). An impassable barrier at the lower end of Kilgard Creek was made passable in 1996.

Fish Production

Chum spawning occurs in the lower reaches of the Sumas River up to the hatchery on Lonzo Creek. Coho spawning occurs in the headwaters of Lonzo Creek past Farmer Road. Major spawning of coho in Lonzo Creek occurs in the headwaters, located in Washington State. Pink spawning occurs in the lower reaches of the Sumas River up to Kilgard Road. Steelhead spawn in the upper reaches.

Activities and Land Use

Agriculture

The Sumas River originates in an agricultural area of the United States. The stream is contaminated by high levels of agricultural field runoff and animal wastes on both the US and Canadian sides of the border.

Agriculture occurs along 91% of the length of Sumas River, and is intensifying. Agriculture occurs throughout the Lonzo Creek watershed and has led to many habitat conflicts. While the usual crop has been corn, brassicas are increasingly being grown. These crops receive high volumes of pesticides and fertilizers. The increase in chemical applications, and the use of liquid manure, is polluting the aquifers which contain the area’s drinking water.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate agricultural, and residential and industrial development.

Secondary Industry/Commercial

Industrial processing occurs along a small portion of the Sumas River's length. Industrial processing exists throughout the Lonzo Creek watershed, and is expanding. Discharges from industrial sites have seriously degraded the system. Land conversion on Kilgard Creek has resulted in extensive riparian loss. A brick manufacturing facility on the lower reaches of Kilgard Creek releases large volumes of clay laden effluent into the creek. Duck farm discharges were polluting Stewart Creek; however, there have recently been significant improvements to riparian protection and manure management at this site.

Linear Development

A BC Telephone lightguide crosses the river. There are railway crossings at the headwaters and the mouth (Canadian National & BC Southern railways). The TransCanada Highway (Hwy. 1) crosses the Sumas River, Sumas Lake Creek and the Vedder River; the TransCanada Highway parallels the Sumas River along the east side of Sumas Mountain. BC Hydro transmission, and oil and gas pipelines lines cross the Sumas River and several of its tributaries. The Sumas River is constrained by an extensive dyking system.

Urban Development

There is urban development in the headwaters of the Sumas River (in the U.S.), and in its lower reaches, on the lower slopes of Sumas Mountain (in Canada), as well as throughout the Lonzo Creek watershed. The effective impervious surface area in the Lonzo Creek watershed is 6%, and 2% in the Kilgard Creek watershed.

Government

The Sumas River is in the City of Abbotsford (Fraser Valley Regional District).

Designated Lands

There are several Indian Reserves (IR) in the Sumas watershed: IR #6 (Upper Sumas), IR #12 (Sumas Cemetery) and IR #5 (Aylechootlook). Because of its location, the new Sumas Mountain Nature Legacy Park will not confer any protection upon the Sumas River or its tributaries. Hougen Park (a small park) lies along the east side of the Sumas River. Department of National Defense lands are located at the mouth of the Sumas River. The McGillivary Slough Wildlife Refuge is located between Sumas Mountain and Chilliwack Mountain. Much of the Sumas River watershed is in the ALR.

Watershed Planning Issues

Management Concerns

- Narrow dykes constrain the river, and riparian vegetation is regularly removed as part of dyke maintenance. Many of the tributaries have been ditched, and although they provide fish habitat, they are scheduled for regular cleaning and maintenance.
- The Barrowtown Pumping Station, located immediately upstream of the confluence of the Vedder Canal and Sumas River, only provides fish passage at low water. It is closed from May to September.
- The McGillivary pumping station at the confluence with Vedder Canal has created fish passage problems.
- The lower system is subject to heavy erosion and sedimentation from adjacent farmlands.

- Ongoing drainage management and dredging activities by the City of Abbotsford are a significant concern.
- Agricultural runoff has led to fish kills in the system and is contaminating the aquifers in the area.
- Removal of riparian vegetation has led to an increase in water temperature.
- Cattle have direct access to the stream along various reaches.
- Lonzo Creek is heavily silted and polluted from highway construction, industrial development, and farming. Industrial and residential development along this creek has increased effective impervious area, which will alter the natural hydrologic regime. Discharges from industry include effluent from a fish hatchery (resulting in low dissolved oxygen concentrations and high phosphorus levels); the discharge of cooling water from an evaporated milk plant (causing temperature problems); and a stormwater discharge from a bulk petroleum storage facility. Landfilling and encroachment on the floodplain have reduced the wetted width of the creek. Well withdrawals from this part of the Abbotsford Aquifer reduce the recharge of Lonzo Creek. The headwaters of Lonzo Creek have been radically altered.
- Flooding from across the border (Washington State) impacts Sumas River tributaries (i.e. Saar); the response from the city is to dig the creeks out.
- Urban developments on Sumas Mountain lack stormwater management facilities and have affected some tributaries to the Sumas River, such as Kilgard Creek (increasing siltation, damaging stream channels, etc.).
- The overall water quality of the Sumas River system is extremely poor.
- Development in the Sumas River watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- This is a system of intense agricultural activity with great conflicts on maintaining fish habitat in stream/lake areas that are now ditches. A farm stream stewardship program is essential should fish have a future in this watershed.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- The Sumas system would benefit from spawning area enhancement on systems such as Kilgard Creek (which still has a good riparian area).

For Sumas River hydrograph, see Appendix 2.
For escapement information on the Sumas River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Chilliwack River, Lower

TREND ***Stable***

Watershed Code: 100-0657-097-000-000-000-000-000-000-000-000-000
RAB Code: 00-0600-020-000-000-000-991
TRIM Map: 92G010, 92G020, 92H001, 92H002, 92H003 , 92H012 and 92H013

STATUS:

Endangered - The majority of streams in this system are endangered through degradation caused by urbanization and agriculture. Lonzo, Saar, Frosst, and Midgley Creeks, Arnold Slough and Sumas River are examples.

Threatened - The lower Chilliwack mainstem and a number of tributaries (including Centre, Slesse, Nesakwatch, and Foley Creeks) and threatened primarily due to logging.

Wild - A number of the smaller creeks, such as Seedling, Fifteen Mile and Post Creeks (tributaries to the Lower Chilliwack) are well removed from settlement impacts and remain wild. A number of tributaries to Cultus Lake (such as Ascaphus, Amadis, Teapot, and Clear Creeks) are also considered wild.

Physiography

Drainage Area

The Lower Chilliwack River, for the purpose of this stream summary, is defined as the river downstream of Chilliwack Lake and the lake itself. The drainage area of the Chilliwack River watershed, from its headwaters in the Upper Chilliwack River to Vedder Crossing (including Chilliwack Lake), is 1260 km^2. Of this, 240 km^2 is the drainage area of Upper Chilliwack River (from the headwaters to Chilliwack Lake). The drainage area of the Chilliwack River downstream of Vedder Crossing to its confluence with the Fraser River is not available. The Lower Chilliwack flows northwest from Chilliwack Lake into Sumas River near its confluence with the Fraser River. The Lower Chilliwack River becomes the Vedder River, then the Vedder Canal (where it flows into the Sumas River), near the confluence with the Fraser River. The tributaries of the Lower Chilliwack include Sweltzer, Salwein, Street, Hopedale Slough, Barrett, Peach, Liumchen, Ryder, Little Tamihi, Tamihi, Thurston, Borden, Slesse, Foley, Nesakwatch, Seedling, Fourteen Mile, Fifteen Mile, Nursery, Buxton, Centre, Radium, Post and Paleface Creeks, Chilliwack Lake and Cultus Lake. A list of names of tributaries (and watershed codes) to the Chilliwack River is provided in Appendix 1.

Stream Description

The Lower Chilliwack River flows from Chilliwack Lake, which lies at an elevation of 610 m. The Chilliwack River system originates from snowmelt in the Cascade Mountains. The upper reaches of the stream flow in a natural channel; the lower reaches have been straightened, channelized, and dyked (Vedder Canal). The Vedder River has a wetland area of approximately 262 ha. The area is classified as 50% stream water, 40% gravel bar, and 20% stream swamp. The Lower Chilliwack River is approximately 61 km long.

Hydrology

The mean annual flow of the Lower Chilliwack River is 64 m^3/s, as measured at the water gauge located near Vedder Crossing. Flooding is a concern. Further up the river, the mean annual flow is 34.9 m^3/s, as measured slightly downstream of Chipmunk Creek. The flow regime has been altered by intensive logging in the watershed. Several tributaries including Wingfield Creek are very flashy. A water license on Liumchen Creek is held by the District of Chilliwack. Significant water withdrawal via licenses occurs on many of the tributaries of the Lower Chilliwack. The District of Chilliwack is investigating Foley Creek as a potential source of drinking water.

Channel Stability Assessment (Preliminary)

Potential landslides that may result from logging on steep hillsides are a concern, particularly as many have already occurred. Flooding, with associated bank and bed destabilization, is an ongoing problem. The Vedder Management Committee manages the lower river for bed aggradation and gravel removal. Regular surveys are used in conjunction with water profile modeling to assess the channel capacity. When capacity is no longer adequate to pass the 200 year instantaneous flood line, discharge bars are mined to increase the size of the channel. Setback dykes, river training and bank revetments have cut off or blocked secondary channels and this has led to the establishment of a single channel. Logging in the upper Liumchen Creek watershed has resulted in increased turbidity and siltation. Ryder Creek has unstable flows and excessive siltation. Extensive logging in Paleface, Slesse, Centre, Foley, Nesakwatch, and Tamihi Creeks has increased peak flows. This flow alteration has contributed to destabilizing the stream. A large landslide into the Chilliwack River, downstream of Slesse Creek, occurred in early 1997. The glacial clay banks in the area are very unstable.

Fisheries Resource

Fish Access

Anadromous fish have access through most of the Lower Chilliwack mainstem and side channels.

Fish Stocks

The Chilliwack River and its tributaries support valuable stocks of sockeye, pink, chum, and chinook salmon; steelhead, cutthroat, Dolly varden and rainbow trout; kokanee, and whitefish.

Restoration/Enhancement

A long history of enhancement activities includes coho stocking, upper Fraser chinook transplants into the Chilliwack River, chinook and coho broodstock collection, Dolly varden releases to Salwein Creek, steelhead smolt releases to Slesse, Salwein, Foley, Liumchen, Tamihi, Post, and Centre Creeks, and Chilliwack/Vedder Rivers. The Chilliwack River Hatchery is located at the confluence of Slesse Creek and the Chilliwack River; it produces chinook, chum, coho, and steelhead. Centre Creek Corrections Camp Hatchery produces coho.

Channelization and dyking on the Lower Chilliwack River has led to the loss of large organic debris and spawning gravels. Restoration/enhancement projects to address these issues have included gravel placement at the Chilliwack Lake outlet; side channels at Centre Creek and Borden Creeks, and on Hopedale Slough; gravel placement and channel deepening on Peach Creek; flow control structure on Sweltzer Creek; beaver dam removal, gabion installment for channel complexing, and side channel and gravel placement on Ryder Creek; barrier removal on Depot Creek; unspecified activities on Foley and Post Creeks; and clay bank stabilization on the Chilliwack River mainstem. Spawning platforms below Chilliwack Lake have been very successful. A large scale rearing and spawning channel has been built below Centre Creek (i.e. Centennial Channel).

Studies show that a pink spawning channel would be beneficial in the lower Chilliwack River, and as well as side channel enhancement. A general cleanup of Fourteen Mile Creek is recommended. Debris removal on Post Creek may improve fish passage. Paleface Creek needs off channel spawning channels and gravel.

Fish Production

There are no fish reported in the Little Tamihi, East Liumchen, Midgey, or Pierce Creeks. Chipmunk and Airplane Creeks are not known to support any salmon. Stocks are declining in Foley and increasing in Slesse and lower Liumchen Creeks. Tamihi, Centre, Thurston, Fourteen Mile, Fifteen Mile, and Post Creeks are in good shape. The Vedder Canal supports migratory and rearing fish. Riparian vegetation that would provide channel cover for good fish habitat is lacking.

Mud slides are a regular occurrence on the Chilliwack River; they are detrimental to fish production because they tend to coat the stream bottom with an impervious layer, which makes it difficult for fish to find clean spawning gravel. If spawning has already occurred, the mud from the slide can clog the gravels thereby destroying the eggs.

There is good steelhead production in the area between Slesse Creek and Vedder Crossing. The upper river has habitat features but cold water may limit production.

Activities and Land Use

Agriculture

Agriculture is the main activity in the lower watershed.

Mining

Exploration for mineral, and sand and gravel extractions are ongoing in many drainages to the Chilliwack River.

Forestry

Active logging occurs in the upper part of the Lower Chilliwack River watershed (e.g. Centre Creek and Nesakwatch Creek), and the watershed has been extensively logged in the past several decades.

Secondary Industry/Commercial

Commercial development (i.e. retail) is usually limited to that which supports residential development.

Linear Development

A BC Telephone lightguide crosses the Chilliwack River west of Yarrow. The TransCanada Highway (Hwy. 1), hydro lines, gas and oil pipelines, and the BC Southern Railway cross the stream system. Dykes constrain most of lower reaches of the river and its tributaries. There are numerous informal campsites along the Chilliwack River and around Chilliwack Lake, which have some potential to affect water quality.

Urban Development

Urban areas are concentrated at Cultus Lake, Vedder Crossing, Slesse Park, Osbourn Road, Bell Acres and Baker Trail. There are a few correctional facilities along the Chilliwack River, one at the mouth of Pierce Creek and another at the mouth of Foley Creek. Two very large communities, Promontory and Ryder Lake, are developing on the slopes of the Chilliwack River. Development in these upland areas is a matter of concern because of the lack of municipal stormwater detention or retention on the developments. Urban generated stormwater will increase flood flows, potentially altering stream channels. The District of Chilliwack has applied for a water license for waterworks on Liumchen and Foley Creeks. Both streams have good quality water supplies with low to moderate turbidity levels.

Government

The Lower Chilliwack River is in the District of Chilliwack (Fraser Valley Regional District). The Chilliwack River forms the border with the City of Abbotsford along the Vedder Canal to where it enters the Sumas River.

Designated Lands

The Department of National Defense has reserves within the watershed (including CFB Chilliwack, Salwein Creek, Cultus Lake, Tamihi Creek, Slesse Creek, Liumchen Creek). Soowahlie Reserve IR #14 is on the Sweltzer River. A private nature reserve has been established near Teske Rd. Brown Road Park is adjacent to the dyke of Hopedale Slough. Cultus Lake Provincial Park lies along the east side of Cultus Lake. International Ridge Provincial Park also extends along the east side of Cultus Lake. Other parks include Chilliwack River Provincial Park, which is located about 7 km east of Vedder Crossing on the north side of the Chilliwack River, and Slesse Park, located 6 km further upstream. Chilliwack Lake Provincial Park, originally a small park at the lower end of Chilliwack Lake, was enlarged to 9258 ha in July 1997, through a Schedule E of the Park Amendment Act designation. This Class A Provincial Park now includes the entire west side of Chilliwack Lake to the height of land, the entire Radium Creek watershed (an unlogged watershed), Chilliwack Lake itself, the entire shoreline of the lake (excluding a small parcel east of the original park and the Ecological Reserve at the south end of the lake along the Upper Chilliwack River), and the Post Creek drainage with Lindeman, Greendrop and Flora Lakes. A small alpine area around Liumchen Mountain has also been proposed to become a Class A Provincial Park. It is expected to be designated in the near future. There is extensive recreational activity (e.g. boating, fishing, hiking and camping) throughout the watershed. There are a number of Ministry of Forests Recreation Sites along the river. A narrow band along the Lower Chilliwack River is in the ALR.

Watershed Planning Issues

Management Concerns

- Continued steep slope logging on tributary streams has the potential to further exacerbate landslide concerns.
- Development in this section of the river associated with flood protection works has done great damage to the river's functioning and the fish habitat base.
- Urban development and agriculture have removed riparian areas which has raised temperatures, eliminated organic debris, and reduced fish food supplies.
- Flooding and associated bank and bed destabilization is an ongoing problem.
- Local municipalities continue to recommend dredging of the main channel and exposed gravel bars are targeted for ongoing excavation to lower the riverbed.

- Sedimentation from agriculture and road construction have seriously degraded the east fork of Salwein Creek.
- Lack of fencing allows livestock to trample streambanks, which causes bank destabilization and loss of riparian vegetation.
- A collapsed culvert at Brown Road on Street Creek has blocked access for fish migration.
- Beaver dams scattered through the system impede fish access.
- A private dam on Barrett Creek is blocking coho access.
- Logging in the upper Liumchen Creek watershed has significantly increased turbidity.
- Extensive logging in Paleface Creek has altered the flow, destabilizing the stream.
- Ryder Creek has unstable flows and excessive sedimentation.
- Residential development has encroached onto the floodplain and into historic sidechannels, and the banks have been severely riprapped.
- Current and proposed development in the watershed increases the risk of altered hydrology, altered water quality from stormwater runoff, contaminant discharges and spills, unauthorized stream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- The existing dykes should be set back in order to allow floodplain processes such as gravel recruitment and establishment of riparian vegetation.
- Resource management agencies are working with local municipalities to monitor the effects of dredging on spawning, and to develop best management practices. The Vedder River Management Committee needs to develop gravel removal plans that minimize habitat disturbances.
- Stream complexity should be restored in the reaches that have been impacted by flooding and flood control works. Gravel placement and side channel development projects should be encouraged.
- Large urban developments on the escarpment need to be designed to control storm water and sediment impacts and monitored closely.
- Low flow problems on Ryder Creek have prompted recommendations for a moratorium on water withdrawals. The setbacks proposed for the Ryder Lake development to protect fish and wildlife habitat need to be encouraged elsewhere in the area.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

For Lower Chilliwack River hydrograph, see Appendix 2 (water guage at Vedder Crossing below Slesse Creek).
For escapement information on the Lower Chilliwack River, see Appendix 3 (Lower Chilliwack River, not including Chilliwack Lake).
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 6 – Chilliwack River

Chilliwack River, Upper

TREND ***Stable***

Watershed Code: 100-0657-097-000-000-000-000-000-000-000-000-000
RAB Code: 00-0600-020-000-000-000-992
TRIM Map: 92H003

STATUS:

Wild - The least disturbed streams in the Lower Mainland include the upper Chilliwack River and its tributaries.

Physiography

Drainage Area

The drainage area of the Upper Chilliwack River (Dolly Varden Creek) is approximately 240 km^2. Tributaries include Little Fork River, and Bear, Indian, Brush, and Easy Creeks. These are all in the United States. A list of tributaries (and associated watershed codes) to the Upper Chilliwack River is provided in Appendix 1.

Stream Description

The Upper Chilliwack River originates from snowmelt in the Cascade Mountains of Northern Washington and flows north into Chilliwack Lake, which lies at an elevation of 610 m. The entire Upper Chilliwack River is approximately 24 km in length; however, the portion on the Canadian side of the border constitutes only 3.2 km of this length.

Hydrology

There have been no calculations of the mean annual flow of the Upper Chilliwack River. The river has a natural flow regime.

Channel Stability Assessment (Preliminary)

The low gradient of the lower reaches of the Upper Chilliwack River results in an accumulation of sediments near the mouth of the river, forming a delta at Chilliwack Lake. Extensive gravel deposits are present throughout the river.

Fisheries Resource

Fish Access

Anadromous fish have access throughout the Upper Chilliwack mainstem and side channels.

Fish Stocks

The Upper Chilliwack River and its tributaries support stocks of sockeye, pink, chum, chinook, coho salmon; steelhead, cutthroat, Dolly varden, rainbow trout, kokanee, and whitefish.

Restoration/Enhancement

No specific enhancement opportunities have been identified.

Fish Production

Kokanee spawn at the confluence of the Upper Chilliwack River and Chilliwack Lake.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

The area has been extensively logged in the past, but there is no substantial logging in the Upper Chilliwack River watershed at this time.

Secondary Industry/Commercial

None.

Linear Development

Numerous old logging roads are located around the lake and on the surrounding slopes south of the lake.

Urban Development

None.

Government

The part of the Upper Chilliwack River that is in Canada is in the Fraser Valley Regional District.

Designated Lands

An ecological reserve (#98) is located where the Upper Chilliwack River enters the lake. The river is located within the Chilliwack Provincial Forest. The headwaters of the Chilliwack River are contained in Cascades National Park (Washington State).

Watershed Planning Issues

Management Concerns

- Any logging in the Upper Chilliwack River drainage, especially on steep slopes, is a concern.
- Chilliwack Lake is reported to be very poorly buffered and extremely vulnerable to acid precipitation inputs.

Management Prescriptions

- Impacts of forestry activities on stream systems in this area need to be assessed before further logging occurs.
- The entire upper Chilliwack drainage is a good candidate for complete protection.

For Upper Chilliwack River hydrograph, see Appendix 2 (water guage above Slesse Creek at outlet of Chilliwack Lake).
For escapement information on the Upper Chilliwack River, see Appendix 3 (includes Chilliwack Lake).

Wilson Slough

TREND *Stable*

Watershed Code: 100-0692-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G020

STATUS:

Threatened - Extensive riparian removal has degraded Wilson Slough.

Physiography

Drainage Area

The area occupied by the Wilson Slough watershed is unknown. The slough flows northwest entering the Fraser River just west of Chilliwack Mountain.

Slough Description

The slough covers approximately 34.1 ha. The slough is a wetland, comprised of 60% floodplain marsh, 20% stream water, and 20% gravel bar.

Hydrology

No hydrologic data are available.

Channel Stability Assessment

No information is available.

Fisheries Resource

Fish Access

Anadromous fish access and use of Wilson Slough is unknown.

Fish Stocks

Unknown.

Restoration/Enhancement

No specific enhancement opportunities have been identified.

Fish Production

No information on fish production is available.

Activities and Land Use

Agriculture

Farming is the main activity in the watershed.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate agriculture and residential development.

Secondary Industry/Commercial

A sawmill is located near the mouth of the slough.

Linear Development

The TransCanada Highway (Hwy. 1) and the Canadian National Railway cross the slough about 1 km from its mouth.

Urban Development

None.

Government

Wilson Slough is in the District of Chilliwack (Fraser Valley Regional District).

Designated Lands

Wilson Slough flows through the Lackaway Indian Reserve #2. The Wilson Slough watershed is in the ALR.

Watershed Planning Issues

Management Concerns

- Fish use and value to the fish habitat base is not known.
- There has been significant removal of riparian vegetation.

Management Prescriptions

- Fishery use must be determined.
- Riparian areas should be re-planted.

Chilliwack Creek

TREND

Declining

Watershed:Code: 100-0718-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0625
TRIM Map: 92G020 and 92H011

STATUS:

Endangered - Riparian removal and channelization affect the Chilliwack Creek system; the creek has water quality problems.

Physiography

Drainage Area

The total watershed area of Chilliwack Creek (Little Chilliwack Creek) is 78.4 km^2. The creek flows northwest into the Fraser River, northeast of Chilliwack Mountain. Tributaries include Luckakuck, Atchelitz and Semmihault Creeks. A list of tributaries and their watershed codes is provided in Appendix 1.

Stream Description

Chilliwack and Atchelitz Creeks form a wetland area of approximately 145 ha. The wetland is classified as approximately 70% stream water and 30% floodplain marsh.

Hydrology

The mean annual flow of Chilliwack Creek is 1.85 m^3/s. Chilliwack Creek and Luckakuck Creek are old channels of the Chilliwack/Vedder River system, and their flows result in part from groundwater inflow and seepage. Agricultural water withdrawals affects flows in these streams. Important spawning areas in Atchelitz Creek are impacted by dewatering, possibly due to a loss of groundwater recharge areas (due to development).

Channel Stability Assessment (Preliminary)

Most of the substrate is silt, except near areas of upwelling where gravels are found. The tributaries have been channelized along various reaches in the system.

Fisheries Resource

Fish Access

Anadromous fish have access throughout the mainstream and tributaries of Chilliwack Creek. The Chilliwack Creek pump house causes passage problems at low flows.

Fish Stocks

Chilliwack Creek and its tributaries support populations of coho and chum salmon; cutthroat trout, sturgeon, stickleback, northern squawfish, carp, and calico bass. Salish suckers have also been recorded in the system.

Restoration/Enhancement

Stream improvement activities have included dredging, gravel placement, and stream cleanup. Luckakuck Creek would be suitable for the introduction of additional fish, after Chilliwack Creek pump house problems are resolved. Chilliwack Creek has been enhanced upstream of Knight Road. About 2 km of channels were excavated where previously there were only standing pools. Chum fry have been transplanted to Luckakuck Creek from Centre Creek. Luckakuck Creek remains unseeded with fry from outside sources.

Fish Production

The Skowkayle Band runs an incubation facility for chum, and a hatchery for coho. The Chilliwack High School has a classroom incubation facility for coho.

Activities and Land Use

Agriculture

Agricultural land use occupies 78% of the watershed. Agricultural water use affects both the water quality and quantity in this creek. Atchelitz Creek has been severely affected by agriculture along the upper reaches; the groundwater table is dropping, sections dewater, and large portions have been channelized. Irrigation withdrawals on Semmihault Creek consume 100% of the naturalized summer 7-day mean low flow. There are intensive dairy operations in the Semmihault Creek watershed.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development. There is a lumber mill in the watershed.

Secondary Industry/Commercial

There are several food processing plants in the watershed. A Dairyland plant has a licence to withdraw water from Luckakuck Creek. There is industrial development along the lower reaches of Chilliwack Creek. Chilliwack Creek receives stormwater from a bulk petroleum facility and cooling effluent from a food processing plant. Industrial activities on Atchelitz Creek include a canning factory, food processing plant, and a sawmilll; more industrial development is occurring in the lower watershed. Atchelitz Creek receives stormwater from two bulk petroleum cardlock facilities and cooling effluent from a food processing plant.

Linear Development

There is a BC Telephone lightguide crossing at the mouth of Chilliwack Creek. The TransCanada Highway (Hwy. 1) crosses the creek several times. Several city streets, including Yale Road and the Chilliwack River Road, cross the creek. The Canadian National and Burlington Northern railways also cross the creek.

Urban Development

There is urban development in the upper watershed of the Chilliwack Creek where it passes through the southern part of the city of Chilliwack. The upstream half of Chilliwack Creek has been built over, and drainage interrupted through the development process. Marblehill and Calkins Creeks are experiencing the beginnings of urbanization; these areas are slated for urban growth in the next ten years. Calkins Creek has been cleared recently; there is minimum riparian vegetation left. Luckakuck Creek originates in Sardis and flows through it for several kilometers; both residential and industrial development encroach on the stream. Riparian vegetation has been removed in the residential section except in a few reaches. About 21% of the Luckakuck Creek watershed is now effective impervious area. The Chilliwack Creek watershed as a whole has an effective impervious area of 6.2%.

Government

Chilliwack Creek is in the District of Chilliwack (Fraser Valley Regional District).

Designated Lands

The following Indian Reserves (IR) are located in the watershed: Skwah IR #4, Skway IR #5, Kwawkwawapilt IR #6, Squiaala IR #7, #8, Aitchelitch IR #9, Skulkayn IR #10, Skulkayn IR #11, and Yakweakwioose IR #12. One branch of Chilliwack Creek originates in Sardis Park. The tributary Semmihault Creek flows through the Chilliwack Airfield. Portions of the upper Chilliwack Creek watershed are in the ALR.

Watershed Planning Issues

Management Concerns

- The Chilliwack Creek pump house causes fish passage problems.
- Bank erosion is causing extreme sedimentation in Atchelitz Creek.
- Industrial and urban development have encroached on the creeks and riparian vegetation has been removed.
- Water flows in Chilliwack Creek are reduced due to the loss of recharge areas and the number of water withdrawal licenses on the system.
- High fecal coliform counts, high dissolved ammonia values, low dissolved oxygen concentrations, high water temperatures are the result of the agricultural and industrial activities in the watershed.
- Waterways are regularly cleared by the District of Chilliwack, resulting in the removal of elements of fish habitat (gravel substrate, riparian areas, large organic debris, etc.).
- Ongoing development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized stream works, bank alterations and riparian vegetation removal.

Management Prescriptions

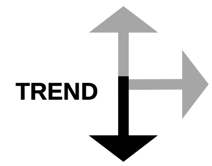
- A moratorium should be imposed on additional water withdrawals due to low flow problems. Ways of returning flows to the stream must be examined.
- This is a system under great stress due to agricultural and urban development. A restoration program associated with improved development technologies must be adopted or the stream's habitat and water quality will continue to be degraded.
- Impacted riparian zones should be revegetated.
- A strong stewardship program which focuses on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system is required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

For Chilliwack Creek hydrograph, see Appendix 2.
For escapement information on Chilliwack Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 7 – Hope Slough Area

Hope Slough

Watershed Code: 100-0741-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0640
TRIM Map: 92H011 and 92H012



Declining

STATUS:

Endangered - Hope Slough and its tributaries have been severely impacted by agriculture (riparian removal, poor water quality, channelization, and water withdrawals).

Physiography

Drainage Area

The total watershed area of Hope Slough is 100.3 km^2. The slough flows into the Fraser River west of Chilliwack. Its tributaries include Elk Brook, Elk Creek, Dunville Creek, Nevin Creek, and Gravel Slough. A list of tributaries and watershed codes is provided in Appendix 1.

Slough Description

The lower end of Hope Slough bifurcates into Hope Slough and Shefford Slough before recombining immediately upstream of their confluence with the Fraser River. Hope Slough is a stable channel fed by groundwater, Camp Slough, and mountain tributary runoff. The slough is approximately 130 ha in size and is classified as 80% oxbow water and 20% floodplain marsh. The upper part of Hope Slough has been lost from Agassiz westward (a bridge goes across the slough, and then this part of the slough was filled in and eliminated due to gravel pit operations over the past several years). In 1983 the Camp Hope Improvement Project (undertaken for irrigation purposes) put diversion pipes and valves in the dyke at Ferry Island to divert Fraser River flows into the Camp-Hope Slough complex. Upper parts of Camp Slough were excavated for the new flow.

Dunville Creek is a small stream which originates in the Skagit Mountains and flows down the mountainside onto the Fraser River floodplain approximately 3.7 km above its confluence with Hope Slough. Elk Creek is another small tributary of Hope Slough, and is similar to Dunville Creek.

Hydrology

The mean annual flow of Hope Slough is 2.09 m^3/s. Several sloughs connected to Hope Slough have been cut off from the Fraser River through extensive dyking. Through this process, several sloughs have become inaccessible to fish. The Elk Creek Water Board is licensed to withdraw 3.0 million gallons per day from Elk Creek and 0.7 million gallons per day from Dunville Creek for domestic use. The status of Elk Creek as a community watershed may change if the District makes the transition from surface water to groundwater withdrawal as the primary municipal water supply source. The District of Chilliwack also has a water license on Nevin Creek for domestic use. These licenced withdrawals contribute to low flows in summer and have resulted in fish kills.

Channel Stability Assessment (Preliminary)

There has been extensive infilling of the channel. This is likely the result of extensive clearing and dyking that has occurred throughout the system.

Fisheries Resource

Fish Access

Anadromous fish have access through most of the system (where the system still exists). Culverts on some tributaries prevent fish access due to culvert placement or erosion.

Fish Stocks

Hope Slough supports stocks of coho and chum salmon; steelhead and cutthroat trout; sticklebacks, northern squawfish, peamouth chub, redside shiner, brown bullheads, and suckers.

Restoration/Enhancement

Stream work has included removing garbage, widening, and dredging Hope Slough. The extensive habitat degradation that has occurred through clearing and dyking lowers the enhancement potential of this system. A milfoil weed control program has been undertaken in Hope Slough. A flow by-pass system on Elk Creek guarantees fisheries flows necessary for spawning and rearing before any water is diverted to the District of Chilliwack. However, only 150 m of spawning area is available; fish could move back up the stream if the water licence was removed. Rehabilitation of the channelized portions of Dunville Creek may improve the spawning area and fish production. A concern about high summer water temperatures in Hope Slough has resulted in proposals to install an intake valve to divert 108 cfs of water from the Fraser River into Hope Slough in order to provide cooling water, but these were not endorsed by DFO. Fraser River water that has been supplementing Camp Slough since 1983 (for irrigation purposes) has not been found to abate high temperatures. The Centre Creek Enhancement Society has enhanced late run coho (February spawners).

Fish Production

Coho fry were transplanted from Centre Creek to Ford Creek and Dunville Creek, and eggs from Elk Creek have also been transplanted to Nevin Creek. Hope Slough is stocked with anadromous cutthroat trout smolts.

Activities and Land Use

Agriculture

The lower portions of Dunville, Nevin and Elk Creeks are adjacent to agricultural lands; they have been channelized and are denuded of riparian vegetation. Agricultural activity occurs along 79% of the stream length. Water demand for irrigation affects flows as well as diversion for waterworks. A system of culverts and ditches has been proposed to drain agricultural fields which tend to pond following heavy rains. The Cheam View Trout Farm is located on Hope Slough. During August low flows, effluent from the fish farm may comprise about 18% of the flow in Hope Slough. Effluent data shows that the biochemical oxygen demand, and concentrations of suspended solids, ammonia and phosphorus have all exceeded permit specifications by significant amounts. Elk Creek is surrounded by farms; most of the lower 4 km are ditched and riparian vegetation has been removed. A watercress farm operates on Elk Creek.

Mining

None.

Forestry

Hope Slough and its tributaries, with the exception of Elk Creek, have been deforested.

Secondary Industry/Commercial

Industrial processing operations occur along approximately 4% of the stream length. Several concrete plants are located just upstream of Hope Slough.

Linear Development

A gas pipeline crosses the slough. Lower Hope Slough is crossed by several roads including Young Street, Menzies Street, Quarry Road, and Barrit Road. Highway 9 (Hope Road) follows part of Hope Slough and most of the length of Camp Slough for 12 km. Yale Road follows Hope Slough for 8 km from Mt. Shannon to Rosedale. The TransCanada Highway (Hwy. 1) and the Canadian National Railway cross the northern tributaries of Hope Slough.

Urban Development

There is extensive urban development along Hope Slough where it flows through the city of Chilliwack. There is development along the length of Hope Slough; it also passes through the community of Rosedale. As properties along Hope Slough extend to the middle of the slough, owners often “beautify” them by removing riparian vegetation and growing lawn to the edge of the slough. In the Ford Creek area, a golf course is being developed on the flats and an entire hillside is the site of new urban developments.

The effective impermeable area of the Hope Slough watershed is 2.4%.

Government

Hope Slough is in the District of Chilliwack (Fraser Valley Regional District).

Designated Lands

Indian Reservations (IR) on the system include Cheam IR #1, Schelowat IR #1, Skwahla IR #2, Skwali IR #3. There are several campgrounds at the mouth of Hope Slough. Much of Hope Slough lies in the ALR.

Watershed Planning Issues

Management Concerns

- Poaching and illegal fishing at the Fraser River confluence is a problem.
- Water removal for irrigation and waterworks from Dunville, Nevin and Elk Creeks cause low flow problems.

- The watershed has been impacted by numerous contaminant spills, and high coliform levels. The water quality throughout the watershed has been severely degraded by agricultural practices.
- Coho spawning and rearing habitat in Elk Creek has been severely degraded by a combination of channelization, water withdrawal, periodic siltation, and the removal of streamside vegetation.
- A Watershed Restoration Program is beginning in the upper reaches of Elk Creek.
- Waterways in this system are subject to clearing every three years through the District of Chilliwack's maintenance schedule, resulting in the removal of elements of fish habitat (gravel substrate, riparian areas, large organic debris, etc.).
- Ongoing development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- A moratorium is required on any further water withdrawals from Dunville, Nevin Elk, Calkins and Marblehill Creeks due to low flow problems which inhibit spawning.
- The shale traps that exist on several tributaries need to be maintained in order to remain passable to salmon.
- Riparian vegetation should be reestablished, particularly on the tributaries.
- Fencing is required to control cattle access.
- Septic systems should be inspected, maintained or decommissioned.
- The Ministry of Forests is preparing an Integrated Watershed Resource Plan for the upper part of Elk Creek.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- There is a need for municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage.

For Hope Slough hydrograph, see Appendix 2.
For escapement information on Hope Slough, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Greyell Slough

TREND ***Stable***

Watershed Code: Unavailable (lateral channel of the Fraser River)
RAB Code: 00-0660
TRIM Map: 92H021

STATUS:

Endangered - Extensive riparian removal has degraded Greyell Slough; there are some water quality problems.

Physiography

Drainage Area

Greyell Slough is a lateral channel of the Fraser River. It is located on the north side of Windermere Island, northeast of Chilliwack.

Stream Description

Greyell Slough is approximately 130 ha in size. It is classified as 90% gravel bar and 10% stream water.

Hydrology

The mean annual flow of Greyell Slough is not known. It is a side channel of the Fraser River.

Channel Stability Assessment

No information is available.

Fisheries Resource

Fish Access

Anadromous fish have access throughout the slough.

Fish Stocks

Greyell Slough supports stocks of sockeye, coho, pink, chum, and chinook salmon; cuthroat, steelhead, Dolly varden, rainbow trout, kokanee, rocky mountain whitefish, suckers, peamouth chub, and black crappie.

Restoration/Enhancement

No specific restoration/enhancement opportunities have been identified.

Fish Production

There is no specific fish production information available. However, as with other side sloughs, it serves as an important migratory and rearing area for the millions of fry and smolt that migrate downstream from upper Fraser River salmonid streams. Greyell Slough supports chum spawning.

Activities and Land Use

Agriculture

The primary land use along the south side of the slough (Windermere Island) is agricultural (cultivated fields and pasture).

Mining

Gravel removal has been a historic problem in most of these side channel areas.

Forestry

The south shore of Greyell Slough (Windermere Island) has been permanently deforested for agriculture.

Secondary Industry/Commercial

None.

Linear Development

The Canadian National Railway runs parallel to Greyell Slough along the south bank.

Urban Development

None.

Government

Greyell Slough is in the District of Chilliwack (Fraser Valley Regional District).

Designated Lands

Greyell Slough is included in the ALR.

Watershed Planning Issues

Management Concerns

- Fraser River side sloughs such as this one have been encroached upon and often cut off from the Fraser mainstem for flood control/land development purposes.
- Extensive riparian vegetation removal has occurred along the slough.

- The slough has been impacted by agriculture and has poor water quality.
- Poaching and illegal fishing at the Fraser River confluence is a problem.

Management Prescriptions

- There is a need to develop a policy to restore and protect these Fraser River side channels.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, and maintain unobstructed fish passage are required.
- Education and stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, discouraging unauthorized instream works, and increasing public awareness about the fisheries values of this system are required.

Wahleach Slough

TREND → ***Stable***

Watershed Code: Unavailable (lateral channel of the Fraser River)
RAB Code: 00-0685
TRIM Map: 92H012 and 92H022

STATUS:
Wild - Wahleach Slough is relatively undisturbed.

Physiography

Drainage Area

The total watershed area of Wahleach Slough is 28.2 km^2. The slough flows south then west and joins the Fraser River at Popkum, just above the Agassiz bridge.

Slough Description

Wahleach Slough is a lateral channel of the Fraser River. The wetland area of the slough is classified as 100% floodplain marsh, and is approximately 3.8 ha in size.

Hydrology

The mean annual flow of Wahleach Slough is 0.67 m^3/s. Flows in the slough are augmented via water from the Jones Creek Power Plant penstock. These flows are usually due to peak power production needs and are not continuous.

Channel Stability Assessment

No information is available. Riparian vegetation is intact.

Fisheries Resource

Fish Access

Anadromous fish have access throughout the slough.

Fish Stocks

Wahleach Slough supports chum spawning annually, and in some years pink, coho, sockeye and chinook have been observed spawning. Cutthroat trout have also been observed.

Restoration/Enhancement

Scott Paper Ltd. has a woodlot license on Herrling Island (between Wahleach Slough and the Fraser River). As compensation for crossing the slough they have dug channels to create spawning areas. There is a rock berm below the spillway that could be removed.

Fish Production

Wahleach Slough is very productive. It can infill during freshets; which aggrades the channel bed and reduces the amount of available habitat during low flows.

Activities and Land Use

Agriculture

Herrling Island was farmed until converted to a cottonwood plantation two decades ago.

Mining

Some unapproved removal of gravel from the channel occurs. A Highways quarry in Ted Creek (downstream of the Hydro tailrace) caused severe sedimentation of the channel in 1985.

Forestry

Scott Paper Ltd. operates a cottonwood plantation in the watershed (on the island between the slough and the Fraser River). Biosolids (from GVRD sewage treatment plants) are applied by Scott Paper.

Secondary Industry/Commercial

The channel receives peaking flows from the Jones Creek power plant.

Linear Development

The Canadian National Railway and the TransCanada Highway (Hwy. 1) run parallel to Wahleach Slough.

Urban Development

None.

Government

Wahleach Slough is in the Fraser Valley Regional District.

Designated Lands

Cheam Indian Reserve #1 and Popkum Indian Reserve #1 are located at the southern end of the slough.

Watershed Planning Issues

Management Concerns

- Sediment accumulation and slope and stream destabilization is exacerbated by forestry and highway practices on the Fraser Valley slopes south of the slough.

- No specific enhancement opportunities have been identified; however, the large water flow variations caused by the B.C. Hydro facility and the long term protection of the channel is a significant concern.

Management Prescriptions

- Conservation priority should be given to Wahleach Slough as it one of few relatively “wild” Fraser River waterways remaining in the Lower Fraser Valley.
- A protection program must address riparian needs along the forest plantation and elimination of low flow sediment impacts; should protect undisturbed gravels; and free Fraser flows in the channel.

For Wahleach Slough hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Bridal Creek

TREND ***Stable***

Watershed Code: 100-0894-071-891-000-000-000-000-000-000-000-000
RAB Code: 00-0690
TRIM Map: 92H012 and 92H022

STATUS:

Endangered - Bridal Creek has been impacted by development and historic mining operations.

Physiography

Drainage Area

The total watershed area of Bridal (Popkum) Creek is 20.4 km^2. The creek flows north through Cheam Lake, and merges with Anderson Creek before flowing into the Fraser River just east of Popkum.

Stream Description

Bridal Creek is a small stream that originates in the Skagit Mountains and discharges into the Fraser River floodplain near the south end of Herrling Island. Bridal Creek flows through Cheam Lake, a site formerly mined for its marl for agricultural lime. The stream bed is coated with marlime from past mining. Anderson Creek, a tributary, often goes dry due to sub-gravel flows.

Hydrology

The mean annual flow of Bridal Creek is 0.90 m^3/s.

Channel Stability Assessment (Preliminary)

The bed material in Anderson Creek is very coarse, due in part to the flashiness of the system and previous debris torrents. The channel is often dry in the summer months. A 30 m riparian corridor protects the lower reaches of Bridal Creek.

Fisheries Resource

Fish Access

Anadromous fish access has been improved through culverts and a fish ladder installed at Cheam Lake.

Fish Stocks

Bridal Creek and Anderson Creek support stocks of coho, pink, and chum salmon; cutthroat trout, and unspecified coarse fish. Cheam Lake supports coho and chum salmon; and rainbow and cutthroat trout.

Restoration/Enhancement

Cheam Lake was drained forty years ago to mine marl. Ducks Unlimited flooded the area (58.3 ha) in 1989. The lake has been restored and provides high quality habitat for many forms of fish and wildlife. SEP has carried out enhancement activities on this creek. Access has been improved through culverts and a fish ladder installed at Cheam Lake. Coho releases (up to 30,000) occur every year.

Fish Production

Spawning occurs upstream to the culvert at the railroad crossing. Rearing occurs in the slough and Cheam Lake.

Activities and Land Use

Agriculture

Agricultural activities have impacted water quality and removed riparian vegetation. There is a feedlot on Bridal Creek; and cattle have free access to the stream which has been denuded of riparian vegetation.

Mining

A historic mining operation removed marl from the bottom of Cheam Lake. The lake has since been flooded and restored.

Forestry

Forest harvesting occurs on Anderson and Bridal Creeks.

Secondary Industry/Commercial

None.

Linear Development

The creek is crossed by the TransCanada Highway (Hwy. 1), the Canadian National Railway, a BC Telephone lightguide, hydro powerlines, an oil pipeline, and several small roads.

Urban Development

Urban development and a golf course are located along the lower reaches of Bridal Creek but a 30 m riparian corridor has been left. A mobile home park and motel are located in the mid reaches, above the TransCanada Highway.

Government

Bridal Creek is in the Fraser Valley Regional District.

Designated Lands

The stream flows through Bridal Veil Falls Provincial Park, and Cheam Lake Regional Park. Popkum Indian Reserve #1 and Cheam Indian Reserve #1 are located in the watershed. Parts of the Bridal Creek watershed are in the ALR.

Watershed Planning Issues

Management Concerns

- The streambed is coated with marl lime sediments.
- Fish access to good spawning areas upstream and downstream of the lake is blocked.
- Culverts under roads and railroad crossings have caved in and may only be passable under some flows.
- The potential August water demand flow for domestic, irrigation and industrial uses 95% of the naturalized summer 7-day mean low flow. Given the natural summer low flows in the creek, these water withdrawals exacerbate the impact of low flows on fish habitat.
- There are extreme agricultural impacts on the riparian zone.

Management Prescriptions

- The denuded reaches of Bridal Creek must be fenced and replanted.
- Fish access should be improved through culverts.
- The impact of water withdrawals on fish habitat should be examined.

For Bridal Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 8 – Wahleach Creek to Hope Area

Wahleach Creek

TREND **Stable**

Watershed Code: 100-1018-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0735
TRIM Map: 92H022 and 92H032

STATUS:

Endangered - The Wahleach Creek watershed has been impacted by forestry activities (riparian removal, degraded water quality and clearcutting), and the flow in Wahleach Creek has been reduced by the hydro dam at Wahleach Lake.

Physiography

Drainage Area

The total watershed area of Wahleach (Jones) Creek is 114 km^2. The creek flows northward to meet the Fraser River east of Peters Indian Reserve. A BC Hydro dam built on Wahleach Lake in 1954 directs most flows west through a tunnel directly to the Fraser River, discharging near Wahleach Slough.

Stream Description

Wahleach Creek is a mid-sized stream which originates in the Cheam Range. The creek flows into Wahleach Lake at an elevation of 642 m. Prior to 1954, the creek flowed downstream from Wahleach Lake onto the Fraser River floodplain and out to the Fraser River. Due to the diversion (the BC Hydro dam), an artificial spawning channel was built on Wahleach Creek in 1954 to maintain salmon runs with the greatly reduced flows. BC Hydro also diverted the flow of Boulder Creek, which originally flowed into Wahleach Creek below the lake, directly into the lake.

Hydrology

The mean annual flow of Wahleach Creek is 3.33 m^3/s. Most of this flow is directed from Wahleach Lake to a powerhouse adjacent to Wahleach Slough, a distance of 5 km downstream of the confluence of the creek and the Fraser River.

Channel Stability Assessment (Preliminary)

Severe sedimentation of the stream was obvious from logging practices in 1972, resulting in a Fisheries Act prosecution. Significant slope failures have been reported in this system in 1983, 1993, 1995, and 1996. Major slides have completely blocked the stream forcing it out of the streambed and spawning channel. Slopes in the watershed are steep and unstable. Sedimentation and debris torrents attributed to logging and logging road construction have totally filled in parts of the stream and destroyed the spawning channel.

Fisheries Resource

Fish Access

Anadromous fish have access to a fish barrier approximately 100 m upstream of the mouth which was to divert fish into a constructed spawning channel (approximately 1000 m long) off the mainstem. The spawning channel was completely eliminated in 1995/96 by debris torrents created by upstream logging and road construction. Resident cutthroat have access throughout Wahleach Creek and have been observed in Wahleach Lake.

Fish Stocks

Wahleach Creek and its tributaries support resident species including rainbow and cutthroat trout, as well as kokanee, which were introduced to Wahleach Lake. Due to the nature of the reservoir and its operations, kokanee have disappeared and experiments to fertilize are now underway. Unique early runs of chum and pink salmon were restricted to the spawning channel and the 100 m of “natural” stream below it. However, due to a recent mass wasting event, they are now believed to be extinct in the system.

Restoration/Enhancement

The lake is stocked with rainbow trout and kokanee. The spawning channel was intended to be used by chum, coho, and pink salmon. Significant restoration works are required in the watershed to address sources of debris torrents, deactivate logging roads, and to “green-up” and stabilize slopes. FRBC will be financing several projects in the watershed. An initial project built a sediment detention pond but it was destroyed by massive wasting in upstream areas.

Fish Production

Salmon (coho, pink and chum) spawning and rearing traditionally occurred in the mid and lower reaches of the mainstem and tributaries. Substrate and cover conditions were good with an estimated one mile of prime spawning gravel. Kokanee used many of the tributaries into the lake for spawning. The kokanee have disappeared and are now subject to a recovery plan. Rainbow and cutthroat trout are present in Wahleach Lake.

Activities and Land Use

Agriculture

Agriculture has denuded the east bank of the bottom 100 m of the stream (i.e. at its confluence with Lorenzetta Creek).

Mining

None.

Forestry

Logging began in the system in the 1940’s, and portions of the watershed are still being logged. The continued logging has resulted in extremely negative downstream habitat impacts (i.e. erosion leading to siltation and mass wasting).

Secondary Industry/Commercial

None.

Linear Development

BC Hydro operates a dam on Wahleach Lake, diverting water through penstocks to the Fraser River. A BC Telephone lightguide transmission corridor, the TransCanada Highway (Hwy. 1), the Canadian National Railway, and an oil pipeline cross Wahleach Creek. Recent channel blockages have threatened the pipeline necessitating the removal of large volumes of gravel from the creek. Linear facilities have greatly impacted the delta section of the stream as it joins the Fraser River.

Urban Development

There are a few homes near the creek. Development of land is planned for the bottom section, near Lorenzetta Creek.

Government

Wachleach Creek is in the Fraser Valley Regional District.

Designated Lands

A government reserve is located at the mouth of Wahleach Lake. Peters Indian Reserve #1 and #2 are located 2 km away from the mouth of the creek. F.H. Barber Provincial Park is located near the mouth of the creek. A small portion at the mouth of the west side of the creek is in the ALR.

Watershed Planning Issues

Management Concerns

- Flows from the Wahleach Lake dam are managed by BC Hydro; however, the dam has no structures for minimum flow releases. A siphon was built to pass water over the dam for spawning purposes when natural flows were low. The siphon does not work at low reservoir levels.
- Forestry activities (including road construction) have destabilized slopes and created debris torrents that have eliminated downstream fish habitat including the artificial spawning channel built in 1954.

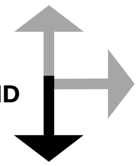
Management Prescriptions

- DFO published a review of this stream in 1997 and the report recommends various management options. These management prescriptions should be seriously considered since the stream has largely been destroyed.
- A major restoration program will be required to stabilize slopes and logging roads in this watershed and to prevent further damage to the stream.
- Ongoing sedimentation sources and minimum flow issues must be addressed.
- The 1997 Hartman and Miles study determined that it will take decades for the watershed to recover, so it is impractical to rebuild the spawning channel. It is recommended that Wahleach Creek be allowed to return to its “natural” streambed and flows be augmented discharges from the reservoir (*Jones Creek Spawning Channel: Post Failure Analysis and Management Recommendations,* February 1997).
- These management prescriptions should be seriously considered in that the stream has largely been destroyed due to impacts in the watershed from logging.

For Wahleach Creek hydrograph, see Appendix 2.
For escapement information on Wahleach Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Lorenzetta Creek

TREND



Declining

Watershed Code: 100-1020-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0736
TRIM Map: 92H023, 92H032 and 92H033

STATUS:

Endangered - Lorenzetta Creek has been impacted by channelization, agricultural activities (i.e. riparian vegetation removal), and settlement.

Physiography

Drainage Area

The total watershed area of Lorenzetta Creek is 11 km^2. The creek is a tributary of the Fraser River which flows westward to meet Wahleach Creek 100 m prior to its confluence with the Fraser River.

Stream Description

Lorenzetta Creek is a steep gradient mountain stream approximately 8.7 km long. The lower 2.3 km of the creek flows across the Fraser River floodplain and is predominantly slough-like with isolated gravel deposits. A channelized chute extends above the slough to the base of the mountain.

Hydrology

Lorenzetta is a very flashy system, moving large quantities of bedload. The mean annual flow of the stream is 1.1 m^3/s. Low flow problems occur as flows go subsurface through the gravel fan but these are probably exacerbated by upstream water withdrawals.

Channel Stability Assessment (Preliminary)

Channel instability and flooding have resulted from sediment accumulation on the fan. Part of the lower reach of the creek has been dyked due to flooding of farm fields.

Fisheries Resource

Fish Access

Anadromous fish have access throughout the creek up to the natural gradient barrier presented by the mountain side. There are a series of small beaver dams in the lower 2 km, all of which are passable by migrating adults.

Fish Stocks

Lorenzetta Creek supports stocks of coho, pink, and chum salmon; steelhead and cutthroat trout.

Restoration/Enhancement

Beaver dams and debris are periodically removed.

Fish Production

Chum spawn in the lower reaches of the creek from 0 to 2.3 km. Coho and pink spawn throughout the system (gradient permitting). Cutthroat and steelhead spawn up to the third bridge.

Activities and Land Use

Agriculture

Dairy farming is the most common agricultural activity on the lower reaches of Lorenzetta Creek.

Mining

None.

Forestry

The upper watershed was logged in the late 1950's and 1960's. Currently, logging is sporadic; however, there are proposals for renewed logging in the upper watershed.

Secondary Industry/Commercial

None.

Linear Development

The Canadian National Railway, the TransCanada Highway (Hwy. 1), a hydro powerline and an oil pipeline cross the creek.

Urban Development

Subdivision of land has occurred in the flat sections of the Fraser River floodplain and several residences encroach upon the riparian area of the stream. A proposal has been made to develop more lots along the stream.

Government

Lorenzetta Creek flows through the village of Laidlaw, and the Fraser Valley Regional District.

Designated Lands

The Lorenzetta Creek watershed is in the ALR.

Watershed Planning Issues

Management Concerns

- Streamside vegetation has been removed in the lower reaches adjacent to farms, and cattle trample the banks.
- A 500 m section at the base of the mountain was channelized to prevent further breakouts and flooding caused by bedload deposition.
- Gravel is periodically dredged and removed from the lower reach of the stream, even though the area is used for spawning, by the Ministry of Environment under the Provincial Emergency Program (PEP).
- The creek often goes dry during droughts when flows are sub-gravel.

Management Prescriptions

- There should be a moratorium on water withdrawals in order to ensure maintenance flows.
- Fencing and riparian planting are required to reduce impacts associated with agriculture.
- Houses built along the stream must better respect the riparian zone; setbacks are essential.

For Lorenzetta Creek hydrograph, see Appendix 2.
For escapement information on Lorenzetta Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Hunter Creek

TREND ***Stable***

Watershed Code: 100-1064-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0760
TRIM Map: 92H023 and 92H033

STATUS:

Endangered - Portions of Hunter Creek have been channelized, riparian vegetation has been removed, and logging has impacted the watershed.

Physiography

Drainage Area

The Hunter Creek watershed occupies 41.6 km^2. The creek is a south shore tributary flowing into the Fraser River west of Hope, Yale District.

Stream Description

Hunter Creek originates in the Skagit Mountains; while a relatively small stream, it is larger than Lorenzetta Creek.

Hydrology

The mean annual flow of Hunter Creek is 1.83 m^3/s. The creek suffers from extreme flow fluctuations. The creek was significantly altered and channelized by highway construction.

Channel Stability Assessment (Preliminary)

Hunter Creek experiences significant erosion, siltation, scouring, and gravel washout.

Fisheries Resource

Fish Access

Anadromous fish access is limited to the bottom .6 km. of the creek, up to an impassable falls.

Fish Stocks

Hunter Creek historically supported stocks of coho, pink, and chum salmon; steelhead, cutthroat, and rainbow trout.

Restoration/Enhancement

The Ministry of Transportation and Highways (MOTH) has completed several bank stabilization projects. A catch basin was installed.

Fish Production

Chum and coho salmon spawn throughout up to the falls. Pink spawn in the lower creek, near its mouth. Steelhead and cutthroat trout have been noted throughout.

Activities and Land Use

Agriculture

Agricultural activity is minimal.

Mining

In the past, a MOTH gravel pit operated on the west bank.

Forestry

Logging operations have been active in the watershed since 1971, primarily in the upper watershed. Riparian removal has been extensive.

Secondary Industry/Commercial

None.

Linear Development

The BC Telephone lightguide corridor, a hydro powerline, an oil pipeline, the Canadian National Railway and the TransCanada Highway (Hwy. 1) cross the creek. MOTH has channelized the creek.

Urban Development

None.

Government

Hunter Creek is in the Fraser Valley Regional District.

Designated Lands

Small recreation sites exist in the watershed. A highway roadside rest stop is located on the west bank of the stream.

Watershed Planning Issues

Management Concerns

- Erosion, silting, scouring, and gravel loss all limit fish production.
- Stream gravel was removed by MOTH after flooding without regard for habitat impacts.

Management Prescriptions

- Riparian planting and replacement of spawning gravel should be priorities.

For Hunter Creek hydrograph, see Appendix 2.
For escapement information on Hunter Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Chawuthen Creek

TREND ***Stable***

Watershed Code: 100-1090-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92H033

STATUS:

Endangered - The lower reaches of Chawuthen Creek are affected by riparian loss and have some water quality problems.

Wild - The upper portion of Chawuthen Creek is relatively undisturbed.

Physiography

Drainage Area

The total watershed area of the Chawuthen Creek is unknown. The creek flows north entering the Fraser River near the town of Flood, west of Hope.

Stream Description

Chawuthen Creek is a small stream which originates in the Skagit Mountains.

Hydrology

No hydrologic information available.

Channel Stability Assessment

No information is available.

Fisheries Resource

Fish Access

Anadromous fish access is unknown.

Fish Stocks

Cutthroat trout and stickleback are found in the creek.

Restoration/Enhancement

No specific restoration/enhancement opportunities have been identified.

Fish Production

No information on fish production is available.

Activities and Land Use

Agriculture

The lower reaches flow though agricultural land.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development.

Secondary Industry / Commercial

None.

Linear Development

The creek flows under the TransCanada Highway (Hwy. 1) and the Canadian Pacific Railway tracks. Additional linear developments in the lower watershed include a hydro powerline and oil pipeline corridor.

Urban Development

There is some rural residential development and a trailer park along the lower reaches. The Hope Airport is located near the mouth of the creek.

Government

Chawuthen Creek is in the Fraser Valley Regional District.

Designated Lands

Chawuthen Indian Reserve #4 is located on the opposite (north) shore of the Fraser River.

Watershed Planning Issues

Management Concerns

- The creek could be impacted by development that is occurring along the highway and railway.

Management Prescriptions

- Protect the stream from impacts of linear development.
- Maintain the riparian area along the stream.
- A fisheries assessment is needed.

Silverhope Creek

Watershed Code: 100-1129-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0790
TRIM Map: 92H023, and 92H033

TREND

Declining

STATUS:

Threatened - Silverhope Creek has been channelized/dyked in the lower reaches.
Past logging activities have impacted the creek.

Physiography

Drainage Area

The total area of the Silverhope Creek watershed is 328 km^2. The creek is a tributary of the Fraser River flowing northwest and entering the Fraser River west of Hope.

Stream Description

Silverhope Creek (approximately 42 km long) drains a mountainous watershed. Originating at an elevation of 1370 m, the upper river drops 800 m in 8 km onto a broad, gently sloping valley, and meanders northwest for 21.5 km before entering Silver Lake. The creek cascades through a narrow valley as a series of rapids and falls below Silver Lake. The slope decreases over the lower 3 km, and is characterized by a boulder-rubble substrate with scattered gravel deposits.

Hydrology

The mean annual flow of Silverhope Creek is 14.4 m^3/s. Mean 7 day summer flows are 33.3 m^3/s whereas mean 7 day winter flows are 4.19 m^3/s. There are several irrigation licences in the watershed.

Channel Stability Assessment (Preliminary)

The channel has been widening from erosion. The creek bed is very mobile; debris accumulates adjacent to bridges crossing the creek. Above Silverhope Lake, the channel is unstable; sections have been rip rapped. Silverhope Creek flows along the west side of its fan and is shallowly entrenched. Houses along the creek bank are at risk from channel avulsion, flooding and erosion. Significant erosion has been occurring on this system since 1980. The creek is pinched by an inadequate opening at the bottom at its confluence with the Fraser River.

Fisheries Resource

Fish Access

Anadromous fish access is restricted by a falls 1 km below the lake; however, the lower 3 km are used extensively.

Fish Stocks

Silverhope Creek supports stocks of coho, pink, and chum salmon; steelhead, cutthroat, Dolly varden, and bull trout.

Restoration/Enhancement

MELP runs a steelhead headwater stocking program on Silverhope Creek. Enhancement efforts have included removing log jams. Other enhancement activities have included headwater stocking (above Silver Lake) for coho, and access improvement through rapids/small falls/chutes areas. There is a permanent log jam at the head of the creek, which the Ministry of Environment would like to leave since steelhead can pass. There is an interest for managing for bull trout in the upper tributaries. The feasibility of reopening a side channel just above the TransCanada Highway should be assessed.

Fish Production

Major spawning of chum occurs between 1 km and 3 km from the mouth. Chum and pink salmon have been noted up to the first falls. Spawning of pink occurs from the mouth to 2 km and in side channels. Steelhead spawn throughout the system to 42 km. Coho are found throughout the system to upper falls. Cutthroat and Dolly varden are present throughout.

Activities and Land Use

Agriculture

Agricultural activity is minimal.

Mining

None.

Forestry

There has been significant logging in the watershed, and further harvest is proposed.

Secondary Industry/Commercial

None.

Linear Development

Gas and oil pipelines, the TransCanada Highway (Hwy. 1) and the Canadian National Railway cross the creek 1 - 2 km from the mouth. There is a BC Telephone lightguide crossing at the mouth of the creek. A secondary (logging and recreation) road extends into the upper watershed and is aligned along the creek, crossing it in several places.

Urban Development

The lower reaches of Silverhope Creek flow through a residential area (Municipality of Silver Creek). There is increasing residential construction in the watershed. The Hope Sewage Treatment Plant is built directly on the west bank of the creek at its confluence with the Fraser River, and discharges at the creek's confluence with the Fraser River. Some campgrounds are located in the watershed.

Government

Silverhope Creek is in the Fraser Valley Regional District.

Designated Lands

The stream flows through Silver Lake Provincial Park. Silverhope Creek also flows through Skagit Provincial Forest.

Watershed Planning Issues

Management Concerns

- Steelhead interception rates are a management concern.
- The creek bed is very mobile; there has been about 1 m of debris accumulation since the 1960's adjacent to bridges that cross the creek.
- Alteration of hillsides and streambeds as a result of residential or linear development represent a significant concern.

Management Prescriptions

- Roads that are directly adjacent to the stream should be relocated away from the stream.
- Residential development should designed to protect riparian zones and the watershed's hydrology through proper stormwater detention/infiltration.

For Silverhope Creek hydrograph, see Appendix 2.
For escapement information on Silverhope Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 9 – Coquihalla River Area

Coquihalla River

Watershed Code: 100-1154-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0800
TRIM Map: 92H033, 92H034 and 92H044

TREND

Declining

STATUS:

Endangered - The Coquihalla River and a number of its tributaries have been severely impacted by road construction, pipelines, logging, and urban development.

Threatened - The Coquihalla River tributaries from Dewdney to Karen Creek, Railway to Deneau Creek, and Nicolum and Kawkawa Creeks are less impacted and are rated threatened.

Wild - A number of creeks, such as Alexander, Berkey, Eight Mile, Wray, and Eleven Mile Creeks remain wild.

Physiography

Drainage Area

The total watershed area of the Coquihalla River is 932 km^2. Some of its tributaries include Kawkawa, Nicolum, Peers, Sowaqua, Dewdney, Ladner, Carry, and Watercress Creeks. A list of tributaries (and watershed codes) to the Coquihalla River is provided in Appendix 1. The river flows in a southwest direction entering the Fraser River through the east side of the town of Hope.

Stream Description

The Coquihalla River is a mountain-fed system that originates in the Hozameen Range. The river flows in a braided, shifting channel across a narrow canyon bounded by steep mountains. The river is characterized by long rapids and riffles with frequent deep pools. The main channel downstream of the Othello falls has a gradient averaging 5%. Velocities are high throughout the channel; however, the gradient lessens near the Fraser River resulting in a slower stream velocity. Most of the lower Coquihalla River flowing through Hope has been dyked. The river has been extensively rip rapped during highway construction. The river has been straightened in several sections to accommodate linear development such as pipelines and fiberoptic cables.

Hydrology

The mean annual flow of the Coquihalla River is 30.0 m^3/s. There are several domestic water licenses on the system. Gradient and water velocities are high downstream of the falls. This is a major rain or snow event watershed. There is a high sediment load from logging and the impacts of the Coquihalla Highway. In the lower reaches, groundwater springs and seeps drain into the river. The salmon streams which drain Kawkawa Lake start from springs on the fan surfaces.

Channel Stability Assessment (Preliminary)

Much of the bank on the lower Coquihalla River has been dyked and rip rapped. A recent flood study indicates that existing dykes are inadequate for the 200 year flood. Bedload transport is frequent; cobble and gravel are deposited in the lower gradient reaches near the mouth and at other upstream locations. Gravel is removed from several tributaries and at various places in the mainstem for flood control. Upper tributaries to

Kawkawa Lake have been channelized where they pass through a subdivision. A spawning channel on Kawkawa Creek was blown out in 1996 by a flood event.

Fisheries Resource

Fish Access

Anadromous fish migration up the Coquihalla River is blocked by the falls at Othello for all species except winter steelhead. There is an impassable falls on Ladner Creek 1 km from the Coquihalla Highway. Boston Bar Creek also has an obstruction 1 km from the TransCanada Highway.

Fish Stocks

The Coquihalla River and its tributaries support stocks of coho, pink, chum and sockeye salmon; steelhead, cutthroat, bull, Dolly varden, rainbow trout, and kokanee.

Restoration/Enhancement

MELP ran a steelhead stocking program and constructed a spawning platform for steelhead on Carry Creek. MELP constructed a barrier to coarse fish on Kawkawa Creek that is passable to salmon but prevents suckers from going to the lake. Other enhancement activities on Kawkawa Creek include the placement of spawning gravels in the lower creek, placement of boulders, and construction of a spawning loop beside the existing channel. A fishway past the first falls on Nicolum Creek would permit access to salmon spawning habitat. Karen Creek was an enhancement side channel (supplemented by subsurface flows) that used to have steelhead in it; however, the dyke protecting the rearing and spawning channel on lower Karen Creek was breached during the November 1995 flood and it is now a wetland. Most structures built by the Ministry of Transportation and Highways as compensation for highway construction on or near the Coquihalla River have disappeared in flood flows of the mid 1990's.

Fish Production

Sockeye salmon spawn in lower reaches. Coho, pink and chum salmon spawn up to the falls at Othello. The status of the runs is generally good. Steelhead spawn at a confluence 4.8 km upstream, and between 17 km and 28 km. There is a resident population of cutthroat and rainbow trout. There was a spawning channel in the lower reaches of Kawkawa Creek which was blown out recently. The tributaries to Kawkawa are critical for kokanee spawning. A spawning channel off the mainstem (Karen Creek) was lost during recent floods.

Activities and Land Use

Agriculture

None.

Mining

The Carolin gold mine on Ladner Creek, which closed in 1982, may re-open. The Ministry of Highways and Transportation opened a quarry at the mouth of Nicolum Creek in 1996, but it was shut down due to conservation concerns.

Forestry

Extensive logging occurs throughout the watershed. Peers, Sowaqua, Boston Bar, and all the creeks between Railway and Deneau have been heavily logged.

Secondary Industry/Commercial

Developments, including highway related developments, encroach on the channel at several sites.

Linear Development

The Coquihalla River has been straightened and confined in a number of areas to accommodate linear development. There is a pipeline on either side of the river. At various locations, the Coquihalla Highway crosses the river and runs through its floodplain. The oil and gas pipeline, a BC Telephone lightguide, as well as several local roads in Hope, cross the river at various locations.

Urban Development

The lower reaches and the mouth of the Coquihalla River are in the town of Hope; the lower reach is flanked by urban development, including a hospital, and a golf course. Within the District of Hope, there is chronic encroachment by development on the floodplain of the river. Most of the section of the river that flows through the town of Hope is dyked. The town of Hope is considering developing more subdivisions in the lower reaches (i.e. Ogilvie Mountain), but there are many hazard concerns (steep slopes, etc.). A trailer park is located along Kawkawa Creek. There is encroachment on Kawkawa Lake from recreational properties and the Indian Reserve, impacting water quality and quantity. There is an interest from private landowners in buying the marsh area below the lake and developing it into recreational properties.

Government

The river discharges to the Fraser River in the town of Hope (District of Hope). The Coquihalla River is in the Fraser Valley Regional District.

Designated Lands

Kawkawa Indian Reserve #6 is on the eastern end of Kawkawa Lake. Kawkawa Provincial Park is on the southern side of Kawakwa Lake. The Coquihalla River Provincial Recreation Area is located between Sowaqua and Dewdney Creeks, on the opposite side of the Coquihalla River.

Watershed Planning Issues

Management Concerns

- The mainstem of the Coquihalla River has been severely degraded by linear developments.
- Linear development structures such as oil pipelines require constant in-river maintenance works.
- Steelhead interception rates are a management concern; the summer steelhead run stocks have not received the same conservation emphasis as Thompson-Chilcotin stocks.
- Poor forest practices and logging road slumpage are causing sedimentation, impacting downstream fish habitat and water quality.

- Organic debris entering the stream usually jams in the narrow canyon reaches prior to reaching Hope. These jams are generally removed by BC Environment.
- Channelization has occurred along sections of both the mainstem and tributaries, and rip rap and dykes constrain the river.
- Licenses for water withdrawal are held on a number of the tributaries (which in general do not affect low flows).
- Significant fish production is currently limited by lack of side channel habitat, deposition of sediment, loss of spawning gravels, rip rap and dyking constraining the channel, and lack of riparian vegetation.
- Increased subdivision is occurring around Kawkawa Lake and in the lower reaches of the Coquihalla River, impacting the hydrology of the area (there are springs and seeps surface everywhere).
- Culvert obstructions above Kawkawa Lake interfere with normal stream processes.
- The linear and urban development along the Coquihalla and its tributaries increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized stream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- The Coquihalla River channel needs to be "unconfined" and allowed to migrate laterally in order to prevent high flows which destroy natural and constructed fish habitat; off channel enhancement opportunities should be identified.
- Fish habitat improvements could include increasing spawning/rearing habitat for steelhead (i.e. re-establishing Karen Creek side channel), and installing rearing facilities.
- Watershed Restoration Programs have begun in several of the logged tributary watersheds. Upland reforestation and slope stabilization is needed to reduce erosion from logged slopes and roads.
- The mitigation/compensation works (for fish habitat) along the Coquihalla Highway need to be reviewed and monitored.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

For escapement information on the Coquihalla River, see Appendix 3.

Chapter 3 – Fraser River North Shore Tributaries

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Map 10 – Vancouver Area

Musqueam Creek

TREND → *Stable*

Watershed Code: 100-0005-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0010
TRIM Map: 92G025

STATUS:

Endangered - Musqueam Creek has been impacted by urbanization (channelized, culverted, degraded water quality, and high effective impermeable area).

Physiography

Drainage Area

The total watershed area of Musqueam (Tin Can) Creek and its tributary Cutthroat (Tin Can) Creek is 6.7 km^2. The headwaters of Musqueam Creek are located near 16th Avenue, in the University of British Columbia Endowment Lands. The creek flows south through the Musqueam Indian Reserve and the Eaglequest Golf Course before exiting through a flood control gate into the mouth of the North Arm of the Fraser River.

Stream Description

Musqueam Creek is a small groundwater stream which originates in the University Endowment Lands and flows into the North Arm of the Fraser River. The Musqueam Marsh, located at the mouth of the creek (approximately 148 ha), is classified as 51% estuarine marsh and 49% estuarine water.

Hydrology

The estimated mean annual flow of Musqueam Creek is 0.23 m^3/s. The average low flow is 0.0002 m^3/s and the high flow is 6.5 m^3/s. Extremely low summer flows are common. An enhancement project which focused on drilling a well and pumping water into Musqueam Creek to augment low flows was initiated in 1996. As of January 1999, pumping has not yet commenced. Floods and base flows have been increased due to residential irrigation and storm drains. Flows have been increased by golf course irrigation and residential peak stormwater drainage runoff. Cutthroat Creek has been diverted into Musqueam Creek.

Channel Stability Assessment (Preliminary)

The reaches in Pacific Spirit Park and downstream of the flapgate are relatively undisturbed. However, the reaches that flow through the golf courses have been channelized. Riparian vegetation has been heavily disturbed throughout both Eaglequest and Shaughnessy golf courses, but is regenerating through I.R.#2 and Musqueam Park. Bank erosion and gravel instability throughout are still a problem.

Fisheries Resource

Fish Access

Salmonid access is only possible into the mouth of Musqueam Creek 20% of the time at high tide, due to the flood control gate there. Access upstream is restricted to Marine Drive in Musqueam Creek and partially into

Shaughnessy golf course in Cutthroat Creek. There is a small resident cutthroat trout population in Cutthroat Creek landlocked above SW Marine Drive..

Fish Stocks

Musqueam Creek and its tributary support coho and chum salmon; cutthroat, western brook lamprey, prickly sculpin, and threespine stickleback.

Restoration/Enhancement

The Department of Fisheries and Oceans stocks the creek every spring with chum. Broodstock is taken from Kanaka Creek. Significant stream clean up activities occurred in 1981/82, 1991, and 1996-98. The habitat improvement projects that have taken place include large organic debris and boulder placement, riparian planting, and erosion control. A wetland development to treat stormwater was constructed in 1997. Upstream access in Cutthroat Creek has been extended due to a pool riffle sequencing project in 1998. A wetland development to treat stormwater has been proposed for the lower watershed.

Fish Production

The Musqueam Marsh provides a highly productive rearing habitat for passing Fraser River stocks. The primary habitat factors limiting fish production in the stream are the infilling of portions of the wetland, removal of riparian vegetation, low summer flows, poor water quality and fugitive contaminant discharges.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development. There may also be some selective removal of trees by the Vancouver Parks Department and BC Hydro.

Secondary Industry/Commercial

Commercial and secondary industrial land use accounts for 2.5% of the drainage area.

Linear Development

The stream is crossed by SW Marine Drive and several residential streets.

Urban Development

A residential area in the lower reaches was developed under lease from the Musqueam Band. Storm sewers discharge into the lower reaches, and there are frequent reports of fugitive contaminant discharges into the stream. These discharges have been responsible for a number of fish kills over the years. In 1997 the City of Vancouver Sewer Department found 2 residential sewer pipes feeding directly into the storm drain system. Both have since been disconnected. There are several golf courses in the drainage including Eaglequest, Point Grey and Shaugnessy Golf and Country Club.

The effective impervious area of the watershed is 12%.

Government

Musqueam Creek is in the City of Vancouver (Greater Vancouver Regional District).

Designated Lands

Musqueam Indian Reserve #2 is located along the lower reaches of the creek. Pacific Spirit Regional Park protects a large portion of the stream. The stream originates in Pacific Spirit Regional Park and flow through Musqueam Park.

Watershed Planning Issues

Management Concerns

- Chemical runoff from golf courses, chlorinated water discharges from swimming pools in the adjacent Salish Park housing development and stormwater discharges have degraded water quality and caused fish kills.
- Spawner access through the flap gate is difficult during low flows.
- Stormwater discharges have altered the natural hydrology, increased both the frequency and intensity of flooding, and eroded the streambed and banks.
- Park visitors disturb spawners in the stream where it flows through the park.

Management Prescriptions

- The isolated stock of resident cutthroat trout in the headwaters needs to be protected.
- Musqueam Creek is the last remaining wild coho salmon stream within the City of Vancouver that supports spawning habitat. Protection, enhancement, and stewardship efforts by the City of Vancouver, the Musqueam Band, Greater Vancouver Regional District, and the University of British Columbia need to be supported and expanded.
- The effective impermeable area is 12%, any increase beyond this may completely destroy the last remaining habitat and salmon runs.

For Musqueam Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Fraserview Creek

Watershed Code: 100-unavailable Fraser River tributary
RAB Code: 00-0010
TRIM Map: 92G025

TREND

Declining

STATUS:

Endangered - Fraserview Creek has been partially culverted and is impacted by urbanization (i.e. removal of riparian vegetation, and water quality problems).

Physiography

Drainage Area

Fraserview (Vivian) Creek flows south through Vancouver entering the North Arm of the Fraser River near Jelicoe Road.

Stream Description

Fraserview Creek is a small groundwater fed stream. The stream discharges into a small tidal marsh at its confluence with the North Arm of the Fraser River.

Hydrology

No hydrological data are available.

Channel Stability Assessment

No geomorphological data are available.

Fisheries Resource

Fish Access

Anadromous fish have access to an impassable culvert at SW Marine Drive. Recent unapproved housing development and extensive covering of the stream will have aggravated this problem.

Fish Stocks

Fraserview Creek supports coho salmon and cutthroat trout reports have been confirmed (1996).

Restoration/Enhancement

Fish access should be restored, and the lower section daylighted.

Fish Production

The bottom reaches are used for rearing, and the upper stream sections by cutthroat trout.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

There has been riparian removal to accommodate development including expansion of the golf course (1996/1997).

Secondary Industry/Commercial

There are some commercial activities and secondary industries located in the lower portions of the stream below SW Marine Drive.

Linear Development

The stream is crossed by the Canadian Pacific Railway and SW Marine Drive.

Urban Development

The lower reaches have been put into a pipe by a recent townhouse development.

Government

Fraserview Creek is in the City of Vancouver (Greater Vancouver Regional District).

Designated Lands

The stream flows through the Fraserview Golf Course and Driving Range which is administered by the Vancouver Parks Board.

Watershed Planning Issues

Management Concerns

- Chemical runoff from the golf course (pesticides, fertilizers, and herbicides) is a concern.
- Proposals to expand the golf course in 1996 threatened significant riparian areas.

- The municipal development approval processes that permitted the culverting of Lower Fraserview Creek need to be re-examined. Approvals for development are required under the Fisheries Act.
- The intensive development in the watershed increases the risk of altered hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- There are reports that the Fraserview Creek culvert at Marine Drive will be modified to allow fish access through the golf course, and 165 m of the creek will be daylighted in the golf course.
- Improved stewardship by both the Vancouver City Parks Board and Fraserview Golf Course are necessary to protect this system in the long term.
- Riparian restoration and mitigation of non-point source pollution from the golf course could improve habitat conditions in Fraserview Creek.
- Options to daylight the section covered by a recent townhouse development must be examined.

Kaymar Creek

TREND *Stable*

Watershed Code: 100-unavailable Fraser River tributary
RAB Code: Unavailable
TRIM Map: 92G015 and 92G025

STATUS:

Endangered - Kaymar Creek has been impacted by urbanization (poor water quality, riparian removal, channelization, and a high effective impermeable area).

Physiography

Drainage Area

Kaymar Creek has a total watershed area of 3.7 km^2. It flows south to the Fraser River entering the North Arm of the Fraser near Boundary Road.

Stream Description

Kaymar Creek is a small, channelized, groundwater fed stream which originates in Kaymar Ravine Park and flows south entering a wetland area east of Boundary Road and south of Marine Way. The wetland (approximately 2.3 ha) is classified as 4% estuarine marsh, 48% estuarine water, and 48% floodplain swamp. The east branch drains a cemetery and surfaces at Rumble Street. It is in a semi-natural state above Marine Drive.

Hydrology

The estimated mean annual flow of Kaymar Creek is 0.13 m^3/s. While there are no documented water use problems, the stream is more sensitive than average to low winter flows. Substantial development in the drainage area has increased impervious areas and created a flashier stream with degraded water quality.

Channel Stability Assessment (Preliminary)

The creek has been channelized below SW Marine Drive. Significant amounts of the natural vegetation have been removed reducing bank stability. This is aggravated by increased peak flows.

Fisheries Resource

Fish Access

Anadromous fish have access to the headwaters of the mainstem, and 200 m up the east branch.

Fish Stocks

Kaymar Creek and an unnamed tributary support small runs of coho salmon, cutthroat trout, and brown bullhead.

Restoration/Enhancement

No specific enhancement opportunities have been identified.

Fish Production

Adult coho have been observed below Marine Drive. Fry have been noted above Marine Drive and in the tributary.

Activities and Land Use

Agriculture

There is some agriculture (market farms) in the lower watershed.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development.

Secondary Industry/Commercial

The mouth of the creek is located adjacent to an industrial area and lumber yard. Secondary industry and commercial activity occupy approximately 12% of the watershed.

Linear Development

SW Marine Drive, Marine Way, and a number of small city streets cross Kaymar Creek. The Canadian Pacific Railway crosses the stream approximately 650 m upstream from the Fraser River.

Urban Development

Urban development dominates the upper watershed, and accounts for approximately 45% of the drainage area.

Government

Kaymar Creek is in the City of Burnaby (Greater Vancouver Regional District).

Designated Lands

Kaymar Creek originates in Kaymar Ravine Park. Fraser Foreshore Park is located immediately east of the mouth of Kaymar Creek. The New Haven Correctional Centre is located in the Kaymar Creek drainage.

Watershed Planning Issues

Management Concerns

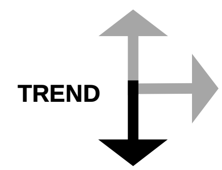
- Natural sources of large organic debris have been eliminated.
- Water quality is an ongoing concern due to the increase in stormwater runoff and erosion associated with urban development.
- The intensive development in the watershed aggravates the risk of altered hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Riparian restoration should be a priority and large organic debris should be reintroduced into the system to recreate habitat complexity.
- Stewardship initiatives which focus on riparian protection or restoration, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, facilitating community outreach and increasing public awareness about the fisheries values of this system are required.

Byrne Creek

Watershed Code: 100-0120-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0060
TRIM Map: 92G016 and 92G026



Declining

STATUS:

Endangered - Byrne Creek has been severely impacted by urbanization. It has an effective impermeable area of 27%.

Physiography

Drainage Area

Byrne Creek and its tributaries, Gray, Froggers (Hollis) Creek, and John Matthew Creeks, have a total watershed area of 9.1 km^2. Byrne Creek flows south to the Fraser River entering the North Arm 250 m west of Byrne Road in Burnaby.

Stream Description

Byrne Creek is a small, slow moving, groundwater stream which originates at the intersection of 17th Street and 17th Ave. in Burnaby. The wetland downstream of Byrne Road is classified as 100% stream swamp. The stream was relocated between Marine Drive and Marine Way and is channelized and ditched between Marine Drive and the mouth.

Hydrology

The estimated mean annual flow of Byrne Creek is 0.31 m^3/s. The high degree of urbanization within the watershed has affected the hydraulic regime of the stream. The flow is augmented by storm drainage from surrounding residential and industrial areas creating a flashy system. At least eight storm drain outfalls discharge into the stream. A riverine marsh is located to the west of the lower reaches. Hollis Creek experiences extreme low summer flows.

Channel Stability Assessment (Preliminary)

The portion of the stream bank located 500-600 m upstream of Marine Drive is undercut and unstable. The channel has been relocated between Marine Drive and Marine Way. The flashy nature of this stream has increased erosion and decreased channel stability.

Fisheries Resource

Fish Access

Anadromous fish have access to the area downstream of Rumble Ave. There is a passable culvert located 0.8 km upstream of Marine Drive. Fraser River rearing chinook have been observed above Marine Way.

Fish Stocks

Byrne Creek and its tributaries support coho and chum salmon, and cutthroat trout.

Restoration/Enhancement

Clean up of the stream was completed by the Vancouver Angling and Game Association (VAGA) in 1991, and in 1992 rock weirs were installed by the City of Burnaby to create pools and a spawning channel. John Matthew Creek, a tributary to Byrne Creek, is stocked annually with 5000 coho smolts. MOE stocks the system with cutthroat trout.

Fish Production

Rearing occurs primarily between the diversion along Byrne Road and 500 m upstream of Marine Way. Juveniles preferentially use the undercut bank area upstream of Marine Drive. The best fish habitat is located upstream of Marine Drive for approximately 300 m.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development.

Secondary Industry/Commercial

There is substantial heavy and light industry, as well as commercial development in the watershed. The lower reaches of Byrne Creek were relocated and channelized to accommodate golf course development.

Linear Development

BC Hydro and Trans Mountain gas pipelines transect the drainage area. The Canadian Pacific Railway crosses Byrne Creek 1.2 km upstream from the mouth. The BC Hydro and Power Authority Railway crosses the creek in the headwaters. Two large thoroughfares - Marine Drive and Marine Way - both cross the creek in the lower watershed.

Urban Development

The mid reaches are surrounded by residential development. The effective impervious surface area in the watershed has already reached 27%. High density urban development is planned for the headwaters (at 19th Ave., south of Southpoint Road). Residential development presently occupies approximately 40% of the watershed.

Government

Byrne Creek is in the City of Burnaby (Greater Vancouver Regional District.)

Designated Lands

BC Hydro owns a right of way between 19th Ave. (Rumble Ave) and the Skytrain corridor. Byrne Creek originates in Byrne Creek Ravine Park, Ron McLean Park, and Powerhouse Park. The tributaries originate in Gray Creek Ravine Park, Frogger's Creek Ravine Park, and Matthew's Creek Ravine Park. ALR designated land is located in close proximity to the upper reaches and along the southeast bank of the mid reaches.

Watershed Planning Issues

Management Concerns

- Water quality in Byrne Creek is an ongoing concern.
- Old car bodies and garbage upstream of Marine Drive may be a significant source of leachates. Sediment samples show high aluminum, calcium, and iron concentrations.
- Undetained or inadequately managed stormwater will further alter the hydrology of the system and increase erosion.
- The extensive development in the watershed increases the risk of stormwater discharges altering water quality and quantity, spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- A stormwater management plan which will address both runoff quality and quantity is required. Weirs and sediment retention/detention facilities upstream of 19th Ave. would benefit the system.
- The stewardship activities of the VAGA in assessing, cleaning up, and advocating awareness of Byrne Creek need to be supported. Other VAGA stewardship activities on Byrne Creek which have included creating instream habitat for, and transplanting of, coho, should be fostered.
- Energy dissipaters on the system, as well as more Storm Drain Marking Programs, would help alleviate scour concerns and reduce unauthorized discharges to the stream.
- Local government policies, bylaws and/or designations which will prevent contamination, maintain streams above ground, improve erosion control, reduce impervious areas, provide unobstructed fish passage and protect riparian vegetation need to be supported and fostered.

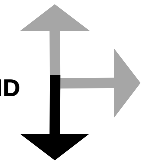
For Byrne Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 11 – Burnaby/Coquitlam Area

Brunette River

Watershed Code: 100-0201-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0100
TRIM Map: 92G026

TREND



Declining

STATUS:

Endangered - Parts of the Brunette River system are channelized, and the system is impacted by urbanization (high effective impermeable area - EIA covers 27% of the watershed - water quality problems, and loss of riparian area along parts of the river).

Physiography

Drainage Area

The Brunette River and its tributaries (major tributaries are Stoney, Robert Burnaby, Eagle, and Still Creeks and Deer Lake) have a total watershed area of 73.3 km^2. The river flows south through Burnaby and New Westminster discharging into the Fraser River at Sapperton Channel (New Westminster).

Stream Description

The Brunette River flows out of Burnaby Lake and is fed by tributaries to both Burnaby and Deer Lakes. The Cariboo Dam is located on the Brunette River just below Burnaby Lake. Several other tributaries including Stoney Creek originate on Burnaby Mountain. Still Creek originates in Vancouver; it is one of the most industrialized streams in B.C. The channelized river flows through a well defined valley and is generally slow moving with limited riffles and shallow pools. The lower mainstem is channelized and has been dyked on both banks.

Hydrology

The mean annual flow of the Brunette River is 2.71 m^3/s. The high degree of urbanization in the watershed has created a flashy system, and has degraded water quality. Stream flow in the lower Brunette system is partially regulated by the Cariboo Dam which is managed by the Greater Vancouver Regional District.

The cool groundwater and tributary discharges in the lower reaches help to moderate the high temperatures and low dissolved oxygen concentrations downstream of the Cariboo Dam. Temperatures reaching 25ºC in August have led to severe water quality problems in the Brunette River. The flows are generally considered adequate for cutthroat production, although extreme low flows have been observed in summer (0.017 m^3/s). The two year, 7-day low flow is 0.119 m^3/s.

Channel Stability Assessment (Preliminary)

The channel is underlain by glaciomarine sediments in some sections. Excavation by the GVRD has exacerbated downcutting into the channel bed. Robert Burnaby Creek has unstable banks; spawning habitat improvement should not be entertained until the erosion problems have been addressed. Eagle Creek and Stone Creek also flow through ravines where banks are unstable. Erosion is a problem throughout the system.

Fisheries Resource

Fish Access

Anadromous fish have access to the headwaters of the Brunette River and Still Creek (a new fishway provides access past the Cariboo Dam year round), and, depending upon gradient, to the headwaters of all tributaries. Three culverts along Eagle Creek may isolate salmonid rearing areas at low flows. There is an impassable culvert on Eagle Creek at Broadway.

Fish Stocks

The Brunette River, its tributaries, Burnaby Lake, and Deer Lake support coho and chum salmon; Dolly varden and cutthroat trout, carp, stickleback, and peamouth chub. There are unconfirmed reports of rainbow trout, brassy minnow, brown catfish, and sculpin in the system. In addition, northern squawfish and brown bullhead are found in Burnaby Lake.

Restoration/Enhancement

The Sapperton Fish and Game Club collects coho broodstock from the Brunette River. The club members are strong advocates for water quality improvements and have undertaken several fish passage improvement projects, including those on the mainstem at the first weir 500 m upstream, at the dam, and at the Burlington Northern Railway crossing on Stoney Creek. There have been several instream enhancement projects including boulder and gravel placement in Robert Burnaby Creek and Deer Lake Creek. The Brunette River has been stocked with coho, chum, steelhead, and cutthroat trout. Deer Lake is regularly stocked with coho and cutthroat trout. Deer Creek was enhanced near the outlet to the lake by the British Columbia Institute of Technology which placed spawning gravel and removed a coarse fish barrier at the TransCanada Highway. Culverts at Canada Way, Sperling Ave, and the Lougheed Highway on Eagle Creek have also been upgraded and have improved passage conditions.

A fish ladder was constructed at the Cariboo Dam in 1992. BCIT and several community groups are actively replacing culverts and planting riparian vegetation along Still Creek. Still Creek has been significantly modified for flow control purposes; however several bank improvement projects including riparian replanting have been completed by the GVRD along the Still Creek corridor. Boulders and gravels have been placed in Robert Burnaby Creek. Pools which have been scoured below log sills have increased rearing habitat. A fish ladder has been placed at the Burlington Northern crossing on Stoney Creek, and baffled culverts at the Lougheed Highway and at Broadway have been proposed. In 1982 the dykes downstream of Braid Street were raised and a flood relief channel constructed. The City of Burnaby is installing stormwater detention facilities upstream of 19th Avenue. A partnership project is planned (GVRD, DFO, Sapperton Fish and Game Club) to install riffle weirs between Highway #1 and North Road.

Salmonid and resident cutthroat enhancement will require resolution of water quality problems, fry stocking, and habitat complexing. Setback dyking in the lower river would have protected more floodplain and provided many more opportunities for habitat restoration. The planting of fast growing riparian vegetation in strategic locations along the Brunette River has been recommended to reduce water temperature and maintain acceptable dissolved oxygen levels.

Fish Production

The chum population has been partially re-established in the river; however, enhancement is limited by poor water quality and restricted access above the first weir. Coho and searun trout stocks are very depressed and will require continuing assistance. Poor water quality, including sedimentation, pollution, and low dissolved oxygen levels, as well as extremely flashy flows limit salmonid production in Still Creek. The watershed has good cutthroat and coho rearing potential, but it is presently operating at approximately only 4% of its potential. Absence of juvenile and adult cutthroat in all reaches, except in Stoney Creek, is most likely the result of poor water quality and over fishing. Fish kills have been a common occurrence in this river system over the past several decades.

Other than the Salmon River, the Brunette basin has the most cutthroat habitat of the streams studied in the Lower Mainland. Stoney Creek is the best sea run trout producing tributary of the Brunette River as access to the upper reaches is unrestricted.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development. There is also a sawmill (Fraser Mills) at the mouth of the Brunette River. Wood debris from mills has historically filled the channel and required routine maintenance dredging.

Secondary Industry/Commercial

Storm drainage from industrial park expansion on Eagle Creek has exacerbated erosion and runoff quality concerns. Industrial wastewater permits have been issued for several operations in the headwaters. Still Creek is largely industrialized in the upper to mid reaches. The lower reaches of the Brunette River, below Brunette St., are industrial (e.g. metal fabrication, warehousing, marine and ship repair, heavy equipment storage). A wood preservation facility (Domtar/Stella Jones) at the mouth of the Brunette River generates a toxic leachate that is discharging to the Fraser River. Approximately 17% of the watershed is zoned as commercial or industrial.

Urban and industrial runoff has resulted in Still Creek and the Brunette River being one of the most polluted stream systems in B.C. Although obvious pollution sources such as the Seagram distillery were discontinued in the 1970s, a multitude of non-point source pollutants including those from cars continue to plague the river.

Linear Development

The Brunette drainage is crossed by several major linear corridors including the TransCanada (Hwy. 1), the Lougheed Highway (Hwy. 7), and the Burlington Northern and Canadian Pacific Railways. Numerous bridges and city streets cross the tributaries, and the lower mainstem is extensively dyked. Stoney Creek has been encroached upon by a pipeline and a service road which run parallel to the stream.

Urban Development

The effective impervious area in the Brunette drainage is already at 27% and high density urban development is proposed for the Deer Lake Creek area. Residential development alone covers more than 48% of the drainage area. Eagle Creek drains a golf course. A large ice rink complex, swimming pool/recreation centre, and numerous schools are located in the watershed. Approximately 23% of the drainage area is undeveloped, most of which lies near the TransCanada Highway, Burnaby Lake and Burnaby Mountain..

Government

The Brunette River is located in the cities of Burnaby, New Westminster and Coquitlam (Greater Vancouver Regional District). The watershed also drains parts of Vancouver and Port Moody.

Designated Lands

Portions of Simon Fraser University (Burnaby Mountain) are within the watershed. The system flows through Burnaby Lake Regional Park; the tributaries flow through Deer Lake, Robert Burnaby, Charles Rummer, and Stoney Creek parks. Numerous other small parks are located within the watershed.

Watershed Planning Issues

Management Concerns

- Intensive development continues to impact the watershed, increasing the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.
- Stormwater quality originating from industrial and residential areas is a significant concern.
- Data suggest that levels of some heavy metals, nutrients, and organic wastes in Burnaby Lake exceed the established criteria for protection of aquatic life.
- The loss of riparian areas has eliminated natural sources of large organic debris that provide instream cover.
- Fecal coliforms and other contaminants may render fish from Deer Lake unfit for human consumption.
- High water temperatures and low dissolved oxygen are ongoing concerns in this system.

Management Prescriptions

- A master stormwater management plan for the entire Brunette basin is underway (by the Brunette Basin Task Group, under the GVRD’s Liquid Waste Management process). An identification and elimination program for illicit cross-connections between sewers (i.e. sanitary and stormwater) is underway.
- Riparian planting is a priority on the lower mainstem and many tributaries in this system.
- Improved riparian setbacks are required for any new subdivision or rezoning applications along watercourses.
- Municipal policies, bylaws and area designations that will reduce contaminant sources, protect or restore riparian vegetation, improve erosion control, reduce impervious areas in new or redeveloped areas and maintain open waterways should be encouraged and supported.

For Brunette River hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Nelson Creek

TREND

Declining

Watershed Code: 100-0110-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G026

STATUS:

Endangered - Nelson Creek has been impacted by urbanization (high effective impermeable area, water quality problems, and riparian vegetation removal).

Physiography

Drainage Area

Nelson Creek flows south through Coquitlam entering the Fraser River at Fraser Mills.

Stream Description

Nelson Creek is a small, groundwater fed system. The creek flows in a meandering channel that originates upstream of a small residential park in the Maillardville area.

Hydrology

No hydrological data are available.

Channel Stability Assessment

No geomorphological data are available. Much of the lower reaches of the creek were swampland and were filled with wood waste, and the stream was put into a ditch.

Fisheries Resource

Fish Access

Anadromous fish access is restricted to the area below Brunette Ave. by an impassable culvert.

Fish Stocks

Nelson Creek supports coho salmon and cutthroat trout.

Restoration/Enhancement

Although the stream is degraded, no specific restoration or enhancement opportunities have been identified.

Fish Production

Coho spawning is occasionally observed in the lower section of the stream.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Several sawmills and lumber mills are located along the lower reaches of the stream.

Secondary Industry/Commercial

The lower reaches of the stream are surrounded by an industrial park. The industries include lumber mills and a chemical plant.

Linear Development

The stream is crossed by the Canadian Pacific Railway, Lougheed Highway (Hwy. 7), and numerous city streets.

Urban Development

The mid and upper reaches of the creek are located in the Maillardville residential area of Coquitlam.

Government

Nelson Creek is in the City of Coquitlam (Greater Vancouver Regional District).

Designated Lands

The stream flows through a small residential park and sports area.

Watershed Planning Issues

Management Concerns

- Severe alteration of the watershed and stream channel has greatly impacted habitat on this stream.
- Maintenance of water quality and adequate flows to support fish is a concern.

Management Prescriptions

- Stewardship initiatives that focus on improving water quality, marking storm drains, reducing impervious surface area, eliminating spills and unauthorized discharges and reestablishing riparian vegetation are required on this system.

- Municipal policies, bylaws, or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Improvements to fish access should be investigated.

Como Creek

TREND **Stable**

Watershed Code: 100-0222-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0150
TRIM Map: 92G026

STATUS:

Endangered - Como Creek has been dyked, dredged, culverted, and has water quality problems.

Physiography

Drainage Area

The total watershed area of Como (Schoolhouse) Creek and its tributaries Booth (Laurentian) and MacDonald (Popeye) Creeks is 7.1 km^2. Como Creek discharges into the Fraser River at Sapperton Channel. The upper watershed is on a plateau and then decends into a swamp complex that has been ditched and totally filled in, in about 1975-1980.

Stream Description

Como Creek is a small groundwater fed stream draining a low-lying watershed. The creek flows in a meandering exposed channel and is generally slow moving with scattered riffles and deep pools. Ditching and channelization have changed the course of the system, and in 1977 the reach downstream of the Lougheed Highway was relocated. The bottom 1 km of the stream flowed through a large peat wetland complex until 1980. This large flood storage area was filled in with garbage and the stream isolated to narrow channels. The creek is partially culverted between Brunette Avenue and Como Lake.

Hydrology

The mean annual flow and naturalized mean annual flow of Como Creek are 0.25 m^3/s and 0.39 m^3/s, respectively, with a mean flood of 7.4 m^3/s. The extensive urban development in the drainage basin has created a very flashy system. Summer low flows are a problem in the lower sections of MacDonald Creek, although flooding also occurs downstream of Booth Avenue. A high flow control structure at Sheridan Ave. diverts water from Booth Creek to MacDonald Creek during high flows to prevent flooding. The summer low flows and high temperature of Booth Creek near the Lougheed Highway are exacerbated by the lack of riparian vegetation.

Channel Stability Assessment (Preliminary)

The stream has been diverted and channelized, and the floodplain filled in, to accommodate development. The mainstem is culverted upstream from Winslow Ave. Como Creek is culverted from Brunette Ave. to Rochester Ave. and then intermittently enclosed up to Como Lake. Sediment traps are located upstream of both Austin Rd. and Rochester Ave. on Como Creek.

Fisheries Resource

Fish Access

Anadromous fish have access upstream to impassable culverts at Booth Ave. on the mainstem, Brunette Ave. on Como Creek, Booth Ave. on Booth Creek, and Brunette Ave. on MacDonald Creek.

Fish Stocks

Como Creek and its tributaries support stocks of coho salmon, cutthroat (resident upstream of Booth Avenue, and sea run downstream), rainbow trout, stickleback, lamprey, and sculpins.

Restoration/Enhancement

Log jams, commercial debris and garbage have been removed in the system since 1980. In the past, coho have been trapped in the lower reaches and transported to available rearing habitat in the upper reaches. As a result of a Fisheries Act prosecution in 1980, aeration ponds have been installed to treat landfill leachates from the extensive garbage fill in the lower reaches of the stream (which is now community property).

Fish Production

Spawning and rearing occurs in unspecified areas below Booth Ave. Resident cutthroat trout are found throughout the system. Coho spawning occurs from the Lougheed Highway to Brunette Ave (North-South section) in MacDonald Creek. Summer low flows are a limiting factor on MacDonald Creek. The coho runs are stable but the returns are low.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

A mill is located at the mouth of the stream. Como Creek was rerouted for a mill and other developments by Crown Zellerbach.

Secondary Industry/Commercial

The Como drainage area is primarily zoned industrial; industrial parks are located in the lower basin. Booth Creek runs through industrial areas and there are warehousing facilities along MacDonald Creek.

Linear Development

The lower reaches of the system are crossed by the TransCanada Highway (Hwy. 1), Lougheed Highway, and the Canadian Pacific Railway 0.8 to 1.0 km from the mouth. The drainage area also includes numerous city streets.

Urban Development

The extensive urban development in the Como Creek drainage in the past 40 years is evidenced by the fact that the effective impervious surface area in this basin is 32%. Numerous residential neighbourhoods have been developed in the watershed. Residential development is prominent in the headwaters of Booth Creek. Residential development covers 22% of the watershed area, 96% of which is high density. A trailer court is located in the drainage area of MacDonald Creek. A shopping mall (Super Store, etc.) is located on a 1970s landfill in the low relief section of the Como drainage area south of Brunette Ave.

Government

Como Creek is in the City of Coquitlam (Greater Vancouver Regional District).

Designated Lands

A sanitary sewage pump station is located just west of Schoolhouse Road. Laurentian Park, Montgomery Park, Rochester Park, and Neighbourhood Park are all located within the watershed.

Watershed Planning Issues

Management Concerns

- The upper watershed was intensively developed for residential purposes some 40 years ago.
- The bottom reaches of the watershed were filled in during the late 1970s with landfill waste.
- Booth Creek has a history of acute chronic pollution problems from warehouses, trucking, landfill waste, and other industry.
- Inadequate stormwater detention and management exacerbate low flows (MacDonald Creek) and flooding (below Booth Ave.) concerns within the watershed.
- The uncontrolled dumping of woodwaste, wallboard and other garbage in the 1970s caused severe water quality problems in MacDonald, Como, and Booth Creeks. Loss of floodplain and swamplands (conversion to solid parking lots) has greatly altered the lower watershed.
- The loss of riparian habitat and loss of groundwater contributes to high water temperatures in the system.

Management Prescriptions

- This is a severely altered watershed and stream. Although recovery is not possible, a great deal can be done to allow fish populations to survive.
- Restoration and enhancement activities including re-establishing riparian vegetation and possibly daylighting culverted sections of the system should be investigated. Invasive

species such as blackberry could be removed and replaced with a more beneficial riparian species.

- A sediment trap and a rearing pond should be located upstream of Brunette Street.
- The industrial polluters, etc., on Booth Creek should be exposed to an industrial stewardship program.
- The large shopping mall should examine storage of stormwater.
- Joint industry, residential and local government stewardship initiatives which focus on restoration, community outreach and education are required on this system.

For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Como Lake

TREND ***Stable***

Watershed Code: 100-0222-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0150-011
TRIM Map: 92G026

STATUS:

Endangered - Como Lake has been impacted by urbanization (removal of riparian vegetation, poor water quality, and loss of wetlands).

Physiography

Drainage Area

Como (Welcome) Lake is located in the headwaters of Como Creek in the City of Coquitlam.

Lake Description

Como Lake is a small shallow lake located within Como Lake Park. Some 40 years ago, Como Lake was natural and had supporting tributaries and wetlands.

Hydrology

No hydrological data are available.

Channel Stability Assessment

No geomorphological data are available.

Fisheries Resource

Fish Access

The lake is stocked with trout as culverts on Como Creek prevent the passage of anadromous fish.

Fish Stocks

Como Lake contains rainbow and cutthroat trout.

Restoration/Enhancement

The municipality has indicated an interest in habitat improvements including the restoration of native riparian vegetation around the lake, and bank stabilization. Como Lake is routinely stocked with rainbow and cutthroat trout.

Fish Production

Local schools release coho fry to Como Lake each May.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting around the lake, parcels have been cleared to accommodate development.

Secondary Industry/Commercial

There are several commercial (retail) operations bordering the lake.

Linear Development

There are numerous city streets and several large thoroughfares (Como Lake Ave., Gatensbury Road) located within the drainage area.

Urban Development

The watershed is completely developed as residential.

Government

Como Lake is in the City of Coquitlam (Greater Vancouver Regional District.)

Designated Lands

Como Lake lies within Como Lake Park.

Watershed Planning Issues

Management Concerns

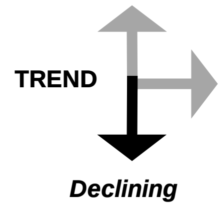
- Severe water quality problems seriously impact the lake.

Management Prescriptions

- Stewardship initiatives that focus on controlling non-point source pollution, community outreach and public education are required for this system.

- The lakeshore should be revegetated with native species.
- Municipal policies, bylaws and area designations which prohibit fouling of watercourses, improve erosion control on sites, reduce impervious surface area and protect riparian vegetation would benefit this system.
- There is a need for a watershed initiative to reconnect the streams to the lake (i.e. for fish migration).

Coquitlam River



Watershed Code: 100-0245-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0180
TRIM Map: 92G026, 92G027, 92H06, 92G02 and 92G037

STATUS:

Endangered - The Coquitlam River system has been severely impacted by urbanization (loss of riparian vegetation, poor water quality and extensive impermeable surface area), and industrial activities (i.e. gravel removal, logging). Coquitlam Lake is impacted by fluctuations in water level due to the dam (Coquitlam Lake is a reservoir for hydro and domestic water supply).

Threatened - Tributaries such as Slade and Or Creeks have been less impacted.

Wild - A number of tributaries below Coquitlam Lake, such as Pritchett, Steelhead and Coho Creeks (east side of Coquitlam River), are relatively pristine. Coquitlam River above the lake is also rated as wild.

Physiography

Drainage Area

The total watershed area of the Coquitlam River and its tributaries is 261.6 km^2. The numerous tributaries include Scott, Hoy, Maple, Pritchett, Coho, Marquart, Partridge, Mantle, Slade and Or Creeks. A list of many of the tributaries (and watershed codes) to the Coquitlam River is located in Appendix 1. The Coquitlam River flows south entering the Fraser River at Queens Reach near the Port Mann Bridge.

Stream Description

The Coquitlam River originates in the Coast Mountains at an elevation of about 1500 m and flows from the mountainside through Coquitlam Lake and onto the Fraser River floodplain west of Douglas Island. The river flows in a braided, shifting channel across a wide, flat-bottomed valley surrounded by steep mountains. A dam at the mouth of Coquitlam Lake, 11.2 km upstream of the Fraser River, is a barrier to all anadromous fish. Slade Creek is spring fed. Hockaday Creek is ground water fed. Coho Creek has flow all year.

Hydrology

The Coquitlam River is a regulated system and drains one of three lakes which contributes to the Greater Vancouver Water District municipal water supply. The mean annual flow of the Coquitlam River is 4.66 m^3/s. Flows are largely regulated by the dam at the mouth of Coquitlam Lake. Until recently Or Creek provided almost all (80%) of the Coquitlam River flows since the Coquitlam Lake dam was constructed. (A new agreement with BC Hydro to increase flow release from the dam to provide water for fish habitat is now in place.) During the winter Or Creek is still a large contributor to Coquitlam River flows. Stormflow management and impermeable surfaces in the Maple Creek watershed have resulted in low flows and the loss of baseflows. The creek dried up in 1986 near the Canadian Pacific Railway tracks. High flows are diverted to Lafarge Lake. Stormwater detention and management in Westwood Plateau is a significant issue and there is a need to investigate options such as flow splitting.

Channel Stability Assessment (Preliminary)

Significant erosion and sedimentation have resulted from construction and routine use of logging roads along Or Creek. The GVRD sanctioned gravel mining in the Coquitlam River immediately downstream of the dam in 1972 destabilized the channel and resulted in spawning gravel loss. Excessive sediment releases from gravel pits and landslides have heightened the concern about sedimentation of the Coquitlam River. The spawning beds of the mainstem have been scoured by fluctuating water levels caused by dam and reservoir operations. Bedload movement is a problem in Or Creek. Erosion and scouring have resulted from diversions of Scott Creek in Eagle Ridge. The lower river is now contained by setback dykes (1994) in the Coquitlam Indian Reserve. The lower reaches and the floodplain of the Coquitlam River have been dyked to protect low lying agricultural and urban areas.

Fisheries Resource

Fish Access

Anadromous fish have access to the Coquitlam Reservoir dam on the mainstem; to the headwaters of Or Creek, although passage is made difficult by velocity barriers (falls) throughout; to an impassable culvert near Capehorn Ave. on Mundy Creek; to the headwaters of Maple Creek (although a dam just downstream of the Lougheed Highway is a partial barrier at low flows); to an impassable culvert at Landsdowne St. on Scott Creek; and to the headwaters of Hoy Creek.

Fish Stocks

The Coquitlam River and its tributaries below the dam (Mundy, Scott, Hoy, Maple, Marquart, Pritchett, Partridge, Mantle, and Or Creeks) support stocks of coho and chum salmon; cutthroat and rainbow trout; steelhead, threespine stickleback, lamprey, and sculpins.

Restoration/Enhancement

Side channel development in the Coquitlam River (1993) provided new spawning and rearing habitat for coho. BC Hydro increased the flows from the Coquitlam River Dam in order to further enhance fish production. The Department of Fisheries and Ocean's Salmon Enhancement Program (SEP) built two rearing pools at Coquitlam River Park. An agreement with BC Hydro to release a minimum year round flow of 17 m^3/s and 2000 cubic feet per second for flushing purposes from the sluice gates on the dam has significantly increased habitat productive potential below the dam.

Numerous riparian revegetation projects have been conducted on the Coquitlam River. Log jam and beaver dam removal, pool deepening, diversions around slides, riparian planting, and enhancement of instream cover by sports groups have been ongoing since 1978. The POCO Hunting and Fishing Club runs a hatchery on the Coquitlam River, raising coho, chum and steelhead. Classroom incubation projects have released coho into the Coquitlam River for several years. Stocking and habitat complexing were identified as the best methods for enhancement of anadromous cutthroat. A side channel was constructed on Or Creek by the Department of Fisheries and Oceans in 1993 to improve chum and coho spawning habitat. Compensation works and a fishway were constructed with the diversion of Mundy Creek to accommodate development. Mantle Creek has been diverted and cleaned. A 400 m culvert on Maple Creek was replaced with eight passable municipal culverts in 1986. The bottom reaches of Scott Creek were replanted in 1993. Boulders were placed in a 550 m section between Guildford and Barnet Highways in 1981. Scott Creek and Hoy Creeks were stocked with cutthroat trout and coho in 1982 and 1984. Obstructions have been removed and stream cleaning has occurred throughout Hoy Creek. A storm overflow dam with a fishway has been installed 30 m downstream of the South Hoy Creek confluence.

Additional enhancement projects by Department of Fisheries and Ocean's Salmon Enhancement Program have been completed on:

- Grant Tomb (ponds and channels),
- Or Creek (ponds and channels),
- Lower Coquitlam (ponds),
- Hoy Creek (rearing pond),
- River Springs,
- opposite the hatchery on the Coquitlam River, and
- Archery Range (channels and ponds).

Fish Production

Chinook rearing occurs in the lower reaches of the mainstem. Chum spawning is concentrated from the replaced bridge on Pitt River Road to approximately 1 km below the hatchery and in Scott and Hoy Creeks. Chum also spawn at the mouths of small tributaries and spawning is concentrated in Lions Park at Shaughnessy Street. Coho rear throughout the system below the dam and spawn in Hoy, Scott, Maple, and Or creeks as well as in the mainstem from Or creek to the dam. Maple Creek is a minor coho producing tributary. Rainbow, steelhead and cutthroat are found in Hoy and Or Creek and in the upper mainstem. Two small low gradient tributaries of Hoy Creek above Barnet Highway provide excellent rearing habitat with chum spawning in Hoy Creek occurring below Hatchery Creek. Gravel mining operations and flood control activities between 1950 and 1969 resulted in very poor spawning conditions in the mainstem. Continuing gravel mining operations and sediment laden discharges from gravel pits are one of the main limiting factors for fish production on the mainstem Coquitlam River.

Activities and Land Use

Agriculture

Farming activity occurs along over 23% of the river's length, and is concentrated largely in the lower watershed.

Mining

Gravel pit operations are located along Pipeline Road throughout the mid reaches of the Coquitlam River mainstem. Historic gravel mining operations in the river removed much of the spawning substrate and the existing discharges are an ongoing water quality concern.

Forestry

The average amount of logging in the watershed is between 180 and 200 acres per year. Extensive logging has occurred around Coquitlam Lake under the jurisdiction of the GVWD. A moratorium on further logging was put in place until a review (1997) of logging in the 3 GVWD watersheds (Capilano, Seymour, Coquitlam) is complete. The logging operations in the Or Creek drainage basin have caused the creek to become very flashy and prone to heavy bedload movement.

Secondary Industry/Commercial

There is significant commercial/light industrial development in the watershed which services the residential communities. An industrial park is proposed at the confluence of Maple Creek near Beresford St. Substantial industrial development is occurring in the lower 4 km of Scott Creek.

Linear Development

The Coquitlam Dam, which impounds the river and creates the Coquitlam Lake reservoir, is located 18.2 km upstream from the mouth of the Coquitlam River. The Mary Hill Bypass, Pitt River Road, the Lougheed Highway (Hwy. 7), and Kingsway Ave. all cross the mainstem. The Canadian Pacific Railway spur line parallels the mainstem along the left bank and the mainline crosses the mainstem approximately 6 km upstream of the mouth. A BC Hydro right-of-way transects Pritchett Creek and there is a line over the lower reaches of Scott Creek. Pipeline Road parallels the mainstem Coquitlam to the GVRD gate. There has been significant encroachment into the floodplain by dyking (from Kingsway downstream to the mouth), land reclamation, and road construction activities.

Urban Development

Urban development occurs along nearly one quarter of the stream length. The Maple Creek watershed is completely built out. The lower 4 km of Scott Creek has experienced considerable change due to residential growth and development, especially in Westwood Plateau (23.7% effective impermeable area on Scott Creek). In Hoy Creek, 20.8% effective impermeable area reflects the heavy residential development which is underway. There is stormwater detention on new developments in the area. Stormwater peaks are diverted to the Coquitlam River from the Hoy and Scott Creek watersheds (where there are large developments, such as Westwood Plateau). The increasing amount of impermeable surface in these watersheds reduces the amount of wetlands and permeable areas, decreasing the amount of water available to streams, which is especially critical in low flow periods (i.e. summer). In 1975, Scott Creek was relocated between the Barnet Highway and Eagle Ridge Drive for development purposes. As development has increased, stormwater quality and quantity problems have become significant. A major issue is baseflow maintenance in developed areas where pavement, rooftops and road surfaces dominate the landscape. The effective impermeable area of the Coquitlam watershed (below the dam) is already 38%.

Government

The lower reaches of the watershed (below the dam) lie within the City of Coquitlam (Greater Vancouver Regional District).

Designated Lands

The headwaters of the Coquitlam drainage are in the Coquitlam Conservation Reserve, which is managed as a protected watershed for a source of domestic water supply. The Coquitlam Indian Reservations #1 and #2 are located in the lower watershed above the Mary Hill bypass and below Pitt River Road respectively. Coquitlam River Linear Park, Coquitlam River Park, Westwood Park, Lions Park, and Reeve Park are located along the mainstem. Many municipal parks including Eagle Ridge, Hoy Creek Linear Park, Town Centre, Wellington, McLean, Rowland, Central, and Greenmount are located in the drainage areas of the tributaries. Upper Coquitlam River Park and the Burke Mountain Provincial Park are located in the headwaters. A green belt has been established along Scott Creek from the Barnet Highway to the upper watershed, and as of 1989, 8% of the land along the Coquitlam River was designated as park land. Portions of the lower reaches flow though the ALR.

Watershed Planning Issues

Management Concerns

- Sediment laden discharges from gravel pits and the removal of spawning gravel have severely impacted fish habitat in the Coquitlam River.
- There have been significant habitat losses in this system as a result of impoundments and water diversions, channelization and dyking, riparian removal, logging, urban development, floodplain encroachments, road construction and gravel mining operations.
- Two tributaries to Scott Creek have been lost and converted to stormsewers in conjunction with the Eagle Ridge development. Other diversions in the Scott and Hoy Creek drainages that were completed to accommodate development are of major concern.
- Erosion control and stormwater runoff quality and quantity are concerns and have become more significant with the increased development in the watershed.
- Low flows and reduced groundwater recharge on Maple Creek are a concern as are bank alterations on Mundy Creek that resulted from road construction.
- Logging activities have significantly impacted Or Creek.
- Operation of the Coquitlam Lake reservoir and watershed, and water diversion to the Buntzen Lake BC Hydro generating system have significantly altered downstream flows and gravel recruitment.

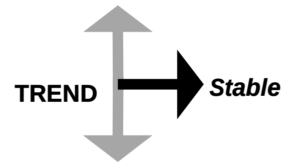
Management Prescriptions

- Municipal policies and bylaws such as the recent Coquitlam sediment control bylaw which will control erosion in new developments should be supported. Additional efforts by the city to address riparian protection and water quality should be encouraged.
- Better industry cooperation and improved water management and pit reclamation plans are necessary to address the chronic sediment discharges from industrial gravel mining operations.
- More effective enforcement of flagrant violations impacting fish habitat are necessary.
- Stewardship and restoration initiatives which focus on water quality improvements, riparian re-establishment, bank stabilization, access management, community outreach, public education and awareness, and compliance monitoring are required on this system. The efforts of the Coquitlam River Watershed Council and the various community groups working on the system including Streamkeepers need to be encouraged.
- Extensive rehabilitation including gravel placement, log weirs, gambions, and bank restoration works could be undertaken on many tributaries.
- A watershed based stormwater management plan which addresses stormwater quality and quantity as well as groundwater recharge is needed.

For Coquitlam River hydrograph, see Appendix 2.
For escapement information on the Coquitlam River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 12 – Pitt Meadows/Maple Ridge Area

Pitt River



Watershed Code: 100-0267-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0200
TRIM Map: 92G027, 92G037 and 92G038

STATUS:

Endangered - The delta/marsh at the mouth of the Pitt River has been largely lost. The river and many of its tributaries have been channelized and dyked, and are impacted by urbanization and agriculture.

Threatened - Pitt Lake and its tributaries and the upper Pitt River and tributaries have been primarily impacted by logging

Wild - Several of the lower Pitt River tributaries (west side) are wild; a number of the upper Pitt River tributaries are relatively pristine.

Physiography

Drainage Area

The total watershed area of the Pitt River is approximately 1660 km^2. The Pitt River has over 200 tributaries. A list of many of the tributaries and their watershed codes is provided in Appendix 1. Some of the better known main tributaries of the Pitt River include the Alouette River (described in the next section), Baker Creek, De Boville Slough, Katzie Slough, Sturgeon Slough, Quarry Slough, Widgeon Creek, Gurney Creek, Fish Hatchery Creek, Corbold Creek, Forestry Creek, Boise Creek, MacIntyre Creek, Homer Creek, Pinecone Creek, Shale Creek, Bucklin Creek, Blue Creek, and Garibaldi Creek. A list of many of the gazzetted tributaries (and watershed codes) to the Pitt River appears in Appendix 1. The upper Pitt River flows south-southeast from Isosceles Peak to Pitt Lake at which point the flow veers southwest. The river acts as the boundary between the City of Coquitlam and the District of Pitt Meadows below Pitt Lake. The Pitt River enters the Fraser River at Douglas Island.

Stream Description

The upper Pitt River (approximately 52 km) is a glacial fed system that originates near Isosceles Peak at an elevation of 1710 m. The river flows in a braided, shifting channel across a wide, flat bottomed valley confined by steep mountains; it is characterized by a long series of rapids and riffles with deep pools. The river flows through Pitt Lake, the largest freshwater tidal lake in North America. It exits the lake in a reverse delta that is exposed at low tide. The lower Pitt River (below the lake) is confined by dykes as it travels through reclaimed historic wetlands before reaching the Fraser River. A multitude of glacial fed streams feed the upper river and lake. The tributaries to the lower Pitt River are primarily sloughs, dredged to drain the surrounding agricultural polder.

Hydrology

The naturalized mean annual flow of the Pitt River is 185 m^3/s. One hundred and forty-one water licenses have been issued, primarily for domestic and irrigation uses. Unstable flows are cited as a major reason for declines in chinook stocks. Smiling Creek is very flashy and also dewaters in the vicinity of Kamloops Avenue; Widgeon Creek has summer low flow problems, and MacIntyre Creek dewaters in its upper reaches.

Hyde Creek is a very flashy system and often becomes a dry channel below Coast Meridian Road between June and October.

Channel Stability Assessment (Preliminary)

The lower reaches, in the vicinity of Fox Reach, are braided and the channel often shifts in response to large floods that transport gravel and debris. The east bank of the river below Katzie marsh is dyked to protect the lowlying agricultural polder while dyking on the west side begins just downstream of MacIntyre Creek and protects Addington Point and much of Port Coquitlam. Boise Creek is unstable, which prompted a request from Ministry of Environment, Lands and Parks to Ministry of Forests to conduct a geotechnical and hydrological assessment of slope stability, and runoff potential associated with proposed logging. The lower section of the watershed has been logged and has become quite unstable. The flashiness of Hyde Creek has resulted in bedload accumulation in the lower reaches of the channel which require maintenance dredging. The slope failures along the ravine in the upper reaches of the stream are believed to be exacerbated by stormwater diversions into the ravine. A portion of Cedar Creek has been diverted into a roadside ditch, and sections of Blaney and Deiner Creeks have been channelized. Hyde Creek has been channelized from Coast Meridian to Cedar Drive; significant culverting and riparian loss has occurred, and stream dewatering has become a recent phenomenon. The lower reaches of Coho Creek have been diverted and the channel widened for floodproofing. Where development has occurred there has generally been encroachment into the floodplain.

Fisheries Resource

Fish Access

Anadromous fish have access to an area of impassable rapids, approximately 40 km upstream of Pitt Lake on the Pitt River. Fish can access the entire length of De Boville Slough although the floodboxes at the end of De Boville Slough which connect to Hyde and Cedar (Partington) Creeks are partial barriers under certain tide conditions. A culvert at Victoria Drive on Smiling Creek is impassable. Access is restricted by a pump station on Sturgeon Slough (carp and black crappie observed above), and to a set of falls, 6 km up Widgeon Creek. Irvine and McLean Creeks have floodgates at the mouth that deny access to fish.

Fish Stocks

The Pitt River and its tributaries support important stocks of sockeye, coho, pink, chum and chinook salmon; steelhead, rainbow, Dolly varden, cutthroat and bull trout; eulachon, kokanee, Rocky Mountain whitefish, catfish, chub, burbot, black crappie, brown bullhead, black bullhead, brassy minnow, western brook lamprey, pacific lamprey, Aleutian sculpin, prickly sculpin, carp, large scale sucker, long nose sucker, long nose dace, northern squawfish, peamouth chub, redside shiner, starry flounder, threespine stickleback, white sturgeon, longfin smelt, and the endangered pygmy longfin smelt. MELP has issued several commercial crayfish licences for the Pitt River watershed.

Restoration/Enhancement

The Hyde Creek Residents group runs an incubation box and rearing facility for coho and chum on Hyde Creek. Gravel was placed in lower Hyde Creek in 1984. Upgrading Apel Drive and Victoria Drive culverts on Hyde Creek would access additional upstream spawning and rearing habitat. Recommended enhancement for De Boville Slough tributaries includes the creation of pools, increasing cover complexity, and fry stocking. Beaver dams which present barriers to fish have been removed on MacIntyre Creek. Channelization and gravel removal was undertaken on Corbold Creek in 1985/86. An incubation box for chinook, and a spawning channel have been recommended for Corbold Creek. A hatchery for sockeye salmon has been operating on Corbold Creek since 1960; another has been recommended for Boise Creek. There are tremendous opportunities for enhancement by retrofitting pumps on Sturgeon Slough in order to provide access to additional nursery areas for coho and cutthroat.

Fish Production

Chinook stocks have declined steadily due to unstable flows that have resulted from logging in the lower reaches of the upper watershed (above Seymour Reservoir). Proposals to increase chinook production have included incubation boxes and the creation of a spawning channel in Corbold Creek. Spawning and rearing potential is good in Widgeon Creek, especially in the east branch. Extensive instream debris is found in the middle sections and the lower section is characterized by cut banks, pools, and side channels. Riprapping and channelization on Deiner Creek in combination with low flows have significantly affected salmon habitat and production. Sturgeon Slough may be important sturgeon rearing habitat.

Activities and Land Use

Agriculture

Agriculture (e.g. dairy and poultry farms, blueberry and cranberry farms, and greenhouses) are present throughout the lower watershed. 94 km^2 of the watershed is in the Agricultural Land Reserve; however not all of it is actively farmed.

Mining

Gravel and rock quarries were previously operated in the headwaters of MacIntyre Creek and south of Addington Point. There are active quarries on the east slope of the Pitt River across from Addington Point. Sporadic mineral exploration has not resulted in significant mining operations. In 1993 Cominco staked four claims in the McIntyre Creek area for sand and gravel. A new gravel mine is proposed for Olsen Creek (which enters the Pitt River opposite Fish Hatchery Creek) on the Upper Pitt River.

Forestry

Forestry is extensive in the upper watershed. Over 10% of the watershed has been logged including 5% recent/proposed activity. Several tree nurseries operate in the polder. Selective logging occurs along the east tributary of Widgeon Creek. A log dump is located at the mouth of Widgeon Creek and log dumping/booming occurs in Widgeon Slough. A dryland sort operates on the east side of Widgeon Creek. A log sort was located on the east shore between the highway and railway bridges. Clearcuts are present west of the Widgeon Creek drainage area. Log booming and storage occurs along the shoreline of the lake.

Secondary Industry/Commercial

A sawmill is located between the Lougheed Highway bridge and the CP Railway bridge on the west shore. Several commercial (retail) operations are located in the lower watershed. Mary Hill and Meridian Industrial parks are located on the west side of the lower Pitt River mainstem. The Carnoustie, Pitt Meadows, and Meadow Gardens golf courses are located within the drainage area. In 1993 there was a proposal for a golf course and recreation vehicle park near MacIntyre Creek.

Linear Development

The Pitt River is dyked on both banks for most of its length below Pitt Lake. The Canadian Pacific Railway and the Lougheed Highway (Hwy. 7) cross the river approximately 3.1 km and 3.6 km upstream of the mouth respectively. Transmission lines cross approximately 13 km upstream of the mouth. Most of the lower sloughs and creeks including the Alouette, De Boville and Hyde Creeks and Sturgeon Slough have been dyked and channelized.

Urban Development

Significant residential development is occurring in Haney and Pitt Meadows, and there is considerable interest by Pitt Meadows in developing the Pitt Polder Highlands into residential areas. The amount of development in the Pitt River watershed overall is generally considered quite small, as almost all concentrated urban development is presently located below Pitt Lake; however several subcatchments have experienced significant development. For example urban development is present along 22% of the Alouette River. Hyde Creek drainage already has 10.6% effective impervious area, indicating fairly high urban development, while 5.5% EIA in Smiling Creek indicates moderate urban development. Residential development is occurring along Partington Creek. Several tributaries such as Smiling Creek may be impacted by the proposed development of the northeast Coquitlam urban core. The headwaters of MacIntyre and Munroe Creeks are slated for urban development. Quarry Road and associated development has encroached onto the foreshore. A marina on Partington Creek is slated for expansion. The upper reaches of Baker Creek and Irvine Creek have been lost (culverted) for residential development.

Government

Urban tributaries on the west side of the watershed lie within the City of Coquitlam (Greater Vancouver Regional District). The Dutch Crown owns part of polder to the east of the river. Urban tributaries on the east side of the watershed lie within the districts of Pitt Meadows and Maple Ridge, also in the Greater Vancouver Regional District.

Designated Lands

The Ministry of Environment, Lands and Parks manages Pitt Addington Wildlife Management Area at Addington Point Marsh, Katzie Marsh and Pitt Marsh. The Widgeon Valley National Wildlife Area is located at the head of Widgeon Slough and mouth of Widgeon Creek. The Katzie Band has a reserve at the mouth of Pitt Lake (Pitt Lake Indian Reserve #4). The area bordering the lake is largely provincial crown land and includes Golden Ears Provincial Park located on the east side of the lake. The University of British Columbia operates a forestry research station between the polder and Golden Ears Provincial Park on the eastern shore.

A significant amount of the watershed lies within Garibaldi Provincial Park (56% of total watershed). Widgeon Marsh Reserve is located along the west side of Pitt River and extends from Widgeon Lake south to Siwash Island. McClean Creek passes through Minnekhada Regional Nature Park. Established in July 1995 Pinecone Burke Provincial Park is located south of Garibaldi Provincial Park, west of Pitt Lake and extends south to include Burke Mountain. The park is 38,000 ha and protects the western shore of Pitt Lake, and Widgeon Creek.

The majority of the land along the eastern side of the river, and parcels along the western side of the mid reaches are within the ALR. A total of 94 km^2 of the Pitt River watershed is located within the ALR.

In 1993 the BC Ministry of Environment, Lands and Parks asked BC Lands for a 60 ha parcel of land between Quarry Road and the mouth of MacIntyre Creek be set aside as a special conservation area. The mouth of MacIntyre Creek is home to small mammals found only in the Lower Mainland - the Pacific Jumping Mouse, the tailed frog, Pacific Water Shrew and Trowbridge Shrew.

Watershed Planning Issues

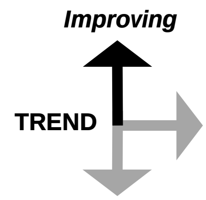
Management Concerns

- A study in 1993 indicated that approximately 8,000 ha of the lower Pitt Valley was cleared or under agricultural land use.
- Channelization, diversions and loss of floodplain have reduced habitat capacity in many tributaries including Hyde, Deiner and Cedar Creeks.
- Heavy erosion and sedimentation is an ongoing concern in Hyde Creek.
- Hyde Creek and Smiling Creek experience extreme summer low flows.
- Hyde Creek has several obstructions to fish passage, including a dam at Cedar Drive, and culverts at Greenwood, Kent, and on an unnamed tributary at Apel Drive.
- Heavy parasite infections were noted in fish from the west fork of Hyde Creek.
- Increasing residential development pressure in the polder and on small subdrainages are a significant concern.
- The demand for recreational access to aquatic areas is increasing; the impact on aquatic areas must be sensitively managed.
- The incorporation of the Widgeon Creek drainage into the Greater Vancouver Water District as a potential water supply is a concern.
- Logging and gravel mining occur in the watershed and may impact fish habitat.
- Golf course and possibly recreational boat discharges to the Pitt River are a concern.
- Recreational boating is creating propwash erosion on the lake.

Management Prescriptions

- The wisdom and possible consequences of including Widgeon Creek in the Greater Vancouver Water District as a future water supply source must be reviewed.
- Urban development should be concentrated in the developed areas of Haney and the urban core of Pitt Meadows below the Lougheed Highway.
- Enhancement activities including incubation boxes are recommended to rehabilitate chinook stock.
- Any logging or gravel mining in the watershed should follow a plan and prescriptions that protect fish habitat, and should be closely monitored for impacts to fish habitat.
- Municipal policies, bylaws or development permit area designation which prevent watercourse contamination, restrict riparian removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage in conjunction with development are required.
- Stewardship initiatives which focus on riparian protection or enhancement, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach and increasing public awareness about the fisheries values of this system are required.

For Pitt River hydrograph, see Appendix 2.
For escapement information on the Pitt River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).



Alouette River

Watershed Code: 100-0267-060-000-000-000-000-000-000-000-000-000
RAB Code: 00-0200-050
TRIM Map: 92G027, 92G028, and 92G038

STATUS:

Endangered - The Alouette River (North and South branches) has been impacted by water diversion, logging, channelization/dyking, riparian removal, poor water quality, high effective impermeable area.

Threatened - Alouette Lake is threatened due to water diversion at the north end of the lake (carries water to Stave Lake), the dam (hydro) at the south end of the lake, which results in fluctuations in water level, and impacts of recreational use on the lake (bank erosion from boat traffic, domestic sewage).

Physiography

Drainage Area

The Alouette River watershed covers an area of 332 km^2. Its direct tributaries include the North Alouette River, McKenney Creek, Coho Creek, Viking Creek, Gold Creek, Millionaire Creek, Mike Lake Creek and Moyer Creek. A list of many of the tributaries (and watershed codes) to the Alouette River is available in Appendix 1. The Alouette River drains west from northern Maple Ridge through Pitt Meadows discharging into the Pitt River 5.8 km upstream of the Fraser River.

Stream Description

The Alouette River has two main branches, the North and South Alouette (mainstem).

The South Alouette River drains Alouette Lake (location of Alouette Dam) and has a total length of 25 km. The upper 9.5 km is largely rapids/pool habitat which flows through a shallow, wooded valley. The gradient decreases in the mid reaches as the river flows through a section that has been channelized and dyked to prevent flooding of adjacent farmland. The lower 7.5 km is tidal and flows in a dyked channel through marsh and meadow.

The North Alouette River originates at an elevation of 760 m. It is joined in the upper 15 km by several tributaries and flows through a densely wooded canyon. The stream emerges from the canyon 10 km upstream of the South Alouette confluence, forming a meandering channel across the plain, becoming slough-like in the final 6 km. There are gravel deposits between 9.5 km and 6 km from the confluence. The channel in the area below 6 km has been dredged and dyked.

Hydrology

The naturalized mean annual discharges of the Alouette (mainstem) and North Alouette rivers are 8.1 m^3/s and 5.1 m^3/s, respectively. Downstream of the Alouette River Dam, licensed water extractions (for domestic and irrigation use), total 0.018 m^3/s. Due to BC Hydro reservoir operations and water diversion to Stave Lake, the Alouette River experiences large fluctuations in flow. Flooding is primarily the result of rainfall, or rain on snow, compounded by spillage of dam storage water. An agreement with BC Hydro in 1996 increased minimum instream flows to 6.05 m^3/sec which increased baseflows below the dam approximately 5 fold. The North Alouette River is prone to flooding downstream from 232nd Street. There are several water withdrawal licences issued for private use on the North Alouette River. McKenney and Latimer Creeks are supported by groundwater sources and have constant flow. In the spring of 1997 the water quality and invertebrate population of many of the tributaries to the Alouette were studied (Walsh et al., 1997).

Channel Stability Assessment (Preliminary)

The flow agreement with BC Hydro respecting operation of the dam on the Alouette River has greatly reduced the erosion problems downstream. The silt catchment basin on Mud Creek has reduced sediment inputs. Coho Creek continues to have a siltation problem. Dredging has been required on Cedar Creek because of gravel accumulation. In the past, waves and wash from power boats caused bank erosion along the lower reaches of the river. Now, a municipal bylaw excludes the use of power boats on the Alouette River.

Fisheries Resource

Fish Access

Anadromous fish have access on the mainstem to the BC Hydro dam at the mouth of Alouette Lake, on the North Alouette River to the impassable falls near the UBC Research Forest border, on Blaney Creek to a falls less than 1 km upstream of the 224th St. bridge, on McKenney Creek to an impassable culvert at Camwood St. downstream of Laity St., and to the headwaters of Coho Creek.

Fish Stocks

The Alouette River and its tributaries support stocks of coho, chum and pink salmon; steelhead, cutthroat, Dolly varden, and lake trout; kokanee, brassy minnow long nose dace, Rocky Mountain whitefish, northern squawfish, peamouth chub, redside shiner, lake char, and large scale suckers.

Restoration/Enhancement

SEP built a spawning channel at the base of the dam on Alouette Lake in 1993 and a rearing channel just downstream of 232nd St. in 1990. MELP has stocked the system with steelhead since 1979. The Alouette River Correctional Institute has operated enhancement facilities since 1980 and has produced chum, coho, pink salmon, and cutthroat and steelhead trout. The Corrections Branch operates a counting fence near the hatchery and has also installed a silt trap at the outlet of Mud Creek. Blaney Creek coho reared in the Inch Creek hatchery have been released into Blaney Creek since 1981, and chum were released from 1981 to 1986. An incubation box for chum was operated in the UBC Research Forest from 1972 to 1979. The wetted usable habitat downstream of the dam has been increased three fold since the flow agreement with BC Hydro was implemented. Specific enhancement opportunities were identified in a study (conducted by R. Davies) funded by the Fraser River Action Plan (DFO) and the Urban Salmon Habitat Program (MELP) in 1996. Local groups are active in improving habitat (i.e. Latimer Creek).

Fish Production

Chum still spawn throughout the system; however the spawning is concentrated in the mid reaches of the mainstem (e.g. 216th St.) and in the central and lower reaches of the North Alouette River. Coho rearing occurs throughout the system, especially in the upper reaches, and throughout the mid and upper reaches of the mainstem and North Alouette (up to the falls). Gravel removal projects for mining and flood control between 1954 and 1966 were coincident with declines in coho and chum stocks, and the demise of pink stocks. The North Alouette River is not as significant a producer as the South Alouette because access to the upper watershed is restricted by waterfalls. The mid and upper reaches of Blaney Creek are used for chum and coho spawning. The major spawning area in Coho Creek is the lower reaches between the confluence and 228th St.

Activities and Land Use

Agriculture

Agriculture occurs along 50% of the mainstem and in the lower reaches of the North Alouette River. There is some agricultural activity in the lower reaches of McKenney Creek and the upper reaches of Laity Creek. Agriculture has seriously impacted Coho Creek (grazing and bank erosion).

Mining

There are some active gravel pits operating within the watershed.

Forestry

Commercial logging has occurred in the UBC Research Forest and continues to a small extent for research purposes in the North Alouette River drainage basin. In addition much of the lower watershed has been cleared for agricultural and urban development.

Secondary Industry/Commercial

Secondary industry is presently very limited in the Alouette River drainage area. The majority of commercial activity occurs in Haney and eastern Pitt Meadows. Golf courses have been developed at several locations in the watershed. There is some commercial activity in the upper reaches of McKenney Creek.

Linear Development

BC Hydro operates the dam at the mouth of Alouette Lake for hydroelectric production. The Alouette and North Alouette Rivers, and Blaney and McKenney Creeks are partially dyked. Harris Road crosses the Alouette approximately 1400 m upstream of the mouth and the drainage basin hosts a network of other streets and roads.

Urban Development

It is estimated that 25% of the land adjacent to the mainstem has been developed, primarily in the mid reaches. Extensive urban development has occurred in portions of the watershed. New housing developments are located in the mid reaches of the North Alouette. Urban development in Haney has had significant adverse impacts on the McKenney Creek drainage basin. Coho Creek has been impacted by stream diversions, setback dykes, and stream channelization in association with urban development. The Coho Creek drainage area has experienced heavy urbanization increasing the potential concerns associated with stormwater runoff quality and quantity. Additional development is proposed for the Pitt Polder highlands. Recently restrictive covenants have been required along streams for new developments.

Government

The Alouette River is in the Districts of Pitt Meadows and Maple Ridge (Greater Vancouver Regional District). Major crown lands in the watershed are managed by B.C. Parks and B.C.Corrections.

Designated Lands & Parks

Fifteen percent of the Alouette River mainstem length is adjacent to parks. The northern part of the drainage is located within Garibaldi Provincial Park, which borders on Golden Ears Provincial Park, through which the drainage also extends. Next, south of Alouette Lake, the stream flows through Blue Moutain Forest and the Haney Correctional Camp. (The Haney Correctional Institute is located further downstream.) The Greater Vancouver Regional District owns a significant area along the mainstem, and has proposed hiking trails throughout this area. Maple Ridge Park and Horseman Park are located along the mainstem. Part of the North Alouette River is located within the UBC Research Forest Reserve. The lower half of the river and parcels along the northwest bank of the upper river are within the ALR.

Watershed Planning Issues

Management Concerns

- Maintain minimum flows out of the dam, and reduce large spill events.
- High winter flows in the North Alouette River have caused scouring which has reduced egg survival.
- Erosion around the culvert at 128th Ave. creates an access problem into the east tributary of McKenney Creek.
- The existing and potential development in this watershed increases the risk of altering stream hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.
- The proposed development in the Pitt Polder highlands and other areas slated for urban development are major concerns.
- The river bottom is privately owned in many sites.
- Sediment discharges are a real concern.

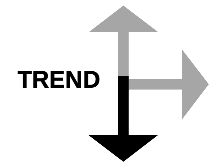
Management Prescriptions

- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required. Furthermore, it is important for all municipalities in this watershed to coordinate development of these protection mechanisms for the entire watershed.
- The covenants on Coho Creek and other watercourses need to be enforced.
- Stewardship initiatives such as those undertaken by the Alouette River Management Society and other Streamkeeper groups that focus on riparian protection and enhancement, water quality protection, preventing stream encroachments, managing access, improving flow conditions, conducting community outreach programs and increasing awareness about the fisheries values and risks to habitat in this system need to be supported and fostered.
- Flow agreements with BC Hydro need to be monitored and additional discussions initiated as required.
- Setbacks are needed when development occurs; ownership of the river bottom should be relinquished.

- Enhancement opportunities identified in the study done by Davies (1996) should be seriously considered by all agencies, organizations and landowners involved in development and management along the Alouette River and its tributaries.
- Any developments along the Alouette River and its tributaries should consider the health of the stream, as rated by Walsh et al. (1997), in their planning and management prescriptions.

For Alouette River hydrograph, see Appendix 2.
For escapement information on the Alouette River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Kanaka Creek



Declining

Watershed Code: 100-0374-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0290
TRIM Map: 92G018 and 92G028

STATUS:

Endangered - Kanaka Creek has considerable urban development within the watershed, and poor water quality, largely due to agricultural activities.

Physiography

Drainage Area

The Kanaka Creek watershed area is 62 km^2. Tributaries to Kanaka Creek include Spencer, Donovan (Dunlop), Salamander, Cottonwood, Rainbow, Seigie and Thornvale Creeks. A list of tributaries (and watershed codes) to Kanaka Creek is provided in Appendix 1. Kanaka Creek drains west - southwest discharging into the Fraser River at the north end of Russel Reach.

Stream Description

Kanaka Creek is an extensive system approximately 19 km in length. It originates in the Blue Mountain Forest north of Maple Ridge. The north branch flows through a wide valley and has good gravel deposits throughout. The south branch has a generally higher gradient and flows through a narrow valley from the mountain source. There are excellent gravel deposits above 3.3 km; and cobble/boulder substrate dominates throughout the remainder of the canyon. The creek emerges from the canyon at 5.7 km and flows in a meandering channel across a low lying plain, becoming slough-like in the lower 3.3 km.

Hydrology

The naturalized mean annual flow of Kanaka Creek is 3.5 m^3/s. There are documented low summer flow problems. A significant portion of flows in the Kanaka drainage is licensed for agricultural and industrial uses.

Channel Stability Assessment (Preliminary)

The substrate is predominantly rubble/boulder, except for a 400 m section of gravel 8.2 km upstream from the mouth. There are two impassable rockfalls in the canyon section of Kanaka Creek. The creek is reported to have mobile bed material, and riprapping and channelization have altered natural channel morphometry.

Fisheries Resource

Fish Access

Anadromous fish access is possible to a falls 200 m upstream of 112th Avenue. Fish have access on Thornvale Creek to an impassable culvert located above Industrial Ave. Fish can ascend 0.5 km above 112th Ave. to Cliff Falls Park on Donovan Creek. The pump station immediately upstream of the Lougheed

Highway on Spencer Creek creates a partial barrier to upstream adult migration, and usually a downstream problem for juvenile fish.

Fish Stocks

Kanaka Creek and its tributaries support populations of coho, pink, and chum salmon, as well as steelhead, and cutthroat trout.

Restoration/Enhancement

The Bell Irving Kanaka Creek hatchery, which produces chum, coho, cutthroat, and steelhead, has been operating on Kanaka Creek since 1981. Donovan Creek is used occasionally for coho and chum broodstock collection for the hatchery. This hatchery and its counting fence serve as interpretation centres for the public. There has been a continuous debris removal effort on this system since 1981. Adult coho were trapped and transported to Donovan Creek above Cliff Falls in 1986 and 1987.

Fish Production

Mainstem spawning occurs primarily between 3.5 km and the falls located 5.5 km upstream. The north branch of Kanaka Creek contains approximately 10 km of good quality rearing habitat that is inaccessible due to an impassable falls. Thornvale and Dunlop Creeks are considered significant for coho production. The searun cutthroat population is limited by the quality and quantity of available spawning and rearing habitat. Low escapement and overharvesting by anglers are factors contributing to the low fish populations. However, stocks are holding their own due in part to the Bell Irving hatchery releases. Rearing potential is considered to be generally poor in the Kanaka system. Minimum flows appear to be a limiting factor on these systems.

Activities and Land Use

Agriculture

Hobby and commercial farms are found along 8% of the stream length and the majority of Donovan Creek flows through agricultural lands. Farming in the lower reaches of the stream has resulted in extensive riparian vegetation removal. The area along Spencer Creek is primarily agricultural. Cattle along Thornvale Creek have trampled the banks and created significant erosion problems. Fur and poultry farms are also located in the watershed.

Mining

There are two large active gravel pits with settling ponds near 240th Street and Websters Corner and an abandoned pit that is eroding and contributing sediment to the creek.

Forestry

Three percent of the total watershed has been logged. A portion of the west branch of the stream was logged in 1945 and log booming activities continue at the Fraser River confluence. Maple Ridge has requested a TFL in the headwaters of Kanaka Creek; the area is currently a forest reserve.

Secondary Industry/Commercial

Secondary industry and commercial activity are limited in the drainage basin and generally concentrated in the lower reaches. There is some commercial activity near the Lougheed Highway including a large auto wrecker. Several sawmills are located downstream of the mouth of Kanaka Creek. An old municipal landfill on Cottonwood Creek has created leachate problems.

Linear Development

The stream is crossed by Lougheed Highway (Hwy. 7), a BC Hydro right-of-way, a gas pipeline, and the Canadian Pacific Railway approximately 0.7 km upstream of the mouth. The drainage area also hosts a network of rural streets and roads several of which cross Kanaka Creek.

Urban Development

Several tributaries including Horseshoe, Spencer, Seagull, Rainbow, Magee, Salamander, and Cottonwood Creeks have been seriously impacted by urban development. A ravine on Dunlop Creek has been filled in which has exacerbated instability concerns and enhanced erosion. The land along Donovan Creek is in transition from rural to urban residential. A large urban development project (Albion) is being planned for the area, and will directly affect a portion of the Kanaka Creek watershed.

Government

Kanaka Creek is in the District of Maple Ridge (Greater Vancouver Regional District).

Designated Lands & Parks

Fifty-six percent of the stream length flows through Kanaka Creek Regional Park. The GVRD continues to acquire land along Kanaka Creek with a goal of establishing a linear greenway from the headwaters to the mouth. There are a number of other municipal parks located within the drainage area, including Cliff Falls Park. The ALR covers much of the landbase in the lower watershed.

Watershed Planning Issues

Management Concerns

- The existing and proposed development in the watershed increases the risk of stormwater impacting stream water quality and quantity, fugitive contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.
- A pump station and large floodgates on Spencer Creek upstream of the Lougheed Highway present seasonal access problems for fish.
- Park expansion and enhanced trail construction may create conflicts between recreation and conservation.

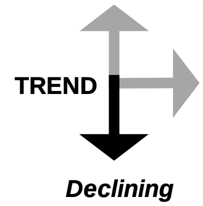
Management Prescriptions

- A water management plan is urgently required which would address existing water licence allocations as well as stormwater generation and implications to stream water quality and quantity.

- The pump station and large vertically mounted floodgates on Spencer Creek should be modified and managed to improve seasonal access.
- The District of Maple Ridge sediment control bylaw needs to be supported. This bylaw is particularly important in this area given the surficial material (clay and silt) in the drainage and the attendant problems associated with managing runoff from such materials once they are disturbed or mobilized.
- Opportunities related to park lands in this watershed should be examined to obtain habitat restoration.
- Ensure a good compliance program for sediment discharge from gravel pits.
- Stewardship initiatives which focus on riparian protection and enhancement, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized or improper instream works, developing community outreach programs and increasing public awareness about the fisheries values of this system are required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain “open” streams with unobstructed fish passage are required.

For Kanaka Creek hydrograph, see Appendix 2.
For escapement information on Kanaka Creek, see Appendix 3.

Albion Creek



Watershed Code: 100-0400-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0305
TRIM Map: 92G018

STATUS:
Threatened - Albion Creek has been impacted by adjacent urban areas.

Physiography

Drainage Area

Albion Creek (Albion Brook) drains south to the Fraser River entering Russel Reach at McMillan Island.

Stream Description

Albion Creek is a small stream which originates on the Grant Hill escarpment. Baseflows have been reduced by withdrawals from domestic wells in the watershed.

Hydrology

No hydrological data are available.

Channel Stability Assessment (Preliminary)

Erosion and sedimentation has been caused by runoff during development.

Fisheries Resource

Fish Access

Anadromous fish have access upstream to at least the CPR tracks.

Fish Stocks

Albion Creek supports populations of coho and chum salmon, and cutthroat trout.

Restoration/Enhancement

A culvert at the mouth of Albion Creek was upgraded in the early 1980’s to allow fish passage. The creek was stocked with 1000 cutthroat fry in 1988.

Fish Production

No specific fish production information is available; however the stream does provide excellent rearing and spawning habitat.

Activities and Land Use

Agriculture

The dominant land use in the watershed is agriculture (hobby farms and some commercial farming).

Mining

There is a gravel pit operation near the mouth of the creek.

Forestry

Parcels have been cleared to accommodate residential and agricultural development.

Secondary Industry/Commercial

There is some light industry in the watershed, located primarily near the mouth. Commercial activity is largely limited to that which supports limited residential development (i.e. retail).

Linear Development

Lougheed Highway (Hwy. 7) crosses the stream approximately 300 m upstream of the mouth and has been upgraded in recent years. The Canadian Pacific Railway crosses Albion Creek near the mouth.

Urban Development

A large urban neighbourhood development project (Albion) is being planned for the area and has implications for the Albion Creek watershed.

Government

Albion Creek is in the District of Maple Ridge (Greater Vancouver Regional District).

Designated Lands & Parks

Langley Indian Reserve #5 is located in the upper watershed. A municipal park is located on Industrial Ave. Albion Creek passes through the ALR several times.

Watershed Planning Issues

Management Concerns

- Significant residential development is planned for the watershed, which increases the risk of altered hydrology, and water quality (from stormwater discharges), contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Municipal policies, bylaws or development permit areas designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce impervious surface areas and maintain unobstructed fish passage are required.
- Stormwater management plans for new developments need to address runoff quality, quantity and baseflow maintenance.
- Extension of the municipal water supply would reduce the impacts of well water withdrawals on stream flows.

Sprott Creek

TREND **Stable**

Watershed Code: 100-0425-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G018

STATUS:

Threatened - Sprott Creek has been impacted by development within the watershed.

Physiography

Drainage Area

The watershed area of Sprott Creek is unknown. The creek enters the Fraser River approximately 1.0 km east of McMillan Island.

Stream Description

Sprott Creek is a small stream which originates in the Grant Hill escarpment. The flow is ephemeral north of Lougheed Highway. There is a wetland at the lower end of Sprott Creek near its confluence with the Fraser River.

Hydrology

No hydrological data are available. Baseflows have been reduced by domestic well withdrawals.

Channel Stability Assessment

No geomorphological data are available.

Fisheries Resource

Fish Access

Anadromous fish have access up the east tributary to the Lougheed Highway. Access to the west tributary is restricted by a gradient barrier.

Fish Stocks

The Sprott Creek system supports stocks of coho and cutthroat.

Restoration/Enhancement

The Fort Langley First Nations have recently completed a biophysical study of the creek which could be used to identify enhancement opportunities.

Fish Production

Coho fry have been observed in the stream, but no specific fish production information is available.

Activities and Land Use

Agriculture

Agriculture accounts for 50% of the surrounding land use.

Mining

None.

Forestry

While there is no significant commercial forest harvesting in the watershed, parcels have been cleared for agriculture and rural residential development.

Secondary Industry/Commercial

There is little or no industry within the watershed.

Linear Development

The stream is crossed by the Canadian Pacific Railway and the Lougheed Highway (Hwy. 7) near the mouth.

Urban Development

The transition from rural to residential or commercial land use will increase as population pressure increases.

Government

Sprott Creek is in the District of Mission (Fraser Valley Regional District).

Designated Lands & Parks

Most of the drainage basin lies within the Langley Indian Reservation 5. The upper reaches cross through the ALR.

Watershed Planning Issues

Management Concerns

- There is increasing development pressure throughout this area.

Management Prescriptions

- There are opportunities in conjunction with First Nations to proactively identify and protect the stream corridor, the riparian areas, the wetlands and natural recharge areas before development is contemplated.

York Creek

TREND *Stable*

Watershed Code: 100-0450-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0365
TRIM Map: 92G018

STATUS:

Threatened - York Creek is threatened by urbanization of the surrounding area.

Physiography

Drainage Area

York Creek drains south from Maple Ridge and discharges into the Fraser River entering Plumper Reach near the west end of Crescent Island.

Stream Description

York Creek is a small stream that originates on the Grant Hill escarpment.

Hydrology

Baseflows have been reduced by domestic well withdrawals by residents.

Channel Stability Assessment

No geomorphological data are available.

Fisheries Resource

Fish Access

Anadromous fish have access to an impassable culvert at 272nd St. There is a partial barrier (hack) above 96th Avenue.

Fish Stocks

York Creek supports populations of coho and chum salmon, and cutthroat trout.

Restoration/Enhancement

The Fort Langley First Nations have recently completed a biophysical assessment of the creek.

Fish Production

Fish populations are considered stable. Cutthroat are found in the headwaters above the barrier.

Activities and Land Use

Agriculture

Small hobby farms (5 acre) dominate the watershed.

Mining

None.

Forestry

Some clearing has occurred to accommodate rural residential development.

Secondary Industry/Commercial

There is very little industry in the watershed.

Linear Development

The Lougheed Highway (Hwy. 7) and the Canadian Pacific Railway cross the stream approximately 0.2 km upstream of the mouth. The Lougheed Highway has been upgraded in recent years.

Urban Development

Urban development is presently at a very low level but the threat of future development is high.

Parks

A small park is located at 108th Ave. and 272nd St.

Government

York Creek is in the District of Maple Ridge (Greater Vancouver Regional District).

Designated Lands

The stream flows through the Whonnock Indian Reservation #1 which is located at the mouth of the stream. The mid and upper reaches flow through ALR lands.

Watershed Planning Issues

Management Concerns

- The potential for conversion of small hobby farms and rural residential to suburban/urban development increases as population pressure increases.

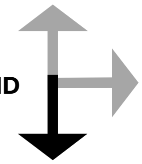
Management Prescriptions

- Municipal policies, bylaws and/or development permit designations which prevent watercourse contamination, restrict vegetation removal, improve erosion control, reduce impervious surface areas and maintain unobstructed fish passage are required and could be applied proactively to this area.

Map 13 – Stave River/Mission Area

Whonnock Creek

TREND



Declining

Watershed Code: 100-0453-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0370
TRIM Map: 92G018 and 92G028

STATUS:

Threatened - Whonnock Creek is impacted by the increasing urbanization within the watershed.

Physiography

Drainage Area

The Whonnock Creek watershed occupies an area of 19 km^2. The creek flows south from headwaters four kilometres west of Stave Lake, to the Fraser River near the west end of Crescent Island.

Stream Description

The creek (approximately 12 km long) flows from the mountains onto a broad plateau, where Whonnock Lake is located, then down a narrow valley to the Fraser River. The lower 1.5 km section provides riffle/pool habitat with gravel substrate. The remainder of the creek is predominately rapids. The stream meanders between kms 4.8 and 8.0 across the plateau.

Hydrology

The naturalized mean annual flow of Whonnock Creek is 1.1 m^3/s.

Channel Stability Assessment (Preliminary)

Whonnock Creek appears to be a stable system; however channel stability is threatened by urbanization in the upper reaches. Attempts to obtain detention and retention structures that are of sufficient size to maintain the natural flow regime have been unsuccessful.

Fisheries Resource

Fish Access

Anadromous fish have access to the BC Hydro right-of-way, three to four kilometers above Dewdney Trunk Road. Resident cutthroat have been reported up to the headwaters. Chum access past the CPR tracks is dependent on flow conditions.

Fish Stocks

Whonnock Creek and its unnamed tributary support populations of coho and chum salmon; steelhead and cutthroat trout; and black crappie.

Restoration/Enhancement

Beaver dams are removed periodically near Whonnock Lake. A Watershed Restoration project was initiated in 1995 in the upper watershed. The project, funded by the District of Mission Forestry Department, included removal of obstructions and placement of large woody debris. The small wetland between Whonnock Creek and York Creek should be restored. The Ministry of Transportation and Highways built a spawning channel near the mouth of Whonnock Creek as compensation for a culvert installation. The Fort Langley Band and Kwantlen bands have conducted extensive surveys on Whonnock Creek, including sampling and biophysical inventories.

Fish Production

Coho spawn between 4.9 km and 7.2 km with heavy rearing in a marshy area at 5.0 km upstream of the creek's mouth. The stream is underutilized by coho even though it has not been heavily disturbed. The limiting factors of production require further study. Chum spawning is heavy in the lower 3.2 km and scattered up to 5.0 km in a lower tributary. Pink salmon occasionally spawn in Whonnock Creek. Whonnock Creek is stocked annually with rainbow trout. SEP stocked the area with coho fry in September 1995.

Activities and Land Use

Agriculture

Agriculture (low intensity) is the predominant land use along the lower reaches.

Mining

None.

Forestry

The headwaters of Whonnock Creek are located in the Mission Timber Forest License (TFL) #26. Logging right to the banks of the creek occurred through the whole watershed 30 years ago; however, the area is greening up and the riparian zone is recovering.

Secondary Industry/Commercial

A cedar shake/chip mill located at the mouth of the creek has historically impacted both foreshore habitat and water quality. A trout farm in the headwaters has encroached on the riparian area and withdraws water directly from Whonnock Creek.

Linear Development

The Canadian Pacific Railway and the Lougheed Highway (Hwy. 7) cross the stream approximately 100 m from the mouth. The CPR crossing has a sill on the culvert, which may cause passage problems for chum at low flows. The Lougheed Highway is being upgraded and widened.

Urban Development

Mission does not have a stormwater detention policy or plan. Large rural lots are being subdivided resulting in a loss of riparian vegetation and reduced stormwater infiltration. The upper reaches of the Whonnock Creek watershed are being urbanized. Most developments are small. Attempts to obtain detention or retention structures that are of sufficient size to maintain the natural flow regime have been unsuccessful. Building is occurring on wetlands and feeder streams, encroaching into riparian areas. The population of Mission is expected to double in the next 20 years. Environmental impacts are expected to increase in the absence of effective environmental protection.

Government

The Whonnock Creek watershed lies within the District of Maple Ridge (Greater Vancouver Regional District) and Mission (Fraser Valley Regional District).

Designated Lands

Whonnock Indian Reserve #1, District of Mission TFL #26, and Twin Maples Correctional Centre are located within the Whonnock Creek watershed. There are two small parks in the watershed located along Whonnock Lake. Although most of Whonnock Creek does not flow through the ALR, a portion of the watershed is in the ALR.

Watershed Planning Issues

Management Concerns

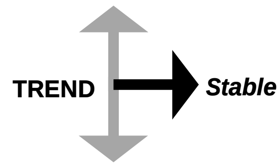
- The CPR culvert may cause fish passage problems at low flows.
- The upper part of the Whonnock Creek watershed is being urbanized without adequately addressing stormwater issues.
- Increasing development in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Municipal planning including a stormwater detention/retention management plan is needed.
- The system (including tributaries) should be mapped and protection needs included in both the Maple Ridge and Mission OCPs.
- The tributaries need to be identified in the field (i.e. signage) and linear park dedication could better protect streams.
- The small wetland between Whonnock Creek and York Creek should be restored.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, control effective impervious areas and maintain unobstructed fish passage are required.

For Whonnock Creek hydrograph, see Appendix 2.
For escapement information on Whonnock Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Stave River Tributaries



Watershed Code: 100-0471-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0400
TRIM Map: 92G018, 92G019, G028, and G029

STATUS:

Endangered - Riparian removal and urbanization have impacted the lower Stave River. The hydro dams on the Stave River result in fluctuating flows in the lower river.

Threatened - Fluctuating water levels due to the dam affect Stave Lake; logging and riparian removal impact a number of tributaries on Stave Lake and the upper Stave River.

Wild - A number of tributaries on Stave Lake and the upper Stave River remain undisturbed and are classified as wild.

Physiography

Drainage Area

The Stave River watershed includes Hayward Reservoir, Sayres Lake, Silvermere Lake, and Donatelli Creek. The total watershed covers an area of 1003 km^2. The river drains south through Stave Lake to its confluence with the Fraser River at Plumper Reach. There are numerous named tributaries to the Stave River, Stave Lake and Hayward Reservoir. They are listed in Appendix 1 with their watershed codes. Most of the South Alouette is diverted by a tunnel to a powerhouse on Stave Lake Reservoir.

Stream Description

The Stave River is a wide and stable system that originates in the Coast Mountains. The lower Stave River is dammed by the Ruskin Dam to form Hayward Lake Reservoir. At the outlet of Stave Lake Reservoir, another dam, Stave Falls Dam, controls water levels in the lake. The lower reach of the Stave River forms a wetland complex of approximately 131 ha. The wetland is classified as 60% shallow basin water and 40% floodplain marsh. Silvermere Lake is a constructed lake that flows into the Stave River.

Hydrology

BC Hydro storage and diversion dams on the Stave River result in extreme flow fluctuations because the power plants generally operate at peak demand. A recent agreement requires a minimum release of 38m^3/s during salmon egg incubation periods, and 76 to 152 m^3/s during chum spawning. The hydrology of the lower Stave River is dictated by the operation of the Stave Falls and Ruskin dams, and is buffered by the size of the reservoirs (Stave and Hayward). The water depths in the lower Stave River are also influenced by backwatering from the Fraser River during high tides and freshets. The high gradient tributaries that have been logged are extremely flashy with very low summer or subgravel flows (e.g. Rolley and Seventynine Creeks).

Channel Stability Assessment (Preliminary)

The majority of the east shore tributaries above Ruskin Dam that have been logged are unstable and subject to severe erosion, bedload movement, channel widening, and hydrologic impacts. The impacted tributaries include Kenyon Lake, Salsbury, Cascade, and Steelhead Creeks. Gravel removal operations in Cascade, Lost, and Hairsine Creeks have adversely affected channel morphology. The riparian vegetation has been removed along many of the creeks decreasing bank stability and fish habitat. Bank stability on Kearsley and Seventynine Creeks on the west shore of the Stave Reservoir have also been impacted by logging.

Fisheries Resource

Fish Access

Anadromous fish access is restricted to the lower river by the Ruskin Dam. There is an active sport fishery above the dam. Resident species include lake trout and Dolly varden.

Fish Stocks

The accessible reaches of the lower Stave River, Hayward Lake Reservoir, Sayres Lake Creek and Donatelli Creek support stocks of coho, pink, chum and chinook salmon. Upstream of the dam there are active fisheries for rainbow, cutthroat, and bull trout. Winslow Creek is a kokanee stream and a bulltrout producer, while Isle Slough is an important cutthroat, Dolly varden, and bulltrout system. Trout have been observed throughout Hairsine Creek. Steelhead Creek supports rainbow and cutthroat trout. Steelhead utilize Blind Slough. The B.C. Corrections Centre operates a small hatchery on Sayres Lake. The lake contains rainbow and cutthroat trout. Cutthroat trout and steelhead are present in Cardinalis Creek. High chum returns have been reported on the Stave River below the Ruskin Dam. This dam is a complete barrier to anadromous fish migration. The upper Stave River and its many tributaries above Stave Falls Dam support rainbow, cutthroat, and Dolly varden trout (and possibly bull trout).

Restoration/Enhancement

A SEP enhancement project diverted flows around the left bank of the main river channel and into old side channels that are directly below the Ruskin dam. The main channel was deepened and narrowed in order to decrease mortality and eliminate access to marginal spawning areas. In 1993, BC Environment installed three weirs on Donatelli Creek to create rearing habitat for cutthroat trout. Sayres Lake Creek was the site of a historic cutthroat and rainbow trout hatchery. A fish ladder was constructed for coho into Silvermere Lake in 1985. Small enhancement facilities for chum and coho operate on Silvermere Lake and at the foot of Statim Street. Chum have been enhanced through Inch Creek hatchery, and chinook have been transplanted from Harrison stocks. A major spawning area reconstruction project for chum was undertaken in 1993 based on an agreement between DFO and BC Hydro to minimize flow fluctuation caused by the dam. The District of Mission Forestry - Watershed Restoration Project plans to examine restoration opportunities on Stave Lake tributaries (1996-1997).

Fish Production

The Stave River system is a significant producer of chum and pink salmon. However, flow regulation and the barrier presented by the Ruskin Dam are major constraints to production. A number of tributaries above Ruskin Dam have good production potential, but there is no access for anadromous fish.

Activities and Land Use

Agriculture

Several hobby and trout farms are located on Hairsine, Steelhead, and Cardinalis Creeks. The small farms are impacting water quality and riparian cover.

Mining

Gravel removal operations on Lost, Cascade, and Hairsine Creeks have altered channel morphology and adversely affected channel stability, hydrology and fish habitat.

Forestry

Extensive logging and concomitant impacts are evident on many tributaries including Steelhead, Seventynine, Cardinalis, Weatherhead, Cascade, Lost, Salsbury, and Kenyon Lake Creeks. Several shake and saw mills are located on the west side of the lower river immediately above the Lougheed Highway. A number of Stave Lake tributaries have headwaters in TFL #26, and have been extensively logged. Leachates from numerous wood waste dumps may seep into the Stave River.

Secondary Industry/Commercial

Many of the tributaries that are accessible, or that have forestry campsites, are subject to heavy recreational use leading to channel and bank impacts from illegal RV use in and adjacent to streams (e.g. Lost, Cascade, and Salsbury Creeks). The lowermost east bank of the mainstem is industrial. Shake and saw mills withdraw water from the river. Portions of the lower river are also used for log storage.

Linear Development

BC Hydro built Ruskin Dam, the Stave Falls Dam, and the Alouette Lake Dam (diversion into Stave Lake) for hydro power generation in the early part of the century. The builders and operators of the dams did not ensure that flows were adequate or that the timing and duration of downstream flows did not negatively impact spawning and rearing of juveniles. In 1993, DFO and BC Hydro entered into an agreement to minimize flow fluctuations during spawning periods and to secure minimum flows during incubation periods. The Lougheed Highway (Hwy. 7) and the Canadian Pacific Railway cross the river at the mouth. Dewdney Trunk Road crosses at the mouth of Stave Lake. Forestry roads, BC Hydro right-of-ways, transmission corridors, and rural roads transect many tributaries. The west side of the river and lakes are accessible. The east side is accessible in only a few places, at Cypress Point (along Salsbury Creek) and at Lost Creek. The far end of the Lost Creek road is private, built by the leaseholders who lease property there.

Urban Development

Cardinalis and Steelhead Creeks are under increasing development pressure as large rural lots are being subdivided. Phillips Creek, a tributary to Hayward Lake Reservoir, is under significant urban development pressure, as is Silvermere Lake. Donatelli Creek, which is transected by the Lougheed Highway, has been heavily impacted by urban development.

Government

The lower Stave River is in the District of Mission (Fraser Valley Regional District).

Designated Lands

Cannell Lake Creek is a community watershed (drinking water reservoir) for Mission which augments Norrish Creek as the primary water source. Langley Indian Reserves #2, #3, and #4 are located adjacent to the lower Stave River, as is the District of Mission TFL #26. The northwestern end of Stave Lake lies within Mount Judge Howay Provincial Park. There are two other smaller provincial parks in the Stave Reservoir basin, Davis Lake Provincial Park (along Davis Creek), on the eastern side of the reservoir and Rolley Lake Provincial Park, on the west side of the reservoir (along Rolley Creek). The headwaters of Stave River originate in Garibaldi Provincial Park. An area just east of Silvermere Lake is in the ALR, as is an area on the northwest side of Hayward Lake Reservoir.

Watershed Planning Issues

Management Concerns

- Fluctuating flows from the dam have significantly reduced fish production potential and historically stranded rearing juvenile salmonids.
- Recreational pressures are a concern.
- Logging in headwater tributaries has destabilized streambeds and impacted productive fish habitat.
- Urbanization of the tributary streams of the lower Stave River is having an impact on riparian vegetation and water quality.
- Most of the riparian area along the lower east bank of the Stave River has been removed. The west bank remains natural though there are development proposals for this area.

Management Prescriptions

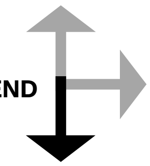
- Priority for conservation and protection should be given to the streams that are pristine (Glacier and Winslow Creeks, and Isle Slough), or in reasonably good condition.
- The streams that have been impacted by logging should be priorities for FRBC Watershed Restoration projects. Future logging along all streams should comply with Forest Practices Code requirements.
- Malfunctioning septic fields should be decommissioned and septic tank maintenance improved.
- Improved stormwater management and treatment in all new subdivisions is required.
- Buffer strips of an appropriate size are needed on all tributaries which may be subject to subdivision or urban growth impacts.
- The off-road RV community should develop a code of ethics to govern activity around streams.
- BC Hydro is developing a Water Use Plan that will incorporate all interests in the use of water from the Stave Reservoir. Long term fishery needs must be addressed.
- An Integrated Recreation Plan for the Stave Reservoir, north of the Stave Falls dam, is being developed for the basin. An Integrated Recreation Plan for the Hayward Reservoir has recently been developed.

- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For escapement information on the Stave River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Chester Creek

TREND



Declining

Watershed Code: 100-0493-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G018, 92G019

STATUS:

Endangered - Chester Creek has been impacted by channelization, riparian removal, and has some water quality problems.

Physiography

Drainage Area

Chester Creek is a north shore tributary of the Fraser River. Its confluence with the Fraser River is approximately 2.8 km upstream of the Stave River confluence.

Stream Description

Chester Creek is a small stream which drains the Silverhill watershed area. It originates in an upland forest and the main channel runs through urban reserve land near Olson Avenue. A portion of the creek has been diverted and channelized, and now runs parallel to the north side of the Lougheed Highway. The lower reach of the stream has been highly channelized. The mouth of Chester Creek forms a wetland of approximately 1.2 ha. This area is comprised of 90% oxbow water and 10% floodplain marsh.

Hydrology

No hydrological data is available. There is a Fraser River flood control pump station located on Chester Creek.

Channel Stability Assessment (Preliminary)

The lower half of the stream has been channelized to flow between the Canadian Pacific Railway and the Lougheed Highway. The slow moving stream accretes sediment that is periodically removed to improve drainage.

Fisheries Resource

Fish Access

Anadromous fish have access to the headwaters, although a pump station near the Lougheed Highway makes migration difficult. The hanging culvert at Silverdale Road is a partial obstruction, and should be replaced. The District of Mission was to upgrade the approach to the culvert in 1997. Coho use the backwater areas between the tracks and the highway for overwintering.

Fish Stocks

Chester Creek and its unnamed tributaries support stocks of chum and coho salmon, and cutthroat trout.

Restoration/Enhancement

Off channel rearing habitat has been created for coho (by the Stave Enhancement Society) on two tributaries to Chester Creek (Radiant and Sylvain Creeks) in conjunction with channel modifications to increase the flow carrying capacity upstream of Chester Road. Fish salvage work was required on Chester Creek due to high flows in the Fraser River in 1997. The Fraser River backs up increasing water levels in Chester Creek prior to smolt migration. The activation of pumps to mediate water levels may result in high smolt mortality.

Fish Production

Very little information on production is available. However, chum have been observed below Silverdale Avenue. Coho and cutthroat utilize the headwaters.

Activities and Land Use

Agriculture

The majority of the lower watershed is agricultural.

Mining

None.

Forestry

A sawmill is present near the mouth of the creek and a tree nursery is located in the watershed.

Secondary Industry/Commercial

There is very little industry in the watershed.

Linear Development

Much of Chester Creek flows between the Lougheed Highway (Hwy. 7) and the Canadian Pacific Railroad. It is crossed by the railway 0.5 km upstream of the mouth and by the Lougheed Highway at 2.4 km. A number of rural streets cross Chester Creek and its tributaries.

Urban Development

There is very little urban development in the system at present; however, urbanization is expected to increase.

Government

Chester Creek is in the District of Mission (Fraser Valley Regional District).

Designated Lands

The lower reaches of Chester Creek are in the ALR, excluding the mouth.

Watershed Planning Issues

Management Concerns

- The pump station at the mouth of Chester Creek leads to fish kills and decreased production.
- Poor water quality is occurring due to agricultural activity in the watershed.

Management Prescriptions

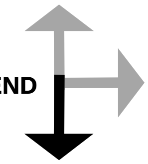
- The pump station needs to be modified to improve fish passage. When the pump is upgraded, a fish friendly pump should be installed.
- The hanging culvert at Silverdale Road should be replaced.
- Enhancement efforts are required in lower Chester Creek where channelization has eliminated most habitat features.
- Agricultural practices, manure management and riparian protection on agricultural lands need to be improved.
- Subdivision and development activities in the watershed require improved riparian protection and stormwater management.
- Tree cutting in the area should be controlled and managed to protect fish and wildlife habitat and reduce erosion.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Silverdale Creek

Watershed Code: 100-0519-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0435
TRIM Map: 92G019

TREND



Declining

STATUS:

Threatened - Development pressures have degraded water quality in Silverdale Creek.

Physiography

Drainage Area

The total watershed area of Silverdale (Silver) Creek is 22 km^2. Silverdale Creek flows through Mission as a north shore tributary of the Fraser River entering the river near the west end of Matsqui Island, near Nelson Road. The creek originates in a forested TFL which is under municipal jurisdiction. Its tributaries include Proud, Gaudin, Nicholson, and Saunders Creeks; Gilbert, Ammon, and Sterns Brooks; and Swift Slough. A list of its tributaries (and their watershed codes) to Silverdale Creek is provided in Appendix 1.

Stream Description

Silverdale Creek is approximately 8 km long. A portion of the upper watershed is located on upland flats where wetlands and forest seeps collect and flow along roadsides and through agricultural properties to join the mainstem. The middle reach flows through an incised valley (steep ravine) and over large bedrock controls. The lower reach flows through a broad floodplain and wetland complex. At Silverdale Creek's confluence with the Fraser River, its bottom reach is an estuary, and covers 115 ha. as part of a wetland complex. The Silverdale estuary covers 115 ha. The lower 1 km of the stream is slough-like, above which the stream-type is riffle/pool with a gradually increasing gradient. An impassable falls is located 4.3 km upstream. The stream is turbulent between 4.3 km and 3.1 km with a boulder substrate. The riffle-pool type stream type dominates the next 1.5 km until the stream forks. The west fork is small and turbulent and originates in a marshy lake at 8.0 km, while the east fork flows for 2.7 km through a series of shallow pools and side channels.

Hydrology

Inadequate municipal stormwater detention policies and standards will result in significant hydrologic and water quality impacts as urbanization increases. The naturalized mean annual flow of Silverdale Creek is 1.1 m^3/s with a mean flood of 11.5 m^3/s. Increased urbanization will likely result in faster and higher peak flows unless impervious surface areas are reduced and stormwater is properly managed. The District of Mission has completed a stream drainage study. Stormwater drainage into this creek has been an issue for over two decades.

Channel Stability Assessment (Preliminary)

The lower reaches of the stream are subject to heavy sedimentation. Gravel pits along the stream have caused siltation of the stream in the past. The banks of the east fork require some excavation and stabilization in order to improve coho habitat.

Fisheries Resource

Fish Access

Access by anadromous fish (coho, chum and steelhead) is limited by an impassable falls 4.3 km upstream. A rock outcrop 400 m below Dewdney Trunk Road impedes fish passage at low flows. Resident cutthroat trout are found throughout the watershed. Coho and cutthroat have been stocked in the upper watershed above Gilbert Brook.

Fish Stocks

Silverdale Creek and its tributaries support populations of coho, pink, and chum salmon; steelhead and cutthroat trout; peamouth chub, and brown bullhead.

Restoration/Enhancement

Coho incubated at the Stave Valley Enhancement Society hatchery have been transplanted above the falls since 1985. An annual coho egg collection (25,000 eggs) and fry release occurs below Dewdney Trunk Road. A private trout farm (Sun Valley) operates within the watershed. Enhancement opportunities have been identified, including bank stabilization, debris removal, and gravel introduction in the east branch to help improve coho habitat, and below Silverdale Road to improve chum spawning.

Fish Production

The upper watershed has been developed for residential use and an increase in urbanization is planned. Chum spawn heavily from 1.0 km to 2.0 km with light spawning up to 3.1 km. Coho spawning is scattered from 1.5 km to 3.1 km and is more concentrated in the upper area between 4.3 km and 5.8 km and in the lower 300 m of the east fork. Rearing potential is good in the scattered, well protected pools of the middle and upper reaches.

Activities and Land Use

Agriculture

Farming is limited to the lower 1.3 km and several water licenses are in place for agriculture for irrigation purposes.

Mining

A gravel pit located above Dewdney Trunk Road has intermittently caused siltation of the stream. Another pit is located at the foot of Israel Avenue.

Forestry

Sawmills are located at the mouth of the stream. The District of Mission has a limited logging program in the headwaters of the east branch (since 1972). There is an active wood waste dump located on the creek bank.

Secondary Industry/Commercial

There is some light industry located within the watershed. Commercial development is largely limited to that which supports residential development (i.e. retail).

Linear Development

The stream is crossed by Lougheed Highway (Hwy. 7) and the Canadian Pacific Railway approximately 0.8 km upstream of the mouth. Dewdney Trunk Road crosses the stream three times in the upper reaches. The drainage area is crossed by a number of rural roads.

Urban Development

The Silverdale Creek drainage is part of the Cedar Valley development area which will experience intensive urbanization. Urban development in the mid and lower reaches of the watershed is increasing and encroachment into riparian areas is occurring, as well as deterioration of water quality. Developments lie close to the stream in the upper watershed where Dewdney Trunk Road crosses it. A major urban development has been proposed upstream of the Lougheed Highway and into the headwaters. A trailer park in the upper watershed may discharge storm sewers into the west branch. The Silverdale delta area, currently zoned Parks and Recreation, is under pressure to be rezoned Commercial. A restrictive covenant is in place on some of the riparian area in the lower creek/delta.

Government

Silverdale Creek is in the District of Mission (Fraser Valley Regional District).

Designated Lands

The headwaters of Silverdale are in a Mission TFL. A small park (Silver Creek Park) is located in the headwaters.

Watershed Planning Issues

Management Concerns

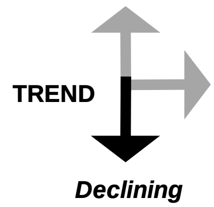
- The potential development in the Silverdale Creek watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.
- Removal of trees and other streamside vegetation in the riparian zone and the forested valley slopes can lead to soil erosion. Increased sediment loads in a salmon stream can rapidly degrade fish habitat.
- The District of Mission has conducted a storm drainage study in the watershed. Storm sewers associated with urban development in the area have caused water quality problems at Dewdney Trunk Rd. and Tyler Rd.
- Urban encroachment upon the floodplain of the stream is continuing to degrade fish habitat and the resource.
- Peak flows are predicted to increase due to urbanization.
- There is a water quality concern associated with rapid urban development and stormwater generation.

Management Prescriptions

- Riparian setbacks along the mainstem of Silverdale Creek and fish bearing tributaries, as well as the floodplain, should be protected against any further development or disturbance.
- Future road, infrastructure, and housing developments should not encroach into the riparian area.
- Comprehensive erosion control, careless management and stormwater management must accompany any new development plans in this watershed.
- Enhancement possibilities including bank excavation and stabilization, debris removal, and gravel introduction on the east branch should be investigated and pursued if deemed feasible.
- The municipality's acquisition policies to secure and protect sensitive areas (such as has been done with the Silverdale estuary and other parcels in the watershed) should be encouraged.
- Secure wide buffer zones to preserve the floodplain.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For Silverdale Creek hydrograph, see Appendix 2.
For escapement information on Silverdale Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Mandale Slough



Watershed Code: 100-0532-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G019

STATUS:

Endangered - Mandale Slough has poor water quality; sections of tributaries have been extensively channelized and culverted; and the system is significantly influenced by urban development.

Physiography

Drainage Area

Mandale Slough (Lane Creek, Mandale Creek) is located on the north shore of the Fraser River slightly east of Matsqui Island. The slough is fed by Windebank and Horne Creeks which flow through downtown Mission.

Slough Description

Once a large backwater slough, Mandale Slough is now only a fraction of its previous size. Developments have filled a significant portion of the slough. Approximately 26.4 ha in size, Mandale Slough is classified as 70% floodplain swamp, 25% floodplain marsh, and 5% oxbow water. The tributaries originate in headwaters on slopes above the slough.

Hydrology

Mean annual discharge data are not available. The headwaters of Mandale Slough and tributaries lie within an urbanized area of Mission. This has led to an increase in the flashiness of the system and decrease in water quality. The water levels are extremely low in fall and winter.

Channel Stability Assessment (Preliminary)

The substrate in Mandale Slough is predominantly fine sediment. Mandale Slough and its tributaries have been severely degraded by urban development, highway/speedway construction, and water quality impacts. The streams have been channelized to fit into highway/commercial developments, and the development of lands on the Fraser River has largely eliminated a significant cottonwood floodplain forest.

Fisheries Resource

Fish Access

Anadromous fish have access to an impassable culvert near 2nd Ave. in Mandale Slough and to at least 7th Avenue in Windebank Creek. Access to Horne Creek (which flows into Windebank Creek) is blocked at Lougheed Highway. There is a pump on Mandale Slough (Lane Creek section) which may cause problems for fish passage.

Fish Stocks

Mandale Slough and its tributaries support stocks of coho, chum, sockeye, chinook, and pink salmon; cutthroat trout; sculpins and carp.

Restoration/Enhancement

Gravel placement has occurred in Mandale Slough downstream of the railway. Mission plans to enhance fish habitat upstream and downstream of the culvert beside the library on 2nd Avenue. A large overwintering area was created downstream of the railway crossing. A fishway has been installed on Windebank Creek at the Lougheed Highway.

The District of Mission enclosed 20 meters of stream for construction of a parking lot adjacent to the library. Compensatory instream enhancement was required.

Fish Production

Mandale Slough is a major rearing area for anadromous Fraser River stocks. Coho spawning has been observed in Windebank Creek up to 7th Ave. while resident cutthroat were observed throughout upper Mandale Slough, Windebank and Horne Creeks. Cutthroat trout have also been captured in Mandale Slough.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development.

Secondary Industry/Commercial

Industry is limited to the lower watershed below the Lougheed Highway. Activities include an auto wrecker and a lumber yard. Large quantities of hogfuel used to backfill a steep embankment near the lumberyard, nursery and temple (1988-90) is generating leachates which are discharging into the creek, despite threatened Fisheries Act charges. While some remedial actions have been taken, they are not sufficient to correct the problem. There is heavy industry on Mandale Slough, and numerous industrial spills have occurred in the system. Commercial development is largely limited to retail enterprises.

Linear Development

The system is crossed by the Canadian Pacific Railway and the Lougheed Highway (Hwy. 7), the Abbotsford-Mission bridge, as well as numerous city streets.

Urban Development

This watershed lies in an urbanized portion of the District of Mission which continues to see substantial growth. Inadequate leave strips are the result of the development that has already occurred along Windebank Creek. The Mission raceway was recently relocated along the slough, resulting in the loss of much of the high water refugia cottonwood forest; some compensation works were done for this.

Government

The watershed lies within the District of Mission (Fraser Valley Regional District).

Designated Lands

The system drains Centennial Park and several other small municipal parks.

Watershed Planning Issues

Management Concerns

- There is insufficient riparian area along the tributaries due to urban development.
- The amount of impermeable area (with the low level of stormwater management) is excessive for a viable salmon stream.
- There is a water quality problem on Mandale Slough at the end of Beatty Street. The hog fuel that was used to backfill a steep embankment behind the lumberyard/nursery area is leaching into the creek.
- Storm sewers drain directly into Mandale Slough.
- There is a major area of natural bank instability along Windebank Creek at 7th Avenue. Mass wasting is contributing sediment to the creek.
- The area of Windebank Creek below the highway is threatened by the proposed Mission bypass.
- The pump station on Mandale Slough (Lane Creek) may cause problems for fish passage.

Management Prescriptions

- This stream has been seriously abused over the years and strong initiatives are required to reverse the negative trends of the past decades.
- A stormwater management plan and appropriate stormwater works are required for both Windebank and Horne Creeks.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- Education and stewardship programs for industry in the lower watershed are required to reduce spills and improve operating practices.
- Impassable culverts should be replaced and flows augmented to improve rearing potential. New developments on Mandale Slough near 2nd Street must be required to provide unobstructed access.

- Further diversions and channelization of Windebank Creek (such as that which occurred above and below Lougheed Highway) must be avoided.
- Arrangements must be in place between federal and provincial governments to assure that water quality problems resulting from the hogfuel leachate generation is prevented from occurring again in the future.
- Bank stabilization along Windebank Creek should be explored.
- It is mandatory that leavestrips of natural vegetation on the streambanks be maintained to protect fish and wildlife habitat and to control soil erosion.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

D'Herbomez Creek

TREND *Stable*

Watershed Code: 100-0567-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G019

STATUS:

Endangered - D'Herbomez Creek has been channelized, is affected by high effective impermeable area in the watershed, and has some water quality problems.

Physiography

Drainage Area

D'Herbomez Creek flows south to the Fraser River. The confluence is located approximately 3 km east of downtown Mission.

Stream Description

D'Herbomez Creek is a small, high gradient groundwater-fed stream that flows down to, and then across, a bench into the Fraser River.

Hydrology

A hydrology study was completed by the District of Mission for community detention. A water reservoir on D'Herbomez Creek acts as a stormwater detention pond. Development in the area has removed sections of forest, resulting in erosion of the till soils on the steeper slopes and alteration of the hydraulic regime of creeks in this area, including D'Herbomez Creek.

Channel Stability Assessment

No geomorphological data are available.

Fisheries Resource

Fish Access

Anadromous fish have access to a culvert at the Lougheed Highway, 20 meters upstream of the Fraser River. Cutthroat trout have access throughout the headwaters. A dam on the detention pond acts as a barrier to fish passage.

Fish Stocks

D'Herbomez Creek supports coho salmon up to the highway. Resident cutthroat have been observed above and below the dam.

Restoration/Enhancement

An old dam near the new highschool is used to control flow during extreme flood events. Compensation work including riprapping to improve bank stability, and the creation of some low water rearing channels for cutthroat, was completed in 1997.

Fish Production

No fish production information was available.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, parcels have been cleared to accommodate development. A forested area still remains in the eastern portion of the watershed.

Secondary Industry/Commercial

Commercial development is largely limited to that which supports residential development (i.e. retail). There is a food packing plant located near the mouth of D'Herbomez Creek.

Linear Development

The Canadian Pacific Railway and Lougheed Highway (Hwy. 7) cross the stream approximately 80 m from the mouth. Prentis Avenue crosses D'Herbomez Creek. Stave Lake Road passes through the drainage area.

Urban Development

Extensive urban development (single family residential, commercial and institutional) is planned and in progress in the headwaters. The flow has already been modified but the riparian area is relatively intact.

Government

D'Herbomez Creek is in the District of Mission (Fraser Valley Regional District).

Designated Lands

The Fraser River Heritage Park borders the southwest reach.

Watershed Planning Issues

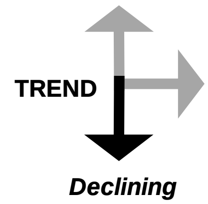
Management Concerns

- Increased urbanization will impact the stream, particularly where riparian vegetation is removed from the steeper slopes where, due to the till soils in the area, erosion occurs quickly.
- D'Herbomez Creek may be affected by the proposed Mission Bypass.

Management Prescriptions

- Restore salmonid access beyond the Lougheed Highway by retrofitting or replacing the culvert at the Lougheed Highway crossing.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

Hatzic Slough



Watershed Code: 100-0585-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0500
TRIM Map: 92G019 and 92G029

STATUS:

Endangered - Hatzic Slough and a majority of its tributaries are impacted by loss of riparian vegetation; several tributaries have been channelized and/or dyked; several are impacted by logging; water quality is a problem in some tributaries.

Threatened - Draper, Wharton, and Currie Creeks have been impacted by urbanization. Durieux, Oru, and Seux Creeks are impacted by agricultural activity in the watershed.

Physiography

Drainage Area

The Hatzic Slough watershed is 82.0 km^2 in area. The slough originates on the Hatzic Prairie, flows south into Hatzic Lake, and then continues into the Fraser River east of Mission. The slough has sixteen gazetted tributaries. These, plus others, are listed in Appendix 1.

Slough Description

Hatzic Slough is a low-lying wetland of approximately 12.3 hectares. The slough drains Hatzic Lake, in addition to many tributaries from the Hatzic Prairie. The slough is classified as 80% stream water and 20% floodplain marsh. A variety of fish and wildlife habitats are provided by the shallow open waters, cattail marshes, willow/hardhack islands and black cottonwood fringe.

Hydrology

The mean annual flow is 5.04 m^3/s. Chilqua Creek originates in a series of debris choked upwelling pools and is fed by a significant groundwater supply. Chilqua Creek also suffers from low flow/high summer water temperatures due to intensive irrigation withdrawals. Agricultural impacts (e.g. irrigation withdrawals) on Lagace Creek are moderate. Heavy flows on Scorey Creek have had negative effects on the stream (see below). The storm sewers in the urban areas of Draper Creek have created unspecified flow problems. McNab Creek dries during the summer. There are several water licenses on tributaries to Belcharton Creek for domestic and agricultural water withdrawals. Local residents have claimed that flows in Belcharton Creek were altered when a rock quarry began work in the stream's headwaters.

Channel Stability Assessment (Preliminary)

Heavy flows on the high gradient portions of Scorey Creek, from historic logging, have led to erosion problems downstream. Lagace Creek is subject to severe and rapid movement of debris and bedload, as well as a shifting channel between Pattison Creek and Farms Road. Gravel removal and dredging of Lagace Creek have been ongoing since 1948 as part of the provincial government's flood control work. Recently, a major landslide occurred in the upper reaches of Pattison Creek. Gravel removal operations are active in Belcharton Creek. The channelization and gravel extraction in the upper end of the watershed has significantly altered hydrology and channel morphology, reducing the stream's fish spawning and rearing potential.

Fisheries Resource

Fish Access

A weir blocks Draper Creek in its lower reaches but does not prevent some cutthroat and coho from finding their way upstream. Anadromous fish have access to the headwaters of Draper Creek (although a culvert 0.8 km from the confluence is impassable during certain flows to chum and coho); to the headwaters of Chilqua Creek (beaver dams are present throughout); to a cascade barrier 2.4 km upstream from the confluence on Scorey Creek; to a gradient barrier on Kenworthy Creek; to the beaver dams at Allan Lake on Lagace Creek; throughout Bouchier Creek (however beaver dams can pose a passage problem). Steelhead have access to above the Pattison confluence; and to a gradient barrier near the headwaters of Belcharton Creek. Cutthroat have access to the headwaters.

Fish Stocks

Hatzic Slough is very important for sturgeon rearing and provides an important migration corridor for anadromous species. Chum spawning is significant in the lower two kilometers of Scorey Creek and some littoral spawning occurs in Hatzic lake. Durieux Creek (a tributary of Belcharton) is important for coho. Cutthroat trout and coho use the lower end of Belcharton for spawning and rearing. Coho and cutthroat trout also utilize Bouchier, Currie, and Pattison Creeks. Steelhead are found in Pattison Creek. Chilqua Creek supports chum, coho, and steelhead. Hereford Creek is quite productive for cutthroat.

Historically, Hatzic Slough and its tributaries supported populations of coho, and chum salmon; rainbow, steelhead cutthroat trout; sticklebacks, lampreys, and sculpins.

Restoration/Enhancement

Side channels have been created in MacNab Creek, and Chilqua Creek and Slough. A rearing side channel was constructed on Draper Creek and an incubation box was operated near the mouth of Draper Creek in Neilson Park. In 1986 bank stabilization was undertaken in Draper Creek and gravel was placed on the beaches of Hatzic Lake in order to augment heavy beach spawning by chum. Boulder complexing was suggested as an enhancement opportunity for Draper Creek. A SEP groundwater spawning channel was developed for chum and coho on Chilqua Creek. Enhancement opportunities suggested for Chilqua Creek include bank excavation and stabilization, debris and silt removal, and gravel placement, in conjunction with remediation of Hatzic pump concerns. Enhancement opportunities for cutthroat trout in Lagace Creek include boulder complexing/rip-rapping in the upper reaches.

Fish Production

Fish are found throughout most of the slough and its tributaries. Littoral beach spawning occurs in Hatzic Lake. Lack of cover and vegetation and low flows have reduced cutthroat production in the system. However, production is greater in the upper reaches where the wetlands are less disturbed and there is more aquatic vegetation. The debris in Draper Creek has not been considered a problem for fish production. The rearing potential of Chilqua Creek is limited by the lack of pools. Scattered spawning is present throughout Scorey Creek while spawning in Kenworthy Creek occurs primarily between 1.2 and 1.6 km. Heavy spawning occurs in Lagace Creek between Dale Road and Sylvester Road. Fish production could potentially be increased in Lagace Creek, but unstable flows and the pump house at the mouth of Hatzic Slough are limitations. Nonetheless, rearing potential is good in the Lagace tributaries. Spawning is heaviest in the lower 1.2 km of the unnamed Bouchier tributary and in the first 1 km of Belcharton Creek and its unnamed tributary.

Activities and Land Use

Agriculture

The primary land use in the watershed is agricultural. Lands surrounding the slough are included in the ALR. Chilqua Slough is surrounded by agricultural land. Discharges from hog farms operating in Bouchier Creek and Belcharton Creek watersheds may have impacted fish habitat. Dale, Durieux, Oru, Scorey, and Seux Creeks have also been impacted by agricultural practices. Much of the agricultural land is flood prone and there is a shallow water table. Riparian vegetation along the stream edge has been removed, and herbicides and pesticides are used to the stream edge.

Mining

Quarry operations on Scorey and Belchartron Creeks have had significant impacts on ground water quality and water supply in streams.

Forestry

Logging has occurred in portions of the eastern Lagace (especially near Pattison Creek) and Bouchier watersheds. Kenworthy Creek is in TFL #26.

Secondary Industry/Commercial

Secondary industry and commercial activity is restricted to the lower watershed near the Lougheed Highway. Lumber mills are located near the mouth of the slough. The Everglades Resort area is located at the southern end of Hatzic Lake, and there are other recreational activities in the area.

Linear Development

The Canadian Pacific Railway and the Lougheed Highway (Hwy. 7) cross Hatzic Slough approximately 2 km upstream of the mouth of the stream. A number of roads cross the slough complex. Lagace Creek has been dyked for 4 km upstream of its confluence.

Urban Development

A 6 acre subdivision is located on Belcharton Creek, near Stave Lake. Draper Creek and Hatzic Island have the most significant urban development pressures.

Government

Hatzic Slough is in the District of Mission (Fraser Valley Regional District).

Designated Lands

A correctional institute is located near the headwaters of Draper Creek. Neilson Regional Park borders the west side of Hatzic Lake. Most of Hatzic Slough (above and below Hatzic Lake) and the watersheds of Draper and Wharton Creeks (tributaries) are in the ALR.

Watershed Planning Issues

Management Concerns

- The major impacts on fish productivity are the result of ditching of streams, clearing, removal of riparian vegetation, trampling of streambanks by livestock, and use of herbicides and pesticides to the stream edge.
- The Hatzic pump station impacts downstream smolt migration (particularly coho), but adults are not affected.
- Stormwater from urban areas is creating flow problems in Draper Creek.
- The provincial government conducts ongoing flood control works on the lowest 4 km of Lagace Creek, including dyking, dredging and gravel removal.
- Logging within the watershed can alter natural channel morphology and hydrology.
- Agricultural discharges in Bouchier Creek may have deleterious effects on fish.
- The hydrology of Bouchier and Lagace Creeks has been affected by domestic wells tapping the aquifer.
- Recreation pressures on this area are significant.

Management Prescriptions

- Despite the low population in the watershed, habitat impacts have been significant. This system has high potential for rehabilitation and good fish production. A stewardship/restoration plan is a high priority.
- Maintain a leave strip of natural vegetation on the slough and lake banks to protect fish habitat.
- The pump house near the mouth of Hatzic Slough hinders passage, especially for smolts. It should be made ‘fish friendly’.
- Enhancement opportunities include boulder complexing for Lagace Creek (however this would require extensive rip-rap to prevent bank erosion along the narrow channel).
- Water quality problems resulting from agricultural practices should be investigated by senior agencies.
- Education and stewardship programs for farmers are required to improve agricultural practices in the watershed.
- A moratorium on quarry operations in Belcharton Creek is required.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For Hatzic Slough hydrograph, see Appendix 2.
For escapement information on Hatzic Slough, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 14 – Nicomen Slough Area

Nicomen Slough

TREND ***Stable***

Watershed Code: Unavailable (lateral channel of the Fraser River)
RAB Code: 00-0552
TRIM Map: 92G020, 92G030 and 92H021

STATUS:

Endangered - Nicomen Slough has been channelized/dyked, and has been impacted by development and agricultural activities (riparian vegetation removal, water quality problems).

Physiography

Drainage Area

The Nicomen Slough watershed occupies a drainage area of 180.8 km^2. Its tributaries include Norrish (Suicide) Creek, Inches Creek, Mud Slough, Worth Creek, Hawkins Creek, Railway (Pothole) Creek, Brousseau Creek, Deroche (Crazy) Creek, Pye Creek, Barnes Creek, Siddle (Bell's, Tatham) Creek, Quaamitch Slough, Zaitscullachan Slough and North Nicomen Creek. Nicomen Slough is a north shore tributary flowing west into the Fraser River 10 km east of Mission. A list of tributaries (and watershed codes) to Nicomen Slough is provided in Appendix 1.

Stream Description

Nicomen Slough and other sloughs in the area (i.e. Zaitscullachan Slough, Quaamitch Slough, and Mud Slough) are remnant side channels of the Fraser River. The upper ends of most sloughs are accreting and have been isolated by dykes. Most of the riparian vegetation along the dykes has been eliminated. Most of the slough flows through a broad, dyked channel across agricultural land.

Hydrology

The mean annual flow of the Nicomen Slough is 15.65 m^3/s. Water licenses for domestic and irrigation uses are held in the watershed. Norrish Creek is a community watershed which provides drinking water to the City of Mission and is administered by the Central Fraser Valley Water Commission.

Channel Stability Assessment (Preliminary)

Excellent gravel deposits are distributed throughout the slough. However, backflooding during peak Fraser River discharges coupled with reduced flows have resulted in the deposition of a thick layer of silt over most of the slough bottom. Clear gravel exists only at channel constrictions and in areas with upwelling water, especially above Deroche.

Fisheries Resource

Fish Access

Coho and chum salmon, and steelhead trout have access above the Lougheed Highway on Siddle Creek. Barnes and Pye Creeks are fairly high gradient; coho are restricted to the lower reaches. Deroche Creek has a spawning side channel at the mouth. Inches Creek is the water source for the Inch Creek Hatchery. A side channel for chum has been recreated near the hatchery underneath the railway crossing. The dam on Norrish Creek (at Dickson Lake) is impassible to all species.

Fish Stocks

Nicomen Slough and its tributaries support populations of coho and chum salmon; as well as steelhead and cutthroat trout. Barnes and Pye Creeks support coho in the lower reaches; Siddle, Bell, and Tathum Creeks support cutthroat, coho, and steelhead; and Norrish Creek supports coho, cutthroat, steelhead, and shiners.

Restoration/Enhancement

Several First Nations groups have submitted proposals to enhance the slough and its tributaries. The Lakahahmen Band has built a side channel in Deroche Creek. Canfor has completed several enhancement projects in the upper areas of Norrish Creek in order to maintain minimum flows. A back channel was recreated in Inches Creek.

DFO constructed a small weir to control water depth and velocity, an infiltration gallery to supply groundwater, and placed spawning gravel and removed silt in Inches Creek in 1960 and 1970 (Inches Creek used to be part of Norrish Creek). DFO has operated a hatchery on Inches Creek since 1981. SEP developed two groundwater spawning channels (Railroad channel and Worth channel) in 1979. Beaver dams in Worth and Siddle Creeks are removed as required, as are gravel deposits at the mouth of Worth Creek. SEP developed a groundwater spawning channel in Worth Creek in the 1970's. Improvements have been completed to enhance coho spawning and rearing habitat at the lower end of Pye Creek.

Enhancement opportunities include re-opening and rehabilitating a mainstem side channel of Norrish Creek that was dyked in 1966, developing a stable spawning area for coho, stabilization of a mass wasting site on Norrish Creek, and developing an incubation box on Siddle Creek.

Fish Production

Norrish Creek has excellent rearing habitat potential. The system was a significantly greater chum producer prior to damming. The production potential in Brousseau Creek is limited by temperature problems. Coho and chum spawn in several places in the system; major coho spawning occurs from the bridge to the canyon; major chum spawning occurs from the mouth to Hawkins Pickle Bridge. Heavy siltation, aquatic plant growth, and low flows have degraded rearing habitat in Nicomen Slough.

Activities and Land Use

Agriculture

Intensive agriculture (farming/grazing) is the primary land use in the Nicomen Slough watershed. The associated impacts include poor water quality, decreased water quantity, riparian removal, dyking, and degradation of river banks by livestock trampling.

Mining

Gravel has been removed from Norrish Creek since 1948. Much of the gravel has been removed in an attempt to reduce flood concerns. A gravel processing plant has facilitated in extensive gravel removal (100,000 yards in 1984). Gold placer mining operations also occur in the Norrish Creek watershed.

Forestry

Logging is extensive in the upper Norrish Creek and Deroche watersheds. Portions of the lower slough are used for log boom storage. A shake mill operates in the lower reaches.

Secondary Industry/Commercial

Commercial development is limited to that which supports residential development.

Linear Development

The Central Fraser Valley Water Commission operates an intake on Norrish Creek (the Dickson Lake reservoir is operated to supply water to the intake and ensure adequate instream flows below. A power line crosses the headwaters of Norrish Creek. The Canadian Pacific Railway and Lougheed Highway (Hwy. 7) run through the Nicomen Slough area. Smaller roads cross the slough complex, and logging roads follow the creeks north of the slough.

Urban Development

Large lot residential subdivisions are developing along Barnes and Pye Creeks above the railway. Suburban development has occurred adjacent to Siddle Creek (near Highway 7) and along Deroche Creek. The District of Mission anticipates 19% growth between 1994 - 2000. There are mobile home parks at the bottom of Deroche Creek, and at the eastern end of Nicomen Slough.

Government

Nicomen Slough is in the District of Mission (Fraser Valley Regional District).

Designated Lands

A conservation forest is situated within the watershed. Indian reserves in the Nicomen Slough area include the Skweahm IR #10, the Lakahahamen IR #11, the Skumalasph IR #16, the Zaitscullachan IR #9, the Papekwatchin IR #4, the Yaalstrick IR#1, the Zaitschullachan IR #9 and the Holatchen IR #8. Most of Nicomen Slough is in the ALR.

Watershed Planning Issues

Management Concerns

- The lack of Fraser River water flushing out the slough (cut off by dykes) has allowed it to become stagnant, and heavy siltation and aquatic plant growth in the sloughs have degraded salmon rearing habitat.
- The lack of flow in the slough has resulted in the Norrish Creek delta being largely cut off from the slough at their confluence.

- Cutting off the slough from the Fraser River in 1948 has greatly reduced access to good rearing habitat for all Fraser River stocks.
- Ongoing gravel removal is disrupting spawning habitat on Deroche Creek, Brousseau Creek, and Norrish Creek.
- Agricultural and logging activities are degrading stream habitat in the watershed.
- The potential development in the Nicomen watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

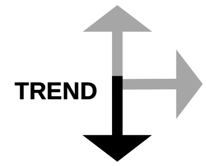
- An integrated management plan which identified resources within the watershed and contained an agreement for the management of flows and provided forestry guidelines for logging plans was developed for Norrish Creek and needs to be monitored for compliance. Flows in Norrish Creek have been managed through a cooperative agreement between Department of Fisheries and Oceans, Ministry of Environment, Lands and Parks, and the former Dewdney Alouette Regional District.
- Stormwater management, erosion control, and riparian protection and restoration plans are required for this watershed.
- Codes of practice for livestock management are required to protect riparian areas and streambanks.
- A gravel management plan is required for Norrish, Deroche, and Brousseau Creeks.
- The feasibility of getting some Fraser River waters into the cut off upstream end of the slough needs to be examined.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For Nicomen Slough hydrograph, see Appendix 2.
For escapement information on Nicomen Slough, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Map 15 – Harrison River Area

Harrison River

Watershed Code: 110-0000-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0552
TRIM Map: 92H021,92H031,92H032,92H041,92H042,92H051 and 92H052



Declining

STATUS:

Endangered - Miami Creek, Hotsprings Slough, Duncan Slough, Bateson Slough are endangered due to poor water quality and riparian removal.

Threatened - The lower Harrison River and a number of tributaries are impacted by logging, riparian removal, channelization, and an accumulation of development activities.

Wild - The upper Harrison River, Harrison Lake, and tributaries on the west side of Harrison Lake are largely wild, whereas tributaries on the east side are threatened due to logging.

Physiography

Drainage Area

The Harrison River watershed covers 8,324 km^2. It is a major watershed of the Fraser River, and has numerous tributaries. On the west side of the Harrison River (and Harrison Lake) these include: Squakum Creek, Errock Lake (and its tributary Holatchen Creek), Elbow Creek, Chehalis River (reported separately), Morris Creek (reported separately), Cartmell, Simms, Walian, Hale, Mystery, Twenty Mile and Kirkland Creeks. Tributaries north of these--Davidson, Trio, Doctor's, Bremner, Tretheway and Tipella--are not listed in Appendix 1, but are significant drainages on the northwest side of Harrison Lake. Tributaries on the east side of Harrison River include: Miami Creek (Miami Slough), Sasquatch, Thunderbird, Trout Lake, Slollicum, Bear, Cogburn, Big Silver and Stokke Creeks. A list of tributaries (and their watershed codes) to Harrison Lake is provided in Appendix 1. The Harrison River flows southwest from Harrison Lake into the Fraser River, north of Chilliwack.

Stream Description

The large Harrison River system originates in the Coast Mountains. The river drains Harrison Lake which is bordered by the Lillooet Range to the east and the Douglas Range to the west. The mouth of the Harrison River forms a floodplain marsh approximately 5 ha in size. Clear Creek, a tributary of the Harrison River, originates from a hotsprings.

Hydrology

The mean annual flow of the Harrison River is 481.6 m^3/s. Harrison Rapids, at the Chehalis Fan, provides an important control on water levels at low discharges. During the spring, the rapids are backwatered and inundated from the freshet flows on the Fraser River.

Channel Stability Assessment (Preliminary)

The Harrison River between Chehalis Village and Harrison Lake is well gravelled, straight, and confined by bedrock through much of its course. The Chehalis Rapids and the lower portion of the river have been dredged to maintain a navigation channel. There is some channel destabilization as a result of logging along Big Silver Creek and Clear Creek.

Fisheries Resource

Fish Access

Many of the tributaries to Harrison Lake (with the exceptions of Miami Creek and Hot Springs Slough) are high gradient. The mouths (particularly if there is an alluvial fan where the stream enters the lake) of these tributaries are used for spawning chum and possibly coho spawning and rearing (i.e. mouth of Twenty Mile creek, Cogburn, and possibly Bear, Slollicum, Thunderbird, and Sasquatch Creeks). Chum spawn in the lower end of Mystery Creek below the impassable falls located 0.5 km upstream of the mouth. There is a pump station at the mouth of Miami Creek and at the mouth of Hot Springs Slough. Cogburn Creek has an impassable falls 1.5 km upstream of the mouth.

Fish Stocks

The Harrison River, the southern end of Harrison Lake, and their tributaries support populations of sockeye, coho, pink, chum and chinook salmon, as well as steelhead, rainbow, and cutthroat trout. Fry are outplanted in Big Silver Creek. The Harrison River has been used by the Department of Fisheries and Oceans as a chinook escapement indicator system since 1984.

Restoration/Enhancement

Many restoration and enhancement projects have been completed on Big Silver and Clear Creeks. Enhancement facilities on the Harrison River include: two groundwater spawning channels for chum (Billy Harris Channel and Ed Leon Channel), two other spawning channels for chum (Little Mountain Side channel and Pretty's SEP Channel), and the Smokehouse Hatchery for chinook. There are six incubation pits located on Smokehouse Slough. Beaver dams are removed as necessary in Squakum Creek to promote fish passage.

Fish Production

Harrison River is a major chum salmon producing system. Most spawning occurs throughout Chehalis flats in groundwater-fed channels which were originally part of the Chehalis River. The spawning area is approximately 176,000 sq. yds. in size. The Harrison River is home to the largest single chinook stock in the Fraser, accounting for 1/3 of the total chinook escapement. The Harrison River is also a significant producer of sockeye, coho, and pink salmon. There are significant conservation concerns for Harrison chinook. The Slollicum offers ideal spawning habitat for rainbow trout. The other species reported from this system include Dolly varden trout, kokanee, mountain whitefish, peamouth chub, redside shiners, black crappie, northern squawfish, sticklebacks, and suckers.

Activities and Land Use

Agriculture

There is some agricultural activity in the watershed. The Canadian Department of Agriculture operates the Agassiz Research Station between the southern end of Harrison Lake and the Fraser River.

Mining

None.

Forestry

Big Silver Creek, Hornet Creek, Clear Creek, and Mystery Creek have been affected by historic logging activities. Forestry harvesting is extensive throughout the Harrison Lake watersheds. Trout Lake Creek watershed was completely logged by 1956. Logging has altered the hydrology, deposited sediment, and led to erosion in many parts of the system.

Secondary Industry/Commercial

An airstrip operates near Hornet Creek. There is limited industrial activity along all of the creeks. Rivtow and several marinas operate in Harrison Lake. The majority of commercial activity is located in the Village of Harrison Hot Springs.

Linear Development

The Canadian Pacific Railway and the Lougheed Highway (Hwy. 7) cross the lower portion of the Harrrison River.

Urban Development

Miami Creek and Hotsprings Slough, which run through the Village of Harrison Hot Springs, have been severely constrained, diverted, infilled, and degraded by adjacent land use and non-point source pollution. The water quality in Errock Lake and Squakum Creek is impacted by sewage discharges and septic fields from settlement around Errock Lake.

Government

The Harrison River flows through the villages of Harrison Hot Springs and Agassiz, and the District of Kent (Fraser Valley Regional District).

Designated Lands

Squawkum IR #3, Chehalis IR #5 and #6, Scowlitz IR #1 lie within the watershed. A wetland along Harrison Hotsprings Slough is protected by the Village of Harrison Hotsprings. Sasquatch Provincial Park lies within the Trout Lake Creek watershed on the east shore of Harrison Lake. The upper end of Trout Lake Creek has park status. ALR land is located between the Chehalis River and Morris Creek (west side of the Harrison River); near Harrison Mills; and between the southern end of Harrison Lake and the Fraser River.

Watershed Planning Issues

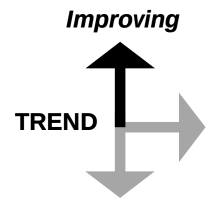
Management Concerns

- The use of Roundup (herbicide) in areas that were logged around Timberline Cove impacted all species of fish present in that area.
- Mosquito spraying in the Squakum Creek area is a concern during chum spawning.
- Water quality in Errock Lake and Squakum Creek is impacted by sewage discharges and septic fields from development around the lake.
- A number of salmon streams have been affected by logging through changes in flow regime, sediment deposition, or erosion.
- The number of motor boats and their docking facilities on the lake is a concern.
- Recreational use (including motor boats) is increasing and is a concern.
- The popularity of four-wheel drive vehicles being used to access the hotsprings at the headwaters of Clear Creek and in other areas is increasing.
- The Harrison Hotsprings Hotel has discharged chlorinated water into Miami Creek and the Harrison River.

Management Prescriptions

- The proposal by the Ministry of Forests and Ministry of Environment, Lands and Parks to create a 25 km^2 recreational and research forest on the west shore of Harrison Lake, including Kirkland and Bremner Creeks, from lakeshore to alpine needs to be pursued.
- Watershed enhancement and restoration activities need to be pursued on many of the logged tributaries.
- Recreational access plans need to be developed for the entire watershed. ATV and four wheel drive travel within streams must be discouraged.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.
- Non-point source pollution (from agriculture and development) needs to be addressed through land owner contact and stewardship initiatives. Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.

For Harrison River hydrograph, see Appendix 2.
For escapement information on the Harrison River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).



Chehalis River

Watershed Code: 110-0902-000-000-000-000-000-000-000-000-000-000
RAB Code: 01-0400
TRIM Map: 92G040, 92H021, and 92H031

STATUS:

Threatened - The upper reaches of the Chehalis River have been heavily impacted by logging; the lower reaches of the Chehalis River are impacted by urban development, flood control, and forestry.

Physiography

Drainage Area

The total area of the Chehalis River watershed is 392 km^2. The river flows south into Harrison River, just upstream of the Morris Valley Road bridge. Tributaries include Coho, Eagle and Maisal Creeks. A list of the named tributaries and the associated watershed codes is provided in Appendix 1.

Stream Description

The Chehalis River flows from the Coast Mountains, joining several tributaries as it flows through a densely wooded canyon. The river flows out of the canyon onto its alluvial fan, just upstream of the Morris Valley Road bridge. The fan is wide and the gradient is low. The river currently occupies the extreme western edge of the fan. The fan was classified as 34% active delta marsh, 33% stream water, and 33% gravel bar.

Hydrology

The mean annual flow of the Chehalis River is 36.2 m^3/s. The Chehalis fan has low flow problems. A significant amount of the water is lost through the thick gravel of the channel bed necessitating the removal of gravel to maintain a surface flow for fish migration. Losses of water to Smokehouse Slough also affect flows. High flows occur in December.

Channel Stability Assessment (Preliminary)

The Chehalis River is laterally and vertically unstable. It has a history of abrupt channel changes and avulsion on its fan. The river has increased its width and sinuosity since the 1940’s, which is consistent with slow aggradation of the channel bed. Dykes have been built to protect various areas including the Chehalis Hatchery from flooding. The flows of the upper Chehalis have been severely affected by logging and are extremely unstable. Maisal Creek has experienced major landslides. Skwellepil Creek has been subjected to huge debris torrents. The boom at the lake outlet was accidentally removed resulting in a significant downstream debris torrent.

Fisheries Resource

Fish Access

Obstructions are common throughout the system and are frequently removed to allow for anadromous fish access. Anadromous fish currently have access to 4.5 km above Chehalis Lake and to all the lower tributaries. In 1996 obstructions were located 6 km above Chehalis Lake, 1.5 km below Statlu Lake, and 0.5 km downstream of the lake (a log jam). Statlu Creek tributaries support rainbow/cutthroat in the lower 150 m. South Statlu supports Dolly varden.

Fish Stocks

The Chehalis River and its tributaries support populations of sockeye (some years), coho, pink, chum, and chinook salmon; steelhead, cutthroat, rainbow, Dolly varden, and bulltrout; Rocky mountain whitefish, longnose dace, American shad, and suckers. Grey Creek is stocked with rainbow trout.

Restoration/Enhancement

Enhancement proposals have been submitted for Pretty Creek. Spawning gravel was placed at the outlet from Chehalis Lake to create spawning habitat for coho and steelhead in 1976. Rearing ponds were created and enhanced in the mid 1980’s to compensate for impacts resulting from the expansion of Morris Valley Road. Enhancement facilities include the Chehalis River Hatchery for chinook, coho, cutthroat, and steelhead. Debris removal was conducted on Coho Creek in 1970 to increase spawning area. Enhancement opportunities include a spawning channel for pink salmon and an incubation box for coho on Coho Creek.

Fish Production

The Chehalis River is a significant producer of chinook, coho, chum, and pink salmon. Coquihalla stock were transferred to the Chehalis hatchery and a summer run was introduced to the system. A steelhead and cutthroat trout brood capture program operates in the river. Anadromous cutthroat trout are stocked on an annual basis.

Activities and Land Use

Agriculture

There is some designated agricultural land between the Chehalis River and Morris Creek.

Mining

None.

Forestry

Extensive logging has occurred in the upper watershed along many of the tributaries (Vaughan Creek, Maisal Creek, and Statlu Creek tributaries). Vaughan Creek is beginning to recover, but the others still experience slope failures, accelerated bed movement, and channel instability.

Secondary Industry/Commercial

Discharge Creek (a tributary to Maisal) receives sewage discharges from the Hemlock Valley Ski Area (i.e. from the Sakwi Creek watershed).

Linear Development

A hydro power line crosses the river.

Urban Development

The Village of Harrison Mills is located immediately south of the mouth of Harrison Bay, and west of the Chehalis River. Portions of the watershed are in transition from forest to rural residential lots. There is also residential development on the Chehalis Indian Reserve (IR #5).

Government

The Chehalis River is in the Fraser Valley Regional District.

Designated Lands

The Chehalis Indian Reserve #5 is located at the mouth of the Chehalis River. The Nature Trust of BC owns a portion of Chehalis Flats that is leased to the Department of Fisheries and Oceans. ALR land is located between the Chehalis River and Morris Creek.

Watershed Planning Issues

Management Concerns

- Sewage from Hemlock Valley Recreational Area flows into Maisal Creek.
- Siltation from logging roads is a concern.
- A number of salmon bearing tributary streams, as well as the mainstem, have been affected by logging, either by changes in flow regime, sediment deposition, or erosion.
- There is significant off road recreational vehicle and camper impact on the Chehalis River delta as it enters Chehalis Lake.

Management Prescriptions

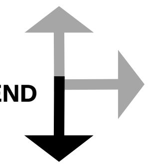
- Conservation of this watershed must be a priority.
- Tributaries that have been impacted by logging activities should receive priority for FRBC restoration projects (riparian planting, slope stabilization and channel stabilization).
- Future logging activities must conform to the Forest Practices Code.
- Recreational use of the area needs to be carefully planned and managed.
- Pink salmon spawning channels could be created.

For Chehalis River hydrograph, see Appendix 2.
For escapement information on the Chehalis River, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Morris Creek

Watershed Code: 110-1492-000-000-000-000-000-000-000-000-000-000
RAB Code: 01-0500
TRIM Map: 92H021 and 92H031

TREND



Declining

STATUS:

Threatened - Morris Creek has been impacted by past logging activity.

Physiography

Drainage Area

The total watershed area of Morris Creek is 52 km^2. Its tributaries include Connor Creek, Weaver Creek and East Creek. The creek flows south into Harrison River from Morris Lake (which is largely a slough).

Stream Description

Morris Creek is a small mountain-fed stream. The creek drains from Morris Lake and forms a wetland of approximately 220 ha at its mouth. The wetland is classified as 50% stream water and 50% stream marsh.

Hydrology

The mean annual flow of the creek is 2.51 m^3/s. The creek has relatively heavy water withdrawals and is characterized by low summer flows. There is a dam on Weaver Lake to augment fish flows in the Weaver Creek spawning channel.

Channel Stability Assessment (Preliminary)

There is substantial erosion and sediment input to the creek.

Fisheries Resource

Fish Access

Anadromous fish have access to all the tributary systems of Morris Creek.

Fish Stocks

Morris Creek and its tributaries support populations of sockeye, coho, pink, and chum salmon; steelhead, cutthroat and rainbow trout.

Restoration/Enhancement

Enhancement activities in the Morris Creek system include the Weaver Lake fishway for rainbow trout; the Weaver Creek spawning channel which was designed for sockeye, but is also used by chum and pink salmon; and a fishway for chum, coho, pink and sockeye salmon. Weaver and Evans Creeks are satellites of the Chehalis hatchery for coho outplanting. The Weaver Creek spawning channel is an important fish viewing area for the public.

Fish Production

Despite over logging and careless road building in the watershed, this is an important area for the production of salmonids. The Weaver Creek spawning channel is designed for accommodating up to 50,000 sockeye spawners. There are large numbers of chum salmon in this system.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Extensive logging has taken place in the watershed and most of it was replanted over 2-3 decades ago. Logging occurs in upper Weaver Creek and Sakwi Creek watersheds. Logging has altered the hydrology and morphology of the stream. In the past, Morris Creek has been used as a log dump; the watershed is now recovering.

Secondary Industry/Commercial

None.

Linear Development

A BC Hydro powerline crosses the watershed and the Morris Valley Road crosses Morris Creek. The Hemlock Valley road caused extensive erosion and bedload buildup in Sakwi Creek. The road was upgraded in the late 1970s.

Urban Development

A year round recreation village was developed in association with the Hemlock Recreation area, which has several ski runs. Sewage has been discharged into the creek from the development. Sewage is normally pumped from the ski village over the divide into the Chehalis system.

Government

Morris Creek is in the Fraser Valley Regional District.

Designated Lands

The Hemlock Valley Recreational Area and Weaver Creek Regional Park are located within the watershed. Chehalis IR #5 is located on the west side of Morris Creek.

Watershed Planning Issues

Management Concerns

- A culvert under Morris Valley Road obstructs fish migration at high flows.
- Maintaining flows for both the spawning channel and for natural spawning in the stream are a management concern.
- The management of excessive gravel from a destablized watershed should be addressed.
- There is a constant need to remove sediment from the spawning channel.
- There are large public impacts from recreation.
- Roads, trails and clearing for the Hemlock Valley Ski Resort combined with extensive logging in the watershed have caused gravel, sediment and logging debris to enter Sakwi and Weaver Creeks.

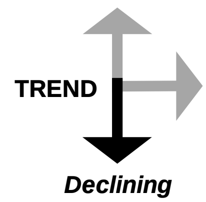
Management Prescriptions

- A gravel management plan for Weaver Creek, downstream of Hudson Bridge, needs to be developed to maintain access to the spawning channel.
- Watershed restoration efforts focused on slope stabilization and road decommissioning is needed on logged tributaries.
- The rehabilitation of the watershed over time needs to be monitored.
- Policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, and maintain unobstructed fish passage are required.

For Morris Creek hydrograph, see Appendix 2.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Mountain Slough

Watershed Code: 100-0836-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0665
TRIM Map: 92H021



STATUS:

Endangered - Mountain Slough has been impacted by riparian removal and has some water quality problems.

Physiography

Drainage Area

Mountain Slough flows into the north side of the Fraser River, east of the Harrison River.

Stream Description

Mountain Slough and its tributaries (including McCallum Ditch, Hogg Slough and Stacey Lake) flow through low-lying farmland bordered to the west by Mount Woodside. Feeder tributaries join the slough from the mountainous east side. The slough is approximately 49 ha in size and is comprised of 75% stream water and 25% floodplain marsh.

Hydrology

No hydrologic data available.

Channel Stability Assessment (Preliminary)

No geomorphological data are available.

Fisheries Resource

Fish Access

Anadromous fish have access to the slough and throughout the tributaries, although downstream migrations are affected by the pump house at the mouth of the slough.

Fish Stocks

Mountain Slough and its tributaries support populations of chum and coho salmon, and cutthroat trout.

Restoration/Enhancement

Enhancement activities have included supplementing the water supply, stream clean-ups, and gravel cleaning and placement.

Fish Production

Chum spawning occurs in the lower 1 km of the slough.

Activities and Land Use

Agriculture

The east side of the watershed is in agricultural land use.

Mining

None.

Forestry

Some forestry occurs on the west side of the watershed (west of Mountain Slough).

Secondary Industry/Commercial

None.

Linear Development

Lougheed Highway (Hwy. 7) and the Canadian Pacific Railway cross Mountain Slough near its confluence with the Fraser River.

Urban Development

Mountain Prison Correctional Institute is located in the upper reaches of the watershed.

Government

Mountain Slough is in the District of Kent (Fraser Valley Regional District).

Designated Lands

The mainstem and eastern tributaries of Mountain Slough are contained in the ALR.

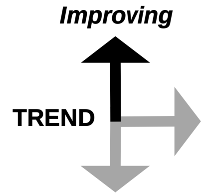
Watershed Planning Issues

Management Concerns

- A pump house at the mouth of Mountain Slough acts as a dam, and is detrimental to smolt out migrations.

Management Prescriptions

- The production potential of the stream needs to be determined so that management decisions regarding possible enhancement and restoration can be made.
- The pump house at the mouth of the slough should be made fish friendly.
- Riparian re-establishment along the sections of the slough that flow through agricultural lands should be a priority.
- Stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.



Maria Slough

Watershed Code: 100-0916-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0700
TRIM Map: 92H022 and 92H032

STATUS:

Endangered - Maria Slough is channelized and dyked, and is impacted by agricultural activities (riparian removal, water quality problems).

Physiography

Drainage Area

The total watershed area of Maria Slough is 33 km^2. Its major tributary is Hicks Creek. Maria Slough flows south into the Fraser River east of Agassiz.

Stream Description

Maria Slough, approximately 13 km in length, is a former side channel of the Fraser River. It flows through low-lying farmland and is bordered by the Kent District mountains in the northwest. The upper (northern) end of Maria Slough was blocked by a Canadian Pacific rail embankment near the turn of the century. The embankment acts as a dyke that provides flood protection to much of Seabird Island.

Hydrology

The mean annual flow of Maria Slough is 1.59 m^3/s. Groundwater upwelling provides coho habitat along the slough. The groundwater apparently comes from the steep slopes near the head of the slough though some may leak through the Canadian Pacific Rail embankment. Hicks Creek is fed by groundwater from the Hicks Lake area and small tributaries. Flows are small in comparison to the capacity of the channel and velocities are always low.

Channel Stability Assessment (Preliminary)

Riparian vegetation has been removed along the road and powerline adjacent to Maria Slough. Heavy aquatic plant growth and siltation may limit rearing capacity. There is some channelization at the top end of Hicks Creek by BC Hydro where the stream comes down the canyon. Gravel deposits exist only at constricted fast flowing areas, particularly on either side of culvert crossings.

Fisheries Resource

Fish Access

The control structure under the Canadian Pacific tracks, and several beaver dams restrict access. However, anadromous fish have been reported in the upper reaches.

Fish Stocks

Historically, Maria Slough and its tributaries supported populations of sockeye, coho, chum, pink and chinook salmon. Maria Slough supports a unique red chinook population. Chinook broodstock are collected 2.5 km upstream of the highway for the Inches Creek Hatchery. Recently, the only species reported in Hicks Creek have been coho and chum. Hicks Creek is a satellite of the Chehalis Hatchery.

Restoration/Enhancement

A spawning platform was created in Hicks Creek (at the end of Camp Road) and channels for chinook spawning were developed in Maria Slough. SEP (DFO) created two groundwater spawning channels (Seabird channel and Hicks channel), and two surface flowing spawning channels (Maria 1 and Maria 2) for chum and coho. Beaver dams are monitored and removed as necessary. Enhancement opportunities include assessment of manipulating flows in conjunction with silt removal for improving chum and pink production, rehabilitation of the two groundwater tributaries of Hicks Creek, and agreements respecting water withdrawals. A mark recovery program occurs on Hicks Creek

Fish Production

Chum spawn in the available gravel deposits throughout the slough. Chinook spawn below the second Cottonwood Island bridge at 2.8 km, in two sections below the Agassiz Corrections camp at 3.3 km and 3.7 km, and at a constriction 5.7 km upstream. Coho have been reported throughout the slough, and have been observed spawning above the Hicks Creek confluence. There is potential to increase the spawning area by diverting or channelizing the flow. There is little potential for coho spawning above the falls on Hicks Creek as the stream has a steep gradient and the bed is composed of 80-90% boulders.

Activities and Land Use

Agriculture

Extensive agricultural activity (dairy, sheep) in the Maria Slough watershed places a heavy demand on summer flows and affects water quality.

Mining

None.

Forestry

Logging is occurring above Kent and has the potential to affect flows and substrates in Maria Slough.

Secondary Industry/Commercial

A golf course is proposed for Seabird Island. The Seabird Band has proposed construction of small weirs to create pools and riffles along the slough in order to improve the channel for recreation as part of the golf course development. The band also has plans to remove gravel from the slough.

Linear Development

The Lougheed Highway (Hwy. 7), the Canadian Pacific Railway and a BC Hydro powerline cross the slough. A gas pipeline transects the watershed. The Seabird Band has also shown an interest in building bridge and pipeline crossings at several narrow points.

Urban Development

None.

Government

Maria Slough is in the District of Kent (Fraser Valley Regional District).

Designated Lands

Maria Slough borders the Seabird Indian Reserve. The headwaters of Hicks Creek are located in Sasquatch Provincial Park. The Maria Slough watershed is in the ALR.

Watershed Planning Issues

Management Concerns

- Agriculture places significant demands on water for irrigation purposes.
- Low flows hinder rearing and migration of coho.
- Dyke maintenance and dredging are constant concerns.
- New development on Seabird Island, including a golf course, are concerns.

Management Prescriptions

- The control structure underneath the CPR tracks should be modified to improve passage.
- A water management plan is required to improve summer flows.
- Agreements on dyke maintenance and channel dredging are required to improve the fish habitat production capacity.
- Agricultural stewardship initiatives which focus on riparian protection, improving water quality, preventing stream encroachments, managing access, discouraging unauthorized instream works, community outreach, and increasing public awareness about the fisheries values of this system are required.
- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious areas and maintain unobstructed fish passage are required.

For Maria Slough hydrograph, see Appendix 2.
For escapement information on Maria Slough, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Water Strategic Quality Plan- Lower Fraser River (1997).

Mahood Creek

TREND → ***Stable***

Watershed Code: 100-1019-792-000-000-000-000-000-000-000-000-000
RAB Code: 00-0740
TRIM Map: 92H032 and 92H042

STATUS:

Wild - The number and type of impacts are extremely limited and do not yet warrant a threatened status.

Physiography

Drainage Area

The total watershed area of Mahood (Gallagher) Creek is 27 km^2. The creek flows southwest into Johnson Slough at Wahleach Island.

Stream Description

Mahood Creek is a small stream which originates in the Lillooet Range east of Harrison Lake. The creek flows from the mountainside and Deer Lake onto the Fraser River floodplain and then into Johnson Slough, 20 km downstream of Hope.

Hydrology

The mean annual flow of the Mahood Creek is $1.31 m^3/s$.

Channel Stability Assessment (Preliminary)

Mahood Creek experiences extremely low flows during the summer, and flooding with erosion during the winter. The creek has a bouldery streambed. Heavy sedimentation also occurs in the lower creek and Johnson Slough.

Fisheries Resource

Fish Access

Anadromous fish have access throughout the creek up to a cascade barrier 2 km upstream of the mouth. Debris frequently forms temporary barriers to fish following heavy rainfall.

Fish Stocks

Mahood Creek supports populations of sockeye, coho, pink, and chum salmon; steelhead, rainbow and cutthroat trout; sculpins, sticklebacks, lampreys, peamouth chub and redside shiners.

Restoration/Enhancement

Coho were outplanted from SEP incubation boxes in 1983. Downstream trapping and carcass recovery programs were completed in 1984 and 1985. The creek was stocked with cutthroat trout (1982) and steelhead (1986 and 1987).

Fish Production

Mahood Creek is a significant producer of pink salmon. There is some spawning area in Inlet Creek to Deer Lake for rainbow trout, cutthroat and sticklebacks. The gravel bars at the confluence of Mahood Creek and Johnson's Slough provide a spawning area for coho.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Extensive logging has occurred in the watershed, including in Sasquatch Park.

Secondary Industry/Commercial

None.

Linear Development

A BC Hydro power line, the Canadian Pacific Railway, the Lougheed Highway (Hwy. 7), and a gas pipe line transect the Mahood Creek watershed.

Urban Development

None.

Government

Mahood Creek is in the District of Kent (Fraser Valley Regional District).

Designated Lands

Wahleach Island Indian Reserve #2 is located near the mouth of Mahood Creek. Bear Creek and Deer Lake Municipal parks and Sasquatch Provincial Park are located within the drainage. A portion of the watershed on the east side of Mahood Creek (mid reaches) is in the ALR.

Watershed Planning Issues

Management Concerns

- Logging in the watershed is believed to have caused degraded fish habitat (debris and sediments) in the past, but natural rehabilitation is well underway.

Management Prescriptions

- Enforce responsible forest practices on private lands.
- Restore riparian vegetation.
- Potential enhancement opportunities and recommendations for Mahood Creek have been identified and should be pursued.

For Mahood Creek hydrograph, see Appendix 2.
For escapement information on Mahood Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Ruby Creek

TREND → *Stable*

Watershed Code: 100-1047-000-000-000-000-000-000-000-000-000-000
RAB Code: 00-0750
TRIM Map: 92H032 and 92H042

STATUS:

Threatened - Ruby and Garnet Creeks have been impacted by logging activities.

Physiography

Drainage Area

Ruby Creek and its tributary (Garnet Creek) occupy a watershed area of 84 km^2. The creek flows south into the Fraser River west of Valsasus Island.

Stream Description

Ruby Creek is a small stream which originates in the Lillooet Range, east of Harrison Lake, at an elevation of about 1200 m. It flows down the mountainside through a steep canyon, onto the Fraser River floodplain and into the mainstem west of Valsasus Island. Garnet Creek is a tributary of Ruby Creek.

Hydrology

The mean annual flow of Ruby Creek is 4.06 m^3/s. Ruby Creek has flashy flows with extreme peak flows.

Channel Stability Assessment (Preliminary)

Ruby Creek is a very flashy system with extreme freshets that cause substantial gravel loss.

Fisheries Resource

Fish Access

Anadromous fish have access throughout the creek to an impassable canyon located 3 km upstream from the Fraser River. Access is often limited by debris clogged culverts.

Fish Stocks

Ruby Creek and its tributary support populations of coho, sockeye, pink and chum salmon; cutthroat, steelhead, rainbow and Dolly varden trout; mountain whitefish, peamouth chub, sculpins, sticklebacks, and suckers.

Restoration/Enhancement

No enhancement activities or opportunities were identified.

Fish Production

No fish production information is available. The Ruby Creek fan is expanding into the Fraser River and provides excellent spawning gravel.

Activities and Land Use

Agriculture

There is some agricultural activity in the Ruby Creek watershed.

Mining

None.

Forestry

Extensive logging occurred up until 1967. Currently there is a small amount of private timber cutting and sales. About 400 hectares of logging is proposed under the current five year plan.

Secondary Industry/Commercial

None.

Linear Development

The Lougheed Highway (Hwy. 7), the Canadian Pacific Railway, a BC Hydro power line and a gas pipeline transect the Ruby Creek watershed.

Urban Development

None.

Government

Ruby Creek is in the District of Kent (Fraser Valley Regional District).

Designated Lands

Indian Reserve #9 (Lukeseetsissum) and #2 (Ruby Creek) are located at the mouth of Ruby Creek. The lower reaches and mouth, as well as a portion of the west side of the mid reach of Ruby Creek are in the ALR.

Watershed Planning Issues

Management Concerns

- Poor logging practices have caused extensive gravel movement during freshets.
- The Ministry of Transportation and Highways removed gravel from the fan in 1973 for use in expansion of the Lougheed Highway. In recent years, the fan of Ruby Creek has been

expanding into the Fraser River. Pink salmon use this area for spawning; however there is interest in removing some of the accumulated gravel.

Management Prescriptions

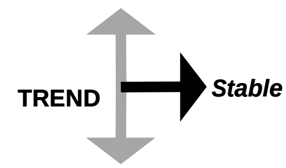
- Ruby Creek is among the least impacted streams within the lower Fraser Valley. It should be a priority for protection and conservation.
- Watershed restoration should concentrate on stabilizing slopes and reducing gravel loss and debris introduction.

For Ruby Creek hydrograph, see Appendix 2.
For escapement information on Ruby Creek, see Appendix 3.
For information on water quality in this system, see:
Fraser River Basin Strategic Water Quality Plan – Lower Fraser River (1997).

Chapter 4 – Burrard Inlet Tributaries

Map 16 – West/North Vancouver/Burrard Inlet Area

Beaver Creek



Watershed Code: 900-0355-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-9
TRIM Map: 92G035

STATUS:

Endangered - Beaver Creek is impacted by its proximity to the urban area (heavy recreational use), and water quality is a problem due to eutrophication in Beaver Lake and runoff from trails.

Physiography

Drainage Area

Beaver Creek is located in Stanley Park, and is part of the Prospect Creek-Beaver Lake-Beaver Creek system. The watershed area of this system is about half of the area of Stanley Park (Stanley Park is about 1000 acres). Beaver Creek flows northeast from Beaver Lake into Burrard Inlet.

Stream Description

Beaver Creek is approximately 300 m long, and flows northeast from Beaver Lake (in Stanley Park) into Burrard Inlet. Prospect Creek flows into Beaver Lake, which flows into Beaver Creek, which enters Burrard Inlet via a through a seawall impass in the Stanley Park seawall.

Hydrology

Historically, the water supply for Beaver Creek came from highly permeable soils, marshes and ponds draining into the system. However, due to various developments over time in Stanley Park (paving for roads, installation of playgrounds, the zoo, removal of trees), the hydrology of this system has been significantly altered. Currently, water flows into the Prospect Creek-Beaver Lake-Beaver Creek system are supplemented by the GVRD water supply. Altered stream hydrology and morphology have also impacted water quality; for example, eutrophication is a problem in Beaver Lake.

Channel Stability Assessment (Preliminary)

Channel stability is threatened by loss of streambank integrity due to the number of dogs allowed off-leash, as well the number of people going off-trail, and into the riparian area and the stream. Streambank stability is also vulnerable to high rainfall events, when gravel from walking trails is washed through the riparian area and into the water.

Fisheries Resource

Fish Access

The seawall impass at the mouth of Beaver Creek restricts access by anadromous fish during all but high tides. A cascade/stop log water control structure under Pipeline Road has recently been rebuilt with a plunge pool so that it should be passable to coho. A fish ladder has been proposed for this section of the creek. Historically, searun cutthroat had access up to Prospect Creek.

Fish Stocks

Beaver Creek supports very limited populations of coho salmon, cutthroat trout, three spined sticklebacks, western brook lamprey, black sculpin, and Beaver Lake supports carp.

Restoration/Enhancement

A sockeye hatchery was located on the Beaver Creek system in 1911. Today, 2000 - 3000 juvenile coho are outplanted yearly into Beaver Creek and Prospect Creek. Through the Classroom Incubation Program, 24 Vancouver schools release approximately 450 fry into the system every year. (All fry are Capilano Hatchery stock.) The Vancouver Salmon Streams Society is conducting stream clean-ups (removing gravel, glass, etc.), improving instream habitat and assessing access concerns at the Stanley Park seawall, Pipeline Road, and Beaver Lake. Beaver Creek experienced a relatively major washout two years ago, when a car hit a fire hydrant, causing flooding which destabilized a large section of bank which slid into the creek. Heavy siltation covered most of the stream bottom in the lower part of the creek. This event caused a significant setback in stream restoration activities. During the restoration process, the plunge pool was rebuilt and made larger and higher so that it is now passable to fish. Streambank revegetation is occurring continuously. Debris blocking streamflow in Prospect Creek is being removed. The Beaver Lake Environmental Enhancement Project is a new effort being undertaken by a local community group interested in improving lake habitat.

Fish Production

Four coho adults were observed in 1993. Signs of anadromous fish returns were noted recently--redds were found at various locations in the lower end of the creek.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Thinning and safety cutting (park trees) occurs in the watershed.

Secondary Industry/Commercial

None.

Linear Development

The creek is crossed by Pipeline Road, and the Stanley Park seawall. There are many pedestrian and bike trails in the drainage.

Urban Development

There are a few small buildings at the Prospect Picnic Ground area.

Government

Beaver Creek is in the City of Vancouver (Greater Vancouver Regional District).

Designated Lands

Beaver Creek flows through Stanley Park.

Watershed Planning Issues

Management Concerns

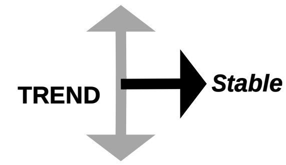
- The system experiences severe water quality problems in the summer including low dissolved oxygen concentrations and high water temperatures in Beaver Lake.
- Stanley Park sees heavy passive recreation use, which result in a number of damaging impacts to the highly sensitive Beaver Creek system. Dogs off-leash cause damage to the riparian area and the watercourse. Gravel is placed regularly on the trails; high rainfall events tend to cause surface runoff to wash the gravel into creek, destroying riparian areas, covering spawning habitat, and destroying pools. Local stewardship groups have been working recently with the Parks Department to address this issue: drain pipes have been put in under the trail to collect water, preventing it from running across the trail, carrying gravel with it. Although the streamside path is a No-Cycling trail, cyclists ride along the stream, causing compacting and gravel displacement, necessitating the application of more gravel.
- Stormdrains carry a large amount of water out of the watershed which otherwise would be available to the stream system. In a park, one should expect that as much water as possible be returned to the soil.
- The seawall impass under the Stanley Park seawall is not high enough to allow proper flushing to occur, resulting in sediments building in the stream system, which causes an already low gradient stream to become even more shallow in the summer (resulting in water quality and quantity problems).

Management Prescriptions

- Remove sediments, trail gravel, glass, etc. covering the streambed, and replace with streambed substrate, including spawning gravels.
- A partial clearing and dredging of Beaver Lake would increase water quantity and improve water quality for fish migrating in the upper system.
- The barriers to anadromous fish migration should be modified to provide access.
- Habitat complexing and instream boulder placement would enhance the system.
- The now discontinued wildlife area of the zoo contains several ponds and a small creek which flows into Beaver Lake. The habitat capacity of these natural features could be enhanced for salmonid use and for rearing.
- This is a stream which, due to its park status, has a very high potential for recovery.

- Enforce bylaws that prevent dogs running off-leash and prevent cycling where it is not permitted (i.e. through environmentally sensitive areas). The streamside trails see heavy use, but if users stay on the trails and do not go onto the stream embankment or into the riparian area, there will be less impact on the stream.
- Stewardship activities are necessary which focus on improving public awareness of fisheries values and conflicts, protecting and enhancing riparian areas, improving water quality, discouraging encroachments, managing access, and encouraging good land use planning practices.

Nelson Creek



Watershed Code: 900-0755-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0990
TRIM Map: 92G034

STATUS:

Endangered - Nelson Creek has been extensively modified by development (i.e. dammed and dredged) and the estuary has been lost.

Physiography

Drainage Area

The total watershed area of Nelson Creek is 5.1 km^2. The creek flows southwest into Fisherman's Cove, north of Point Atkinson.

Stream Description

Nelson Creek is a small mountain fed system. Nelson Creek has been diverted, via a pipeline, to Eagle Lake (formerly called Dick Lake), which is part of the drinking water system for West Vancouver. Overflow from the lake forms a tributary, which flows back into Nelson Creek. Downstream of this, Whyte Creek joins Nelson Creek. Whyte Lake is at the headwaters of Whyte Creek.

Hydrology

Nelson Creek peak flow water is diverted, via a pipeline, to Eagle Lake, which has been dammed to provide drinking water to West Vancouver. Overflow from the dam forms a tributary, which eventually flows back into Nelson Creek.

Channel Stability Assessment (Preliminary)

A 70 m stretch of Nelson Creek has been culverted and channelized at and below Marine Drive. Riprap and concrete have been installed along the banks of the lower reaches.

Fisheries Resource

Fish Access

Anadromous fish have access to a culvert located at Marine Drive, 0.1 km upstream. Additional barriers exist further upstream.

Fish Stocks

Nelson Creek historically supported populations of chum and coho salmon, and cutthroat trout. Some coho were seen above Marine Drive during high water in 1997.

Restoration/Enhancement

SEP transplanted 67,500 coho to the incubation box at Cranley Drive between 1981 and 1983. An additional 75,000 chum were transplanted between 1984 and 1986. A small public hatchery was built in 1991 (upstream of the TransCanada Highway) and stocked with 100,000 chum, and 20,000 to 30,000 coho fry annually. Coho fry were released in 1994. The chum re-stocking has not been successful. Coho (up to 30) returned in 1995 and 1996. Baffle placement in the culvert at Marine Drive has been recommended to enhance fish access.

Fish Production

Coho spawn in the lower 100 metres of the stream. Cutthroat have been observed throughout the system while steelhead have only been observed in the lower 100 m.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

There has been commercial harvesting historically in this watershed, and the lower reaches have been cleared to accommodate development.

Secondary Industry/Commercial

Commercial activity is limited to that which supports residential development (i.e. retail). The Thunderbird Marina and an abandoned gas station are also located in the watershed. The development of the marina has resulted in significant fish habitat losses at the mouth and lower reach of the stream.

Linear Development

The creek is crossed by the BC Rail sluiceway and trestle, the TransCanada Highway (Upper Levels Hwy.), Marine Drive, and one municipal street.

Urban Development

Residential development (Fisherman's Cove) exists at the mouth of the creek and development continues up the stream to the Upper Levels Highway.

Government

Nelson Creek is in the District of West Vancouver (Greater Vancouver Regional District).

Designated Lands

The middle reach of the creek flows through Nelson Canyon Park. The upper reaches of Nelson Creek are used for a source of drinking water; this area is a District of West Vancouver managed watershed, and public access is restricted.

Watershed Planning Issues

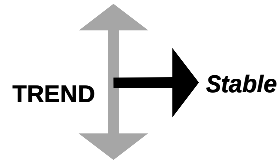
Management Concerns

- Peak flows from Nelson Creek are diverted to a reservoir on Eagle Lake; however there is no provision for flow augmentation to Nelson Creek or minimum flows for fish.
- A broken sewer line discharged sewage into Nelson Creek in the summer of 1997.
- In 1967, the lower 250 ft. of Nelson Creek were eliminated by dredging. As a result salmon can only enter the creek when tides are above 15 ft.
- There is no estuary left.
- Existing and potential development in the watershed increase the risk of altered stream water quality and quantity (from stormwater), spills, riparian removal, unauthorized channel and bank alterations.

Management Prescriptions

- Municipal policies, bylaws or development permit area designations are required which prevent watercourse contamination, prohibit riparian vegetation removal, improve erosion control, reduce effective impervious surface areas, maintain ‘open’ streams with unobstructed access for fish.
- Stewardship activities have begun which focus on improving public awareness of fisheries values and conflicts, protecting and enhancing riparian areas, improving water quality, discouraging encroachments into ravines and stream corridors, and encouraging good land use planning practices.
- A water management plan for this watershed is required which addresses instream flows and minimum flows for fish.
- Although this was historically a significant salmon stream there is very little known regarding current and potential fish production potential and hydrology on this system. This information is required to develop detailed management prescriptions for Nelson Creek.
- A study to review the potential of reversing significant stream losses in the 1960s should be undertaken.

Eagle Creek



Watershed Code: 900-0753-000-000-000-000-000-000-000-000-000-000
RAB Code: 900988
TRIM Map: 92G034

STATUS:

Threatened - Eagle Creek is impacted by urbanization (water diversion, sewage line seepage, accidental spills, alteration of the stream channel).

Physiography

Drainage Area

The total watershed area of Eagle Creek is 3.8 km^2. The main tributary of Eagle Creek is Wood Creek. The creek flows southeast into Eagle Harbour, Queen Charlotte Channel, north of Point Atkinson.

Stream Description

Eagle Creek (approximately 4.0 km) is a small mountain fed stream originating from the west slope of Black Mountain, Britannia Range, at an elevation of 1100 m. Eagle Lake is dammed as a public reservoir for drinking water for West Vancouver. Wood Creek joins Eagle Creek 140 m upstream of the ocean. Eagle Creek discharges into a marina at Eagle Harbour.

Hydrology

The system is flashy with high flows commonly occurring in the fall and low to moderate flows occurring in midsummer.

Channel Stability Assessment (Preliminary)

Gravel and debris transport associated with high discharges commonly cause channel shifts. The lower reaches are low gradient and stable. Natural woody debris has been removed from the creek. Retaining walls are common in the lower reaches.

Fisheries Resource

Fish Access

Anadromous fish have access up to an impassable culvert located 0.8 km upstream from the mouth. A culvert located at the mouth is impassable at low water levels.

Fish Stocks

Eagle Creek supports small populations of coho and chum salmon, and cutthroat trout. The low gradient stream reaches have good gravels and could be very productive for chum and cutthroat, if not for the obstructions (culverts, trash rack on Wood Creek).

Restoration/Enhancement

A series of pools have been created at the mouth to assist chum and coho migration up to the culvert. Capilano coho fry (20,000 to 30,000) have been stocked in the lower reaches of the creek inaccessible to fish. Smolts were released to upper Eagle Creek in 1993. In 1997, 50,000 chum fry were released.

Fish Production

Coho and chum spawning is scattered throughout Eagle Creek up to the top of Daffodil Land and on Wood Creek to Parc Verdun. Chum spawn on the tidal flats at the mouth of the creek when access is possible.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed there has been significant clearing below the TransCanada Highway to accommodate existing urban development.

Secondary Industry/Commercial

There is a shopping mall near Wood Creek at the Caulfield exit of the TransCanada Highway. Eagle Harbour Marina is located at the mouth of the creek.

Linear Development

Eagle Creek is crossed by the TransCanada Highway and Marine Drive. The BC Railway crosses Eagle Creek approximately 300 m above Marine Drive. The storm drains at Marine Drive (just before Park Verdun) cause difficult conditions for survival of aquatic organisms. There are numerous streets and roads in the watershed (though few creek crossings).

Urban Development

Eagle Creek flows through the community of Eagle Harbour. There has been significant encroachment into the riparian/stream corridor in the settlement area. The storm drains from the Caulfield Plateau all drain into Wood Creek.

Government

Eagle Creek is in the District of West Vancouver (Greater Vancouver Regional District).

Designated Lands

Eagle Creek flows through Parc Verdun in its lower reaches.

Management Concerns

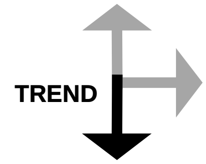
- Sewage line seepage and accidental spills have caused water quality problems and fish kills (1997) in the system.
- Land management practices on private property have reduced fish habitat productive capacity due to encroachment into the riparian and stream areas.
- Existing and potential development in the watershed increase the risk of altered stream water quality and quantity (from stormwater), spills, riparian removal, unauthorized channel and bank alterations, and conflicts between conservation and recreational access through riparian areas are concerns.

Management Prescriptions

- Municipal policies, bylaws or development permit area designations are required which prevent watercourse contamination, prohibit riparian vegetation removal, improve erosion control, reduce effective impervious surface areas, and maintain ‘open’ streams with unobstructed access for fish.
- Stewardship activities are developing which focus on improving public awareness of fisheries values and conflicts, protecting and enhancing riparian areas, improving water quality, discouraging encroachments into ravines and stream corridors, and encouraging good land use planning practices.
- A comprehensive stormwater management plan is needed which addresses stream water quality and quantity including maintenance of baseflows. The District of West Vancouver carried out an extensive study and repair of storm sewers in the early to mid 1990’s. Sanitary and storm sewer cross connections need to be addressed.
- In any redevelopment of properties, removal of any development footprint encroaching in the stream or riparian area should be encouraged

Cypress Creek

Watershed Code: 900-0735-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0970
TRIM Map: 92G034



Declining

STATUS:

Endangered - Urban development in the lower watershed, dredging of the lower reaches, and development in the upper watershed have impacted Cypress Creek.

Physiography

Drainage Area

The total watershed area of Cypress Creek is 13.3 km^2. The creek flows south into Vancouver harbour, northeast of Point Atkinson in Burrard Inlet.

Stream Description

Cypress Creek (approximately 9.0 km), is a small mountain fed stream originating from Hollyburn Ridge at an elevation of 1200 m. It is West Vancouver's largest stream. There are a number of small lakes in the Cypress Creek watershed, including Yew Lake (originally called Cypress Lake).

Hydrology

The system is flashy with naturally high flows occurring in the fall and low to moderate flows occurring in midsummer. There is an intake for water supply to the West Vancouver Laboratories (formerly Fisheries and Oceans Canada science lab). The District of West Vancouver is considering a proposal to divert a tributary of upper Cypress Creek to Eagle Lake to augment the domestic water supply.

Channel Stability Assessment (Preliminary)

Gravel and debris transport associated with high discharges commonly causes channel shifts. Heavy flooding and upper watershed degradation have seriously affected the stability of this stream. Portions of the creek have been channelized, the gravel scoured, and accumulated woody debris removed.

Fisheries Resource

Fish Access

Anadromous fish have access up to a 10 m falls located approximately 1.6 km upstream.

Fish Stocks

Cypress Creek supports populations of coho, and chinook salmon (has supported chum in the past); cutthroat, steelhead and rainbow trout. Salmon returns are low. Most reports are sightings of cutthroat tout with occasional sightings of coho. The creek is not surveyed regularly.

Restoration/Enhancement

Stewardship groups such as the Cypress Creek Enhancement Society are looking into possible restoration work, but there is limited suitable land for such projects. A West Vancouver Streamkeepers group (formed in 1997) is involved in monitoring, restoration, and advocacy on Cypress Creek.

Fish Production

Coho spawn between Keith Road and the mouth of Cypress Creek. There have not been many coho sightings in recent years.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Most old growth forest was historically logged. There has been significant clearing in the lower reaches to accommodate development. Expansion of ski operations in Cypress Provincial Park will result in some commercial forest harvesting in the upper reaches. Cypress Bowl Recreation will be doing some replanting as part of its master plan.

Secondary Industry/Commercial

Commercial development is largely limited to that which supports residential development (i.e. one gas station/store complex). Cypress Bowl Ski Area is an expanding commercial enterprise.

Linear Development

The creek is crossed a few major thoroughfares including the TransCanada Highway, Cypress Bowl Road, and Marine Drive. The BC Railway crosses the creek approximately 300 m upstream of Marine Drive. There are numerous municipal roads and streets in the drainage area (though few creek crossings).

Urban Development

There is significant urban development in the watershed below the TransCanada Highway including the communities of Sandy Cove and Cypress Park. Above the highway the neighbourhood of Cypress Park Estates has developed along the west side of Cypress Falls Park and new developments are under construction.

Government

Cypress Creek is in the District of West Vancouver (Greater Vancouver Regional District).

Designated Lands & Parks

The headwaters of Cypress Creek are in Cypress Provincial Park. Immediately above the TransCanada Highway Cypress Creek flows through Cypress Falls Park.

Watershed Planning Issues

Management Concerns

- Channel dredging below Marine Drive has simplified the stream channel.
- Proposed residential and commercial (i.e. Cypress Bowl Ski Area) development in the upper watershed are concerns.
- Existing and potential development in the watershed increase the risk of altered stream water quality and quantity (from stormwater), spills, riparian removal, unauthorized channel and bank alterations, and conflicts between conservation and recreational access through riparian areas.

Management Prescriptions

- In any redevelopment of lands, development should be moved back from the stream.
- Municipal policies, bylaws or development permit area designations are required which prevent watercourse contamination, prohibit riparian vegetation removal, improve erosion control, reduce effective impervious surface areas, and maintain ‘open’ streams with unobstructed access for fish.
- Stewardship activities have begun which focus on improving public awareness of fisheries values and conflicts, protecting and enhancing riparian areas, improving water quality, discouraging encroachments into ravines and stream corridors and encouraging good land use planning practices.

Rodgers Creek

TREND → ***Stable***

Watershed Code: 900-0723-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0940
TRIM Map: 92G035

STATUS:

Endangered - Sections of Rodgers Creek and its tributaries have been impacted by urbanization (channelized, culverted, loss of riparian area, poor water quality).

Physiography

Drainage Area

The watershed area of Rodgers Creek is 2.6 km^2. The creek flows south into Burrard Inlet west of Dundarave.

Stream Description

Rodgers Creek is a small mountain fed system whose headwaters originate on the southern slopes of Hollyburn Ridge at an elevation of approximately 900 m (older maps do not include all the tributaries of Rodgers Creek).

Hydrology

Rodgers Creek is considered flashy with high flows commonly occurring in the fall with low to moderate flows in midsummer.

Channel Stability Assessment (Preliminary)

Gravel and debris transport associated with the high discharges commonly cause channel shifts. The lower reaches have been channelized and the accumulated woody debris removed.

Fisheries Resource

Fish Access

Anadromous fish have access to an impassable culvert located 0.4 km upstream from the mouth at Marine Drive.

Fish Stocks

Rodgers Creek supports populations of coho salmon and cutthroat trout.

Restoration/Enhancement

SEP transplanted a total of 55,000 Capilano coho eggs into Rodgers Creek between 1980 to 1983. SEP transplanted an additional 60,000 Chehalis chum eggs into the system from 1984 to 1989. An incubation box at Palmerston Ave. was removed in 1990 because of siltation problems. The lower reaches of the stream (that are inaccessible to fish) were stocked with 20,000 to 30,000 Capilano coho fry annually up to 1992. Very few fish return.

Fish Production

Coho salmon spawn near the mouth of Rodgers Creek. Rodgers Creek is reported to have good habitat almost up to the TransCanada Highway, but below Marine Drive there is little woody debris or riparian vegetation, necessary elements of fish habitat.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed there has been significant clearing to accommodate development.

Secondary Industry/Commercial

There is no commercial development present in most of the watershed, although the Cypress Bowl Ski Area is expanding as a commercial enterprise.

Linear Development

Rodgers Creek is crossed by the TransCanada Highway (Upper Levels Hwy.), Cypress Bowl Road and Marine Drive. The BC Railway crosses Rodgers Creek just north of Bellevue Avenue. There are also numerous municipal streets and roads in the watershed (though few creek crossings).

Urban Development

The lower reaches are developed as commercial/residential areas. Among the neighbourhoods are Upper Levels, Dundarave, Wadsley and Altamont. The upper watershed is being intensively developed into large single family residences with very high effective impervious areas and lot coverage. A tributary has been culverted and buried, and a portion of the streambed ‘concreted’ to the top of the ravine.

Government

Rodgers Creek is in the District of West Vancouver (Greater Vancouver Regional District).

Designated Lands

None.

Watershed Planning Issues

Management Concerns

- There have been repeated toxic spills into the creek (including a concrete truck washing into the storm drain--charges are pending). Siltation from land development immediately downstream and upstream of the TransCanada Highway has been a serious concern.
- The existing and potential development in this watershed increases the risk of altered water quality and quantity (from stormwater), spills and fugitive discharges, unauthorized instream and bank works, riparian vegetation removal, and encroachment into the ravines and floodplains.

Management Prescriptions

- Municipal policies, bylaws or development permit area designations which prevent watercourse contamination, prohibit riparian vegetation removal, improve erosion control, reduce effective impervious surface areas and maintain open streams and provide unobstructed fish passage are required.
- Stewardship activities have begun that focus on improving water quality, managing recreational access issues, increasing public awareness, protecting and rehabilitating riparian areas, and advocacy.
- A master stormwater management plan is required for this system that addresses water quality and quantity in streams (including maintenance of baseflows).
- A fishway could be installed at the culvert located 0.4 km upstream from the mouth to provide fish access.
- Where development has encroached on the stream and the banks have been covered with concrete, much can be done to reduce the impact when redevelopment occurs, or as other opportunities permit.

Capilano River

TREND ***Stable***

Watershed Code: 900-0711-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0900
TRIM Map: 92G035, 92G045 and 92G055

STATUS:

Endangered - The lower Capilano River has been impacted by impoundment, flow diversion, urbanization (riparian removal, channelization, high effective impervious area, water quality problems). The estuary has been largely lost.

Wild - The upper Capilano River (above the reservoir) is managed as a protected watershed, and is relatively wild.

Physiography

Drainage Area

The Capilano River Watershed occupies 172 km^2. The upper tributaries to the river include Crown, Fellowes, Nicky, Sisters, Dean, Healmond, Eastcap, Hesketh, Enchantment, Hanover, Andrews and Windsor Creeks. The lower tributaries below the dam include Brothers, Hadden, and Houlgate Creeks. A list of the tributaries (and watershed codes) to the Capilano River is supplied in Appendix 1. The river flows south to Burrard Inlet and discharges immediately west of the Lions Gate bridge at First Narrows.

Stream Description

The upper Capilano River is a glacial fed system that originates near Capilano Mountain at an elevation of approximately 1,800 m. The river flows in a braided, shifting channel across a wide, flat bottomed valley confined by steep mountains. The upper Capilano River drains into Capilano Lake, a reservoir created by the Cleveland Dam. The river is characterized by a long series of rapids and riffles with deep pools.

Brothers Creek, located in the lower reaches of the Capilano River, has the biggest salmon runs of any tributary to stream systems in West Vancouver. Brothers Creek has two main tributaries, West Brothers and Hadden Creeks, that join Brothers Creek below the TransCanada Highway, and several unnamed tributaries. The mid and lower reaches of the watershed have fairly good riparian zones (Brothers and West Brothers creeks are located in ravines below Cross Road).

Hydrology

The lower Capilano River is a regulated river. It drains the 60,000 acre feet Capilano Lake reservoir which, in addition to reservoirs on the Seymour and the Coquitlam River provides the Greater Vancouver Water District (GVWD) with its domestic water supply. The flow to the lower river is controlled by releases from the pump house located immediately below the Cleveland Dam or via the spillway when the reservoir is full. Under agreement with DFO the GVWD is obligated to provide a minimum release of 20-25 ft^3 /s (0.56 - 0.7 m^3/s) to the Capilano hatchery. Average total monthly discharges from the Cleveland Dam range from highs of greater than 50 m^3/s in late winter (January 1992) to lows of less than 1.0 m^3/s during summer months (July /August).

Channel Stability Assessment (Preliminary)

Mainstem flows downstream of the dam will vary in direct response to precipitation events; however, the mainstem Capilano River is relatively stable. Brothers Creek and several other headwater tributaries are quite flashy.

Fisheries Resource

Fish Access

On the Capilano River, anadromous fish have access to the Capilano Hatchery located approximately 5 km upstream of the mouth (i.e. at the base of the dam).

Brothers Creek has resident cutthroat trout above Cross Creek Road (3 km upstream of the mouth), but other species have been restricted by culverts and the steep gradient. Recently, the culverts on Brothers Creek under Taylor Way and the TransCanada Highway (Upper Levels Hwy.) were baffled to provide upstream fish access. A fishway was installed in 1997 in the culvert under Wildwood Lane. On Hadden Creek, baffles were placed in the culvert under the TransCanada Highway in 1997. Fish passage (culvert work) is now being improved to West Brothers Creek.

Fish Stocks

The Capilano River and its tributaries support populations of pink, chum, chinook, and coho salmon; steelhead, rainbow, Dolly varden and cutthroat trout. (The West Vancouver Streamkeepers group observed at least 50 chum and 50 coho returning on the Brothers Creek tributary in 1997.)

Restoration/Enhancement

The Capilano hatchery is located just below the dam and a fishway has been constructed to allow entry to the hatchery. The hatchery enhances chinook, coho, and steelhead stocks. Chinook are not native to this system. Chinook at the hatchery originate from the Chilliwack River; in the past they have been supplied from the Big Qualicum River. Coho fry have been stocked into Capilano Lake and above. A percentage of the fry are trucked past the dam every year (as a safety measure in case anything happens to the flow to the hatchery). The North Vancouver School District has also been very active in classroom incubation and fry release programs. The West Vancouver Streamkeepers group is involved in monitoring, restoration, and advocacy on Brothers Creek.

Fish Production

Some natural spawning of chinook occurs in the Capilano River between the hatchery and the TransCanada Highway (Upper Levels Highway). Coho, steelhead and cutthroat spawn throughout Brothers Creek and spawning extends beyond the Upper Levels Highway. Chum spawn in the lower reaches of the Capilano River and Brothers Creek. Some natural spawning of coho occurs downstream of the hatchery and in the tributaries. Pink spawn during odd years only in the lower reaches of the Capilano River and lower Brothers Creek. Coho, steelhead, and cutthroat populations are considered stable.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

The GVRD logs in the upper watershed for "management" purposes: to control disease, fire hazard and reduce windthrow. A moratorium on further logging was put in place until a review (1997) of logging in the 3 GVWD watersheds (Capilano, Seymour, Coquitlam) is complete. There has been extensive clearing in the lower watershed to accommodate residential development.

Secondary Industry/Commercial

There has been extensive industrial/commercial redevelopment near the mouth of the river including the Lions Gate Sewage Treatment Plant and Park Royal Shopping Centre along the west bank, and a large trailer park along the east bank. Capilano Golf Course is located on Hadden Creek. Hollyburn Winter Club is located between the main and west arm of Brothers Creek. Part of the Cypress Bowl Ski Area is in the upper watershed of Brothers Creek.

Linear Development

Capilano River is crossed by two significant thoroughfares--the TransCanada Highway (Upper Levels Hwy.) and Marine Drive. The river is also crossed by a suspension bridge and two street crossings in the lower watershed. The BC Railway crosses the Capilano River at the mouth, and constricts the estuary at that point. There are numerous municipal streets and roads in the watershed (though few creek crossings).

Urban Development

The river is surrounded by residential developments including the neighbourhoods of Pemberton, Capilano Highlands, Glenmore, Cedardale, British Properties and Sentinel Hill. Newer housing developments in the upper watersheds, and infill or renovation housing, have high impervious surface cover. A large synagogue was recently constructed between Taylor Way and the Upper Levels Highway and significantly encroached upon the riparian zone.

Government

The Capilano River forms the boundary between North and West Vancouver (Greater Vancouver Regional District)--and thus falls into the jurisdiction of both municipalities.

Designated Lands

The Capilano Indian Reserve #5 extends from Marine Dr. to the mouth of the river. There are several parks in the watershed which provide some enhanced protection to the river including Capilano River Regional Park, Hugo Ray Park, Klee Wyck Park, Klahanie Park and Ambleside Park. The upper watershed of the Capilano River is in a protected watershed managed by the GVRD as a domestic water supply source.

Watershed Planning Issues

Management Concerns

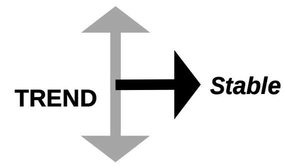
- Although the upper Capilano River watershed is managed as a potable water supply for the Greater Vancouver area, water quality problems resulting from the surrounding urban development is a concern in the lower reaches, especially in tributary streams such as Brothers Creek.
- The Cleveland Dam has been upgraded to current seismic standards. However, there is high seepage through the abutment of the dam on the North Vancouver side. The GVRD is considering placing a clay blanket on the upstream face of the abutment to reduce this seepage. The Capilano hatchery currently uses some of the seepage as a water source.
- The estuary has been largely lost, due to industrial/commercial development.
- With infill and redevelopment now occuring in this area, increased impervious surface area will have additional impacts on stream flows.
- Watershed logging is controversial. There are concerns associated with the effect of maintenance logging on water quality and turbidity in the reservoir. The reservoir will act as a buffer to downstream areas.
- There is significant aboriginal fishing and recreational angling pressure on the system.
- Fish passage was improved to Brothers and Hadden Creeks in 1997, and will be done for West Brothers in 1998.
- On Brothers Creek, the baffles in culverts under Taylor Way and the TransCanada Highway (Upper Levels Hwy.) need to be maintained.
- An old landfill site and a cemetery site are discharging leachate into the river.
- The intensive development (current and proposed) in this watershed increases the risk of stormwater impacts to stream water quality and quantity, spills, riparian impacts, encroachments, unauthorized instream and bank works, and channelization/channel modifications.

Management Prescriptions

- A better flow agreement with the GVRD to establish minimum and flushing flows for fish is required. An accidental reduction of flow from the Cleveland Dam in the summer of 1997 caused stranding of adult and juvenile coho.
- Infill housing and renovation in areas next to the stream system must be planned with minimum impact on the riparian area. Where possible in redevelopment, an adequate riparian area can be re-established to contribute to functioning fish habitat.
- The District of North Vancouver should be encouraged to maintain, and possibly expand, its comprehensive Environmental and Preservation Bylaw which protects, preserves, and conserves natural settings and ecological systems of trees, watercourses, soils and lands. The District of West Vancouver should be encouraged to develop and enforce provisions which would give a similar level of protection throughout the watershed.
- Stable large woody debris could be added to tributaries in the system to recreate habitat features.
- Enhancement upstream of the dam can include fry outplanting.

For escapement information on the Capilano River, see Appendix 3.

MacKay Creek



Watershed Code: 900-0693-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0860
TRIM Map: 92G035

STATUS:

Endangered - MacKay Creek has been impacted by urbanization (riparian removal, channelization, poor water quality, and high effective impermeable area). The estuary has been lost.

Physiography

Drainage Area

The total watershed area of MacKay Creek is 7.8 km^2. There are several branches of MacKay Creek, all of which originate on Grouse Mountain. MacKay Creek flows south through North Vancouver into Burrard Inlet, east of the Capilano River.

Stream Description

MacKay Creek is a small (8.1 km), fast moving stream that originates on the southwest slope of Grouse Mountain at an elevation of approximately 1000 m. The stream flows along a narrow, shifting channel. Much of the mid-reach is in a ravine, which has a good riparian zone.

Hydrology

The peak flows relative to return periods on MacKay Creek are 37 m^3/s for the 100 year return period and 44 m^3/s for a 200 year return interval. Although flows are generally considered stable, the creek has overtopped its banks during periods of high flows.

Channel Stability Assessment (Preliminary)

The system is geologically active and subject to significant debris flows. A large landslide and debris torrent occurred above the BC Hydro right-of-way on November 23, 1995. Once the upper reaches have stabilized, gravel recruitment may be affected. The potential is significant for additional sediment and debris laden flows. Several areas of the creek have been channelized and diverted.

Fisheries Resource

Fish Access

Anadromous fish have access up to a 2 m gradient barrier (falls) located near Montroyal Blvd.

Fish Stocks

MacKay and Emsley Creeks support small populations of chum, pink and coho salmon; steelhead and cutthroat trout.

Restoration/Enhancement

MacKay Creek has one incubation box for coho located at Brookridge Dr., a net pen at Canyon Blvd., and a fishway located just south of Ridgewood Drive. Strong efforts and advocacy by the Northshore Fish and Game Club and Streamkeepers have significantly reduced the frequency and severity of spills and other water quality problems. Plans to restore the habitat degraded by the 1995 debris flow were completed in 1997 (included constructing a debris basin, riprap placement, and planting). Enhancement proposals for MacKay Creek include side channel development, realignment of the river, and re-creation of the estuary. Emsley Creek has also been enhanced and additional enhancement proposals for this creek include side channel development and storm drain marking programs. Storm drain marking has been done throughout the watershed.

Fish Production

Chum spawn from the area 200 m downstream of Marine Drive to the TransCanada Highway. Coho and steelhead spawn from Marine Drive upstream throughout up to the creek to the fish barrier at Montroyal Blvd. Cutthroat trout spawn throughout the system. The escapements for all species are very low.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, there has been extensive clearing to accommodate development.

Secondary Industry/Commercial

BC Rail, the Vancouver Port Corporation, autobody shops, and other light industries are located along the lower reaches. Seaspan’s tug and barge towing operation is located at the mouth of the creek.

Linear Development

MacKay Creek is crossed by the TransCanada Highway, Marine Drive, and a few city streets (Welch, Ridgeway, Montroyal, Prospect, Ranger). BC Railway crosses the creek at its mouth immediately south of Welch Street.

Urban Development

The watershed is heavily developed as residential up to the Grouse Mountain gondola area. Several of the larger neighbourhoods include Hamilton, Norgate, Lionsview, Capilano Highlands, Forest Hills, Canyon Heights, Cleveland Park, and Grousewoods. There are recurrent development applications on this system which propose to divert, dyke, infill or modify the floodplain and mouth of MacKay Creek. The Grouse Mountain ski area has a number of buildings and roads in the watershed; some ski hill activities (such as snow making) may affect natural water supply.

Government

MacKay Creek is in the District of North Vancouver and the City of North Vancouver (Greater Vancouver Regional District).

Designated Lands

MacKay Creek flows through MacKay Creek, Heywood, and Murdo Frazer Parks.

Watershed Planning Issues

Management Concerns

- Grouse Mountain ski area activities may be a concern to downstream water supply and quality.
- The intensive development in this watershed increases the risk of spills, stormwater impacts on water quality and quantity, riparian removal, unauthorized instream works and bank alterations, and channel modifications.

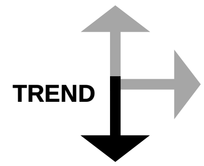
Management Prescriptions

- The District of North Vancouver should be encouraged to maintain, and possibly expand, its comprehensive Environmental and Preservation Bylaw which protects, preserves, and conserves natural settings and ecological systems of trees, watercourses, soils and lands. The City of North Vancouver should be encouraged to develop similar provisions that would give a consistent level of protection throughout the watershed.
- Pink and chum smolt releases could be undertaken to enhance runs (coho is already being released into the stream).
- Fishways at Montroyal Blvd. could be installed to improve fish passage.
- In addition to the enhancement efforts by volunteers in this watershed, additional stewardship activities are required which focus on preventing spills and reducing stormwater impacts on stream water quality, protecting and restoring riparian habitat, land owner contact, improving public awareness, preventing stream encroachments, and advocacy.
- Stormwater and debris management plans are urgently required for this watershed. Future stormwater infrastructure especially needs to be developed within the framework of a management plan.
- The restoration of an estuary area would provide a resting and feeding area for fish, as well as habitat for other wildlife.

- Developing off-channel habitat can help to protect fish during summer and winter extreme flows.
- Recreational access throughout this system needs to be carefully managed.
- Redevelopment proposals in this watershed should be encouraged to increase setbacks from top of bank, modify the development footprint, or restrict access to the watercourse.

Mosquito Creek

Watershed Code: 900-0690-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0850
TRIM Map: 92G035



Declining

STATUS:

Endangered - Mosquito Creek has been impacted by urbanization (riparian removal, channelization, poor water quality and high effective impermeable area). The estuary has been lost.

Physiography

Drainage Area

The drainage area of Mosquito Creek is approximately 14.5 km^2. Its tributaries are Wagg, Mission and Thain Creeks. Mosquito Creek flows south through North Vancouver into Burrard Inlet at the Mosquito Creek marina. The mouth of the stream historically supported a large estuary, which has been dredged and filled, and no longer exists.

Stream Description

Mosquito Creek is a small, fast moving stream that originates on the forested east slope of Grouse Mountain. In the upper watershed, the creek flows through a canyon; most of the lower part of the creek is channelized. Large boulders in the upper reaches create many small waterfalls and chutes. Ravines and parkland afford the creek some protection in developed areas of the watershed.

Hydrology

This is a naturally flashy system with no flow control. There is a small debris basin at Evergreen before the creek goes underground. Low to moderate flows dominate in midsummer. Peak flows relative to return periods for Mosquito Creek are 62 m^3/s for the 100 year return interval; and 72 m^3/s for the 200 year return period.

Channel Stability Assessment (Preliminary)

The system is geologically active and produces significant sediment and debris. The gravel and debris transport associated with the high discharges commonly cause channel shifts. The average channel width is 10 m and bank height is 2 m. Approximatley 0.5 km of the channel was enclosed in the 1950’s, and major channel stabilization works were undertaken in the 1980’s. Approximately 20% of the remaining stream bank is unstable. The bed material consists of large cobbles and boulders (90%) and gravel (10%).

Fisheries Resource

Fish Access

Anadromous fish have access up to an impassable culvert located at Queens Road, above the TransCanada Highway.

Fish Stocks

Mosquito Creek and its tributaries support populations of coho salmon, cutthroat, and steelhead.

Restoration/Enhancement

DFO and MELP have transplanted coho salmon and cutthroat trout into Mosquito Creek. Students release fry (from Capilano hatchery) into the stream through the Salmonids in the Classroom program. Proposals to create side channels below Queens Road have resulted in the construction of two backwater channels, one by the City of North Vancouver and one by the Ministry of Transportation and Highways. Plans are being submitted for a side-channel in Griffin Park for 1998, with DFO, the District of North Vancouver, and North Shore Streamkeepers involved.

Fish Production

Coho have been noted spawning in the lower part of Thain Creek (tributary of Wagg Creek) (North Shore Streamkeepers' spawner survey).

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

The watershed was extensively logged at the turn of the century, and again in the 1960's and 1970's. Significant clearing has occurred to accommodate residential and commercial development, much of which is immediately adjacent to the creek on both banks.

Secondary Industry/Commercial

A marina (Mosquito Creek Marina) is located at the mouth of the creek. The lower reaches of Mosquito Creek are heavily industrialized (auto wreckers, sheetmetal manufacturing, municipal works yards, railway and marine terminals).

Linear Development

Mosquito Creek is crossed by the TransCanada Highway (Hwy. 1), Marine Drive and a number of city streets and roads. The channel has been enclosed in a .5 km long culvert above Queens Road. The BC Railway mainline crosses the creek at its mouth. The extension of the low level connector road will create a major thoroughfare and a four lane bridge crossing at the intersection of Fell and Welch Streets near the mouth of the creek (completed 1997/1998).

Urban Development

The watershed is heavily urbanized and there has been significant development and encroachment into riparian areas throughout the watershed. There are also ongoing and significant water quality problems in this drainage.

Government

Mosquito Creek is in the District of North Vancouver and the City of North Vancouver (Greater Vancouver Regional District).

Designated Lands

The mouth of Mosquito Creek is located on the Mission Indian Reserve #1. Mosquito Creek originates in forested undeveloped reserve in the District of North Vancouver. The lower reaches of Mosquito and Thain Creeks flow through Mosquito Creek Park and William Griffin Park, while Wagg and Mission Creeks flow through Mahon Park and Lonsdale Park respectively.

Watershed Planning Issues

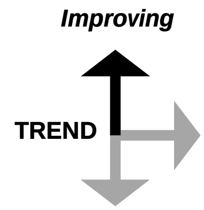
Management Concerns

- Many of the fish habitat attributes of Mosquito Creek have been eliminated by development.
- Water quality in the watershed has been compromised by stormwater discharges from residential development, and the City of North Vancouver Works Yard. Wagg Creek and Mission Creek have serious non-point source water quality problems. Activities at the Grouse Mountain ski area (i.e. snow making) may impact water quality.
- There may be some water quality and quantity impacts from snowmaking and resort activities from the Grouse Mountain Ski Resort.
- The stream has been significantly altered by flooding and flood control engineering works above the TransCanada Highway.
- A gravel trap on Evergreen Road, above Queens, results in loss of gravel and large substrate in the main channel downstream.
- The lack of refugia and gravel movement is a major problem in the creek.
- More than 70% of the estuary has been lost.
- The intensive development (and proposed redevelopment) in this watershed increases the risk of further water quality and quantity impacts from stormwater, spills, encroachments, loss of riparian area, unauthorized instream works, recreational/conservation trail use conflicts and bank/channel alterations.

Management Prescriptions

- Stewardship activities beyond those presently underway need to focus on improving public awareness, protecting and enhancing riparian habitat, improving water quality and preventing unauthorized discharges, stormdrain marking, signage, and advocacy for improved land use planning in the watershed.
- The remaining riparian habitat needs to be protected and replanted where possible.

- A comprehensive stormwater management plan is required for the watershed which addresses water quality and quantity as well as baseflow maintenance.
- Proposed redevelopment in this watershed should be encouraged to increase setbacks from top of bank, modify the development footprint, and restrict access to the watercourse.
- Developing off-channel habitat can help to protect fish during summer and winter extreme flows.
- The District of North Vancouver should be encouraged to maintain, and possibly expand, its comprehensive Environmental and Preservation Bylaw which protects, preserves, and conserves natural settings and ecological systems of trees, watercourses, soils and lands. The City of North Vancouver should be encouraged to develop similar provisions that would give a consistent level of protection throughout the watershed.



Lynn Creek

Watershed Code: 900-0669-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0800
TRIM Map: 92G035 and 92G045

STATUS:

Endangered - The lower reaches of Lynn Creek have been channelized and a significant amount of the riparian vegetation removed. The creek has significant and recurring water quality problems.
Wild - Most tributaries to Lynn Creek upstream of Lynn Canyon Park are relatively undisturbed.

Physiography

Drainage Area

The total watershed area of Lynn Creek is approximately 55.2 km^2. Its tributaries include Keith, Hastings, Kennedy, Wickenden, Norvan, Hanes, and Coliseum Creeks. A list of tributaries (and watershed codes) to Lynn Creek is provided in Appendix 1. Lynn Creek flows south into Burrard Inlet, west of the Seymour River at the Lynnterm marine terminals.

Stream Description

Lynn Creek originates in a forested area of the Lynn Headwaters Regional Park at an elevation of approximately 1500 m. The creek is over 18 km long and flows through a number of significant canyons. It has been described as a braided, shifting channel flowing across a wide, flat bottomed valley surrounded by steep mountains. Lynn Creek is characterized by a series of rapids and riffles with deep pools.

Hydrology

The Lynn Creek hydrograph reflects the strong influence of summer snow melt modified by fall and spring precipitation. There is no flow control on this system. The peak flows relative to return periods are 143 m^3/s for the 100 year return interval; and 165 m^3/s for the 200 year return period.

Channel Stability Assessment (Preliminary)

The watershed is active geologically and produces significant sediment and debris. Gravel and debris transport are associated with the snow melt discharges, and cause periodic debris flows and frequent channel shifting. The lower reaches on the fan experience significant bedload aggradation which requires periodic removal.

Fisheries Resource

Fish Access

Anadromous fish have access up to a rock barrier (Twin Falls) in Lynn Canyon Park, below the suspension bridge (5.6 km upstream).

Fish Stocks

Lynn Creek and its tributaries support populations of coho, pink, chum and chinook salmon; cutthroat, Dolly varden and steelhead trout. The coho stocks have been improving, and chinook and chum (small runs) are stable. Pink salmon are found only in the mainstem.

Restoration/Enhancement

Enhancement activities include historic releases of coho fry above the falls by DFO and Morten Creek SEP and in Lynn Canyon Park by the School District. Morten Creek SEP stocks Lynn, Coleman, Thames, Kilmer and Morten Creeks with coho fry, and Lynn Creek with chum fry. Hastings and Keith Creeks are now self-sustaining. An incubation box has been constructed on Morten Creek. Many successful enhancement projects, including fish ladders, have been completed on Hastings Creek. The Northshore Streamkeepers and Morten Creek SEP are actively involved with Hastings Creek. The other community groups that are active in the watershed include the Northshore Fish & Game Club, Northshore Streamkeepers, Seymour Salmon Society, and the Morten Creek Project. A fish ladder on Hastings Creek at Lynn Valley Road and Mountain Highway provides coho access to spawning beds in Hunter Park. A lower ladder on Hoskins Road/Arborlynn Drive provides access to Coleman, Kilmer, Thames and others. A hand excavated watercourse (Morten Creek) now flows into Lynn Creek (enters Lynn Creek through a culvert at the north end of the Premier St. landfill) and supports fish. Morten Creek has been the subject of several enhancement projects. Hoskins Creek is still not accessible; Morten Creek SEP is mapping the creek and looking into installing a fish ladder if habitat warrants. There are proposals to replace the culvert at the mouth of Keith Creek, and address other obstructions.

Fish Production

Chinook, coho, and steelhead spawn from the falls downstream to the Upper Levels Highway bridge. Chum spawn from Blue Pools downstream to Main Street; pinks spawn from the Upper Levels Highway downstream to Main Street.

Activities and Land Use

Agriculture

An equestrian centre operates in the lower Lynn watershed near Capilano College.

Mining

A gravel mine operated on Lynn Creek at the north end of the Premier Street landfill.

Forestry

There has been significant historic logging in this watershed. There has also been significant clearing to accommodate residential development on the west bank.

Secondary Industry/Commercial

There is heavy industrial land use along the lower reaches. The Municipal Works Yard is located between Keith Road and Main Street on the creek, and many warehousing, marine terminals, auto repair, heavy equipment storage, marinas, and lumber storage areas are located below Keith Road in the first kilometre of the stream. The estuary has been infilled and paved over by the industrial development and expansion in lower Lynn Creek. The closed Premier Street landfill is located on the creek approximately 2 km upstream of the mouth. This landfill caused the stream to be channelized and significant leachate problems. In the late 1970s a major washout of the landfill took place. Fisheries Act charges were laid.

Linear Development

Lynn Creek is crossed by the TransCanada Highway (Hwy.1) and Main Street. There is a pedestrian bridge at the confluence of Lynn and Hastings Creeks. The lower reaches (below the landfill) have been dyked, and there are numerous city roads and streets throughout the watershed. The CN Railway crosses Lynn Creek at its mouth immediately south of Cotton Road.

Urban Development

Upper Lynn and Westlynn neighbourhoods are located along the west side of the creek. There has been severe encroachment into the riparian areas and significant riparian loss on all tributaries to Lynn Creek. Fugitive chlorine spills from swimming pools, other spills and contaminated stormwater runoff have severely impacted many of the tributaries.

Government

Lynn Creek is in the District of North Vancouver (Greater Vancouver Regional District).

Designated Lands

Lynn Creek flows through the Lynn Headwaters, Seylynn, Bridgeman, and Lynnmouth (at the mouth of the creek) Parks. Kennedy Creek flows through Lynn Canyon Park, and the lower reaches of Keith Creek flow through a municipal park. Hastings Creek flows through Princess and Hunter Parks.

Watershed Planning Issues

Management Concerns

- The estuary has been lost due to urban/industrial development.
- The Premier Street landfill, which is located at approximately 0.5 km upstream of the mouth, is now required to collect and treat leachates before discharging; however, the groundwater collection ponds for the landfill have been known to overflow into the creek.
- Dredging in the lower system is required to address gravel accumulation and floodproofing concerns.

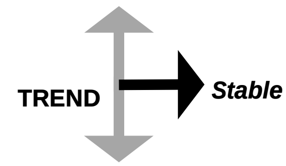
- Keith, Hastings and Thames Creeks all have serious non-point source water quality problems.
- Water withdrawals from Kennedy Lake by Grouse Mountain Ski Resort to make snow in the winter, and Grouse Mountain Road run-off are both major concerns.
- The intensive residential/commercial and industrial development in this watershed places it at significant risk for water quality and quantity problems, riparian loss, channel modifications/diversions, unauthorized bank works and unmanaged access.

Management Prescriptions

- A gravel management plan is required to minimize routine gravel scalping.
- A comprehensive stormwater management plan for the entire drainage is required to address stream water quality and quantity as well as maintenance of baseflows during development and redevelopment in the watershed.
- In addition to the enhancement efforts of volunteers in this watershed which need to be supported, additional stewardship initiatives are required which focus on riparian protection/restoration, preventing spills and unauthorized discharges, landowner contact to discourage stream encroachments, bank alterations and riparian removal, and enhance public awareness.
- Proposed redevelopment in this watershed should be encouraged to increase setbacks from top of bank, modify the development footprint, and restrict access to the watercourse. A program for acquisition of riparian areas that have been severely compromised as part of private lot development can be undertaken.
- Sediment erosion control and setback dyking are needed for Hastings Creek to reduce flood risk and maintain somewhat natural channel morphometry.
- The District of North Vancouver should be encouraged to maintain, and possibly expand, its comprehensive Environmental and Preservation Bylaw which protects, preserves, and conserves natural settings and ecological systems of trees, watercourses, soils and lands. The City of North Vancouver should be encouraged to develop similar provisions that would give a consistent level of protection throughout the watershed.

For escapement information on Lynn Creek, see Appendix 3.

Seymour River



Watershed Code: 900-0661-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0700
TRIM Map: 92G035, 92G036 and 92G046

STATUS:

Endangered - Urbanization, impoundment and diversion of flows, and historic logging in the watershed have significantly impacted the Seymour River. The estuary of the Seymour River has been extensively modified.

Wild - Several tributaries to Seymour Lake, and to Seymour River above the lake, are largely wild.

Physiography

Drainage Area

The Seymour River watershed is 176 km^2 in size. The tributaries include Maplewood, First Lake, Hydraulic, Paton, Gibbens, Boulder, Burwell, Fannin, Orchid, Belfour, Shera, and Clipper Creeks. A list of tributaries (and watershed codes) to the Seymour River is provided in Appendix 1. The river flows south from Seymour Lake into the Second Narrows of Burrard Inlet.

Stream Description

The Seymour River watershed is a mountain fed system that originates in the Fannin Range and drains into the Seymour reservoir which is created by the Seymour Dam. The river is 19 km long below the dam and flows in a braided, shifting channel across a wide, flat bottomed valley confined by steep mountains before entering the lower gradient reaches below Mount Seymour Parkway and discharging to Burrard Inlet, east of the Second Narrows Bridge. The river is characterized by a long series of rapids and riffles with deep pools.

Hydrology

The Seymour River is a regulated river. The reservoir, which is considered fairly small at 28,000 acre feet, is one of three reservoirs in the Lower Mainland which support the Greater Vancouver Water District (GVWD) municipal water supply. Under agreement with DFO the GVWD now releases flows from the reservoir for fish that range from 20 ft^3/s to 48 ft^3/s (0.56 - 1.34 m^3/s). An experimental release of water was planned for the fall of 1997, during which time the flows would be incrementally ramped up over 7 days to simulate fall high flows. These increased flows will be assessed with respect to the effect they have on downstream wetted width, available habitat area, and fish migration behaviour. Release volumes are dependent upon the time of year and the amount of storage remaining in the reservoir; however, the total monthly discharges from Seymour Falls Dam typically range from greater than 30 m^3/s in late winter to less than 1.0 m^3/s in late summer.

Channel Stability Assessment (Preliminary)

The fact that the river is regulated results in relatively stable channel morphology, as naturally high flows are dampened by impoundment.

Fisheries Resource

Fish Access

Anadromous fish have access to the Seymour Dam located 19 km upstream of the mouth. Maplewood Creek access is limited by a partial obstruction at the outlet from Maplewood Farm, and a total barrier under the Mount Seymour Parkway. A narrow gorge located 4 km upstream of the mouth is passable in all but extreme high or low flows; enhancement activities (i.e. blasting) were done in 1980's to improve passage through this obstruction.

Fish Stocks

The Seymour River and its tributaries support populations of coho, pink, chum, and chinook salmon; steelhead, cutthroat, Dolly varden and rainbow trout. Some anadromous fish in the Seymour are believed to be strays from the Capilano system.

Restoration/Enhancement

The Seymour River hatchery is located at the dam 19 km upstream, the flows for which are provided by leakage from the dam. Enhancement activities include incubation, rearing and overwintering ponds and spawning channels, obstruction removal, managing a counting fence, and conducting sampling and mark recovery programs. A transplant of 92 coho was undertaken near Edgewater Park by the North Vancouver School District in 1991. Enhancement projects on Junior Creek added 2 km of new habitat, and created coho ponds and spawning channels. Twenty thousand coho were planted above the dam in 1997. Rice Lake is routinely stocked with trout by the Fraser Valley Trout Hatchery.

Fish Production

All salmon stocks have been enhanced. The populations of pink, chum, and chinook are rebuilding. Coho stocks are fairly stable, but vary from year to year. Chum and pink salmon spawn between the Dollarton Highway and the gorge at 4 km. Coho spawn mainly in the upper reaches 3.2 km below the dam. Chinook spawning is concentrated at spur 7 which is located approximately 15 km upstream of the mouth. Pink salmon have been observed above the gorge; however, access beyond this point is dependent upon water releases from the dam.

Activities and Land Use

Agriculture

There is a small demonstration farm on Maplewood Creek. This farm has caused water quality problems in the past from keeping excessive livestock in a small area. There is an equestrian center on Mount Seymour Parkway/Riverside Drive.

Mining

None.

Forestry

Logging has occurred above the dam in the past, and selective harvesting for forest management is still occurring. A moratorium on further logging was put in place until a review (1997) of logging in the 3 GVWD watersheds (Capilano, Seymour, Coquitlam) is complete.

Secondary Industry/Commercial

The Seymour watershed is one of three Lower Mainland watersheds managed by the GVRD as a domestic water supply source. The lower watershed (below Dollarton Highway) is industrialized and includes ship building and repair facilities, warehousing, automotive repairs, metal recycling and other industries, as well as significant rail loading and unloading facilities. The estuary has been reduced to a fraction of its original size as a result of the industrial development and expansion in the lower river. An abandoned gravel sorting area in the lower watershed is now being developed for commercial purposes, and a major retail outlet has been constructed.

Linear Development

A GVRD road parallels the Seymour River up to the Seymour Dam, which sees much use by recreational bikers and rollerbladers on weekends and during the summer. Two large municipal thoroughfares (Dollarton Highway and Mount Seymour Parkway) cross the lower river while Riverside Drive parallels the river on the east bank for several kilometeres. The lower 3 km (up to 500 m above the Grantham bridge) have been dyked on both banks. Maplewood Creek was diverted in the early 1980s as part of the building of the Seymour Parkway. BC Hydro has several right of ways through the watershed. The CN Railway crosses the river at its mouth, and encroached into the estuary in the mid 1980s as part of railroad upgrades.

Urban Development

Extensive urban development has occurred along the lower reaches of the river. There are several large residential neighbourhoods in the drainage including Seymour, Riverside, Blueridge and Maplewood.

Government

The Seymour River is in the District of North Vancouver (Greater Vancouver Regional District).

Designated Lands

The Mount Seymour Demonstration Forest, Capilano College, the North Vancouver Cemetery and Seymour Creek Indian Reserve #2 are located within the watershed. The upper watershed of the Seymour River is in a protected watershed managed by the GVRD as a domestic water supply source. The river flows through the Seymour Demonstration Forest, Lynn Creek and Riverside Parks. The upper reaches of Maplewood Creek are protected in Maplewood Park.

Watershed Planning Issues

Management Concerns

- There have been discussions regarding bringing water from the Capilano watershed into the Seymour River system. This would involve a new treatment plant using chlorination and ozonation to disinfect drinking water, which would potentially discharge treated water into a settling pond, and then into the Seymour River below Rice Lake. However, this plan has been put on hold (water will not be brought in from the Capilano and the treatment plant not built), and will be reviewed five years from now (2002).

- There have been several fish kills (including those resulting from low dissolved oxygen and high ammonia concentrations) in Maplewood Creek. Manure leachate and runoff from equestrian centres and farms are a concern.
- The mainstem of the Seymour River is becoming flashy, impacting rearing and spawning potential.
- Steelhead and coho have been subject to heavy sport fishing.
- CN Rail and Squamish First Nations have dredged the mouth of the river. The estuary has been virtually lost.
- The intensive development in the lower watershed increases risks of spills and unauthorized discharges, stormwater impacts on stream water quality and quantity, riparian removal, floodproofing and encroachments, bank alterations and unauthorized instream works.

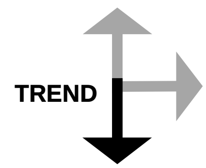
Management Prescriptions

- A flow agreement with the GVRD is required to establish minimum and flushing flows for fish and fish habitat protection and could be developed as part of any dam upgrading proposal.
- Back channels and side channels would help to counter the impact of an increasingly flashy system on rearing and spawning areas. Sidechannels have been constructed in most of the feasible areas. Seymour Hatchery and other organizations have researched where back or sidechannels could be constructed, finding that Spur 4 is the only remaining spot. Construction of a sidechannel at this location would involve a great deal of funding and work.
- Gravel should be added to the reaches where it is deficient.
- In addition to the volunteer efforts at the Seymour hatchery and other Streamkeeper activities which need to be supported, additional stewardship initiatives are required which focus on protecting water quality, preventing spills, protecting or rehabilitating riparian habitats, managing access, fostering community outreach, and increasing public awareness.
- The demonstration kiosks and education programs in the demonstration forest could be expanded to include education on urban watershed protection problems and solutions.
- Should the water treatment plant proceed at a later date, it should be required to dechlorinate the backwash and either discharge to ground (exfiltration gallery) or locate discharges in the most sensitive manner possible.
- The District of North Vancouver should be encouraged to maintain, and possibly expand, its comprehensive Environmental and Preservation Bylaw which protects, preserves, and conserves natural settings and ecological systems of trees, watercourses, soils and lands. The City of North Vancouver should be encouraged to develop similar provisions that would give a consistent level of protection throughout the watershed.

For escapement information on the Seymour River, see Appendix 3.

McCartney Creek

Watershed Code: 900-0644-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0690
TRIM Map: 92G036



Declining

STATUS:

Endangered - Riparian removal, urbanization, culverting, and degraded water quality are impacts on McCartney Creek.

Physiography

Drainage Area

The total watershed area of McCartney Creek is approximately 4.6 km^2. McCartney Creek flows southwest then south into Burrard Inlet at Maplewood Flats, North Vancouver.

Stream Description

McCartney Creek (approximately 2.2 km in length) has a moderately low gradient but is a flashy system which originates in a forested area of Seymour Heights, at an elevation of approximately 300 m, and flows through a series of cascades before entering the Maplewood Flats wetland. The lower reaches are developed in a mix of older and new residential neighbourhoods. Maplewood Flats (approximately 95 ha) is classified as 94% tidal marsh and 6% estuarine marsh.

Hydrology

The peak flows on McCartney Creek relative to return periods are 11.8 m^3/s for a return period of 10 years; 17.7 m^3/s for a 100 year return period; and 19.8 m^3/s for a 200 year return period. The creek is described as very flashy and midsummer flows are generally low to moderate.

Channel Stability Assessment (Preliminary)

McCartney Creek has a steep incline and flows through a series of steps. The average channel width is 2.5 to 4.0 m with an average wetted width of 1.0 to 2.5 m. Ravine instability problems have emerged on a Blueridge Creek tributary. Bedload aggradation problems in the vicinity of the Dollarton Highway have necessitated bedload removal.

Fisheries Resource

Fish Access

Anadromous fish have access up to an impassable falls 0.3 km upstream from the mouth. There are culverts under both the Mount Seymour Parkway (impassable) and the Dollarton Highway (passable). Resident cutthroat trout are found above the Mount Seymour Parkway.

Fish Stocks

McCartney Creek supports populations of coho and chum salmon; and cutthroat trout.

Restoration/Enhancement

The Capilano hatchery transplanted 60,000 coho eggs into the creek with SEP volunteers between 1982 and 1986. There are plans to rebuild chum stocks to historic levels.

Fish Production

Coho spawning has been observed in the first 250 m of the creek. Chum have also been observed spawning in the area but in very small numbers.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed any longer, significant clearing of the watershed has occurred.

Secondary Industry/Commercial

Commercial development is largely limited to that which supports residential development (i.e. retail).

Linear Development

The creek is crossed by the Dollarton Highway and is culverted beneath Mount Seymour Parkway. There are numerous city roads and streets throughout the watershed.

Urban Development

The creek runs through the residential neighbourhood of Seymour Heights. Additional residential development has been proposed in the watershed near the Blair Rifle Range.

Government

McCartney Creek is in the District of North Vancouver (Greater Vancouver Regional District.)

Designated Lands

McCartney Creek flows through McCartney Creek Park and Maplewood Flats.

Watershed Planning Issues

Management Concerns

- The proposed housing development in the Blair Rifle Range near the headwaters is a concern.
- Soils in the upper watershed have elevated levels of lead and copper, as do creek sediments.
- The intensive development in the watershed increases the risk of altered water quality and quantity (from stormwater discharges), contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.
- There are numerous obstacles to migration located between Mount Seymour Parkway and Dollarton Highway.
- There is significant angling pressure near the mouth of the creek which may be responsible for low adult escapement.

Management Prescriptions

- The public interest groups (i.e. Wild Bird Trust) who are working with local government to clean up the Maplewood Flats wetland need to continue to be supported.
- Additional stewardship activities are required which focus on riparian protection or re-establishment, improving water quality, preventing stream encroachments, managing access, discouraging instream works, fostering community outreach programs, and increasing public awareness.
- Selective log jam removal below Northlands Road should be investigated as a means of improving fish access.
- A fishway at Mount Seymour Parkway is needed to provide anadromous fish access into the rest of the watershed.
- The District of North Vancouver should be encouraged to maintain, and possibly expand, its comprehensive Environmental and Preservation Bylaw which protects, preserves, and conserves natural settings and ecological systems of trees, watercourses, soils and lands. The City of North Vancouver should be encouraged to develop similar provisions that would give a consistent level of protection throughout the watershed.

Parkside Creek

TREND ***Stable***

Watershed Code: 900-unavailable Burrard Inlet tributary
RAB Code: 90-2800-120
TRIM Map: 92G036

STATUS:

Threatened - Portions of Parkside Creek have been culverted and channelized, and the creek has water quality problems.

Physiography

Drainage Area

The total watershed area of Parkside Creek is approximately 1.2 km^2. The creek flows into Deep Cove in Burrard Inlet at Cove Cliff.

Stream Description

Parkside Creek is a small, low gradient groundwater fed system. The lower reaches have been scoured and the stream bed is predominately composed of coarse, bouldery gravels. The upper watershed is forested and is located on lower Mount Seymour. The middle reaches are located on Indian River benchland which has been the site of some recent urban development. The lower reaches in Deep Cove are significantly developed.

Hydrology

Peak flows relative to return periods are 2.1 m^3/s for a 2 year return period; 3.0m^3/s for 10 year return, 3.5 m^3/s for 25 years; and 4.2 m^3/s for 100 year return period.

Channel Stability Assessment (Preliminary)

Parkside Creek is relatively low gradient with moderately low sediment transport capability. Significant sections of Parkside Creek have been culverted.

Fisheries Resource

Fish Access

Anadromous fish have access up to an impassable culvert at Cove Cliff Road approximately 1.0 km upstream.

Fish Stocks

Parkside Creek supports populations of coho salmon and cutthroat trout.

Restoration/Enhancement

Several restoration/enhancement projects have been completed in the system by Cove Cliff Elementary school in conjunction with the District of North Vancouver. Projects have included construction of a side channel, incubation boxes, and stream cleanups. A fishway at the mouth of the creek is proposed as the system is only accessible to anadromous fish at high tide.

Fish Production

There is no specific information concerning fish production available.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial forest harvesting in the watershed, there has been significant clearing to accommodate residential development.

Secondary Industry/Commercial

Commercial development is largely limited to that which supports residential development (i.e. retail).

Linear Development

A few municipal roads and streets cross the creek including Cove Cliff Road, Dollarton Highway, Deep Cove Road and Cliffmont Road.

Urban Development

The creek is surrounded by residential development in the Cove Cliff neighbourhood.

Government

Parkside Creek is in the District of North Vancouver (Greater Vancouver Regional District).

Designated Lands

There are several municipal parks in the watershed including Parkside Park and Deep Cove Park.

Watershed Planning Issues

Management Concerns

- There have been a number of spills and fugitive discharges to Parkside Creek and two fish kills.
- The intensive development in the watershed increases the risks of poor water quality and reduced flows due to impervious surface areas, unauthorized instream works, bank alterations, stream channelization and culverting, and riparian vegetation removal.

Management Prescriptions

- Stewardship initiatives which focus on improving water quality, preventing encroachments into the channel and floodplain, stormdrain marking, signage and access management, landowner contact, and increasing public awareness are required.
- The District of North Vancouver should be commended for, and encouraged to maintain and possibly expand, its comprehensive Environmental and Preservation Bylaw which protects, preserves, and conserves natural settings and ecological systems of trees, watercourses, soils and lands.

Richards Creek

TREND ***Stable***

Watershed Code: 900-0527-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0390
TRIM Map: 92G036

STATUS:

Threatened - Linear development and some urban influences impact Richards Creek.

Physiography

Drainage Area

The total watershed area of Richards (Buntzen Bay) Creek is unknown. The creek flows west into Buntzen Bay in Indian Arm.

Stream Description

Richards Creek is a steep, fast, cascading stream with intermittent flows. It originates in the mountains north of Tangled Summit. The stream flows underground for a short distance.

Hydrology

No data are available.

Channel Stability Assessment (Preliminary)

Flashy flows and flooding have created an unstable channel. Sections of the bank have been rip-rapped to prevent erosion. These modified banks may require continual maintenance.

Fisheries Resource

Fish Access

Anadromous fish access is restricted to the first 300 m above the mouth whereupon the gradient becomes a natural barrier to migration.

Fish Stocks

Richards Creek supports populations of chum, chinook, and coho salmon, and cutthroat trout.

Restoration/Enhancement

A community hatchery operates on Richards Creek.

Fish Production

A hatchery operated by the Buntzen Bay Residents group produces chinook and coho smolts. Each year 40,000 chinook and 2000 coho fry are released into Richards Creek. Spawning habitat is limited in the system. Boulder pools provide good rearing habitat for cutthroat trout juveniles.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

None.

Secondary Industry/Commercial

None.

Linear Development

A hydro right-of-way and power line cross the creek about 1 kilometre from the mouth.

Urban Development

Three houses are presently located at the mouth of Richards Creek.

Government

Richards Creek is in the City of Port Moody (Greater Vancouver Regional District).

Designated Lands

A BC Hydro right-of-way passes through the watershed.

Watershed Planning Issues

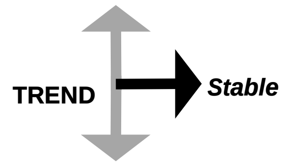
Management Concerns

- The natural flows in the stream are extremely variable and both the stream banks and bed are unstable.

Management Prescriptions

- Should any development be planned, the stream requires proper setbacks and stormwater management.
- The boulder pool habitat should be protected, as it recruits gravel and provides a good holding area for fish during high flows.

Windermere Creek



Watershed Code: 900-0505-000-000-000-000-000-000-000-000-000-000
RAB Code: Unavailable
TRIM Map: 92G036

STATUS:

Threatened - Windermere Creek is threatened due to its proximity to urbanizing areas.

Physiography

Drainage Area

The total watershed area of Windermere Creek is unknown. The creek flows westward from Sasamat Lake into Bedwell Bay, in Indian Arm.

Stream Description

Windermere Creek is a small stream which drains Sasamat Lake and the surrounding highlands.

Hydrology

No information is available.

Channel Stability Assessment (Preliminary)

The small creek system is buffered by a lake and regulated by a weir dam at the lake outlet. As a result both flows and channel morphometry are considered stable.

Fisheries Resource

Fish Access

Anadromous fish have access to a cascade barrier located 200 m upstream from the mouth of the creek.

Fish Stocks

Windermere Creek supports populations of coho salmon and cutthroat trout.

Restoration/Enhancement

The Bedwell Bay Barnacle Club operates a sea rearing pen, which held 50,00 chinook and 10,000 coho smolts in 1997. The Seymour hatchery released coho fry into the creek in 1994. While there have been proposals to construct a fishway into the lake, low lake levels from November to May appear to be the limiting factor for access.

Fish Production

There is no specific information concerning fish production potential available.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

None.

Secondary Industry/Commercial

None.

Linear Development

None.

Urban Development

The watershed is urbanized from the lake down to the mouth of Windermere Creek. The riparian area has been impacted by this development. A campsite is located at the lake adjacent to the creek. Sasamat Lake has heavy recreational use, causing some coliform and water temperature concerns.

Government

Windermere Creek is in the Village of Belcarra (Greater Vancouver Regional District).

Designated Lands

Windermere Creek originates in Sasamat Lake which is located in Belcarra Regional Park.

Watershed Planning Issues

Management Concerns

- Recreational use of the lake, and the campsite at the lake, adjacent to Windermere Creek, causes some water quality concerns.

- The potential for development in the Belcarra area increases with increased population pressure. Development would increase risks of altered water quality and quantity (from stormwater), spills and other fugitive discharges, unauthorized instream works, bank alterations and encroachments, and riparian vegetation removal.
- Garbage and litter in the creek is an ongoing concern.

Management Prescriptions

- The park designation could be expanded to ensure the creek is protected from urbanization in perpetuity.
- Water quality monitoring of Sasamat Lake will help to determine whether water quality issues need to be addressed on Windermere Creek.
- Proactive stewardship initiatives on this system could include improved signage, stream cleanups, sensitive access planning and management and landowner contact to improve public awareness

Schoolhouse Creek (North)

TREND *Stable*

Watershed Code: 900-unavailable Burrard Inlet tributary
RAB Code: 90-0300
TRIM Map: 92G026 and 92G036

STATUS:

Endangered - Schoolhouse Creek (North) has been impacted by urbanization and reduced water quality.

Physiography

Drainage Area

Schoolhouse Creek (North) is located in on the north side of Port Moody Arm. The mouth of the creek is located on the north shore of Burrard Inlet, approximately 50 metres east of 1st Avenue.

Stream Description

Schoolhouse Creek (North) is approximately 2.0 km long. The source of creek flows is natural runoff. The creek has a south aspect and meanders through a second growth Coastal Western Hemlock forest before discharging to Burrard Inlet at Ioco.

Hydrology

Schoolhouse Creek (North) has an average gradient of 5% and an average discharge of 0.07 m^3/s. The mean velocity is 0.47 m/s.

Channel Stability Assessment (Preliminary)

Unstable banks upstream of Ioco Road increase erosion concerns and pose a threat to water quality.

Fisheries Resource

Fish Access

Fish appear to have access to the headwaters (approximately 2.0 km upstream of the mouth).

Fish Stocks

Schoolhouse Creek (North) supports populations of coho and chum salmon, and cutthroat trout. The habitat is most suited to spawning coho and chum salmon; some areas provide potential rearing habitat for coho fry.

Restoration/Enhancement

Coho fry from Mossom Creek Hatchery are released into Schoolhouse Creek (North) annually. A fish ladder is located approximately 60 m upstream from the mouth.

Fish Production

There is no specific information concerning fish production available. However, very few pools are present on Schoolhouse Creek (North) meaning that this is a limiting factor as rearing habitat for coho fry.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

There has been some clearing to accommodate development in Anmore.

Secondary Industry/Commercial

The commercial activity in this watershed is largely limited at present to that which supports residential development (i.e. retail).

Linear Development

Schoolhouse Creek (North) is crossed by Ioco Road, Sunnyside Road, and the Canadian Pacific Railway.

Urban Development

There has been some very limited residential development to date in the Anmore portion of the watershed.

Government

Schoolhouse Creek (North) is in the City of Port Moody and the Village of Anmore (Greater Vancouver Regional District).

Designated Lands

Schoolhouse Creek (North) flows through a government reserve located immediately above Ioco Road.

Watershed Planning Issues

Management Concerns

- There have been several toxic spills and there are concerns associated with garbage/litter and sediment laden discharges into the creek. There is a large amount of metal debris in the downstream portion of the creek which could create water quality problems.
- There are ongoing maintenance issues associated with a fishladder that was constructed by DFO in the 1970's. Debris accumulation has created washout concerns - maintenance is the responsibility of Ministry of Transportation and Highways and is not consistently done.
- The potential for development in this watershed increases as population pressure increases and with potential development come increased risks of spills, stormwater impacts (water quality and quantity), unauthorized stream encroachments and instream works, bank alterations and removal of riparian vegetation.
- Unstable banks may create sedimentation that will lead to excess silltation smothering spawning beds.

Management Prescriptions

- The potential barriers to fish migration should be investigated and addressed.
- Municipal policies, bylaws or area designations could proactively be used in this watershed to maintain open streams, prevent water quality deterioration, prohibit riparian vegetation removal, prevent erosion, reduce impervious surfaces and maintain fish passage.
- Port Moody and Anmore should develop and implement an Environmentally Sensitive Areas Strategy to protect and maintain important fish producing streams such as Schoolhouse Creek (North) in the face of increasing development pressure.
- Proactive stewardship activities are required on this creek to protect and restore riparian vegetation, improve water quality, prevent stream encroachments, manage anticipated access issues, discourage unauthorized instream works and foster community awareness and support for protecting fish habitat in this system.

Mossom Creek

TREND *Stable*

Watershed Code: 900-0463-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0320
TRIM Map: 92G026 and 92G036

STATUS:

Threatened - Impacts related to urbanization in the watershed affect Mossom Creek (stream flow, water quality).

Physiography

Drainage Area

Mossom Creek originates northeast of the East Road and Water Street junction in Ioco. It flows southwest from its mountainside source, passes beneath Ioco Road and enters Burrard Inlet at Dockrill Point.

Stream Description

Mossom Creek is a small stream which originates near Eagle Mountain. The creek is characterized by steplike sequences of cascades, riffles, and pools. The gradient in the steep and rocky creek varies from 4 to 13%. It has good riparian crown closure over it and good spawning gravel.

Hydrology

The average mean velocity of Mossom Creek is 0.54 m/s. Flow levels are rated as moderate. The average discharge of Mossom Creek is approximately 0.32 m^3/s.

Channel Stability Assessment (Preliminary)

The creek banks are very stable. Vegetation, boulders, and large organic debris help to stabilize the channel. The stream bed is primarily composed of boulders with some cobble, gravels, and fines.

Fisheries Resource

Fish Access

Anadromous fish have access to a culvert (37 m) 0.5 km upstream, which is passable at high flows.

Fish Stocks

Mossom Creek supports populations of chum, coho, and pink salmon, and cutthroat trout.

Restoration/Enhancement

The Burrard Inlet Marine Enhancement Society/Centennial School operates a hatchery on Mossom Creek, which releases coho fry and smolts into the creek. This program is funded by a partnership composed of schools, private companies and government. Chum are reared in seapens in Burrard Inlet near the Ioco Boat Club.

Fish Production

Chum spawn from the mouth of Mossom Creek to approximately 100 m above Ioco Road. Coho spawning has been observed up to 1.4 km above Ioco Road.

Activities and Land Use

Agriculture

There are several hobby farms in Anmore.

Mining

None.

Forestry

There is some private logging on small parcels of land in Anmore, and there has been some clearing to accommodate residential development in the lower watershed (i.e. Sunnyside).

Secondary Industry/Commercial

Commercial development is largely limited to that which supports residential development (i.e. retail), although the creek runs through Imperial Oil lands. The refinery is located approximately 1 km east of the mouth of Mossom Creek.

Linear Development

Mossom Creek is crossed by East Road approximately half way up the drainage and by Ioco Road near the mouth.

Urban Development

Mossom Creek is located between the Anmore residential areas in Ioco and the Sunnyside residential area in Port Moody. Urban development in Anmore is expected to increase significantly as population pressure increases.

Government

Mossom Creek is in the City of Port Moody and the Village of Anmore (Greater Vancouver Regional District).

Designated Lands

The lower reaches of Mossom Creek immediately above Ioco Road flow through a government reserve.

Watershed Planning Issues

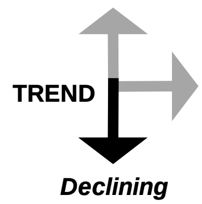
Management Concerns

- The potential development in Anmore and the City of Port Moody increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.
- Fish passage problems at the culvert are a concern and should be investigated.

Management Prescriptions

- Municipal policies, bylaws and/or development permit designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce impervious area and maintain unobstructed fish passage are proactively required for this area. Efforts need to be coordinated with neighbouring municipalities to protect the watershed.
- The efforts of the Burrard Inlet Enhancement Society, which manages Mossom Creek hatchery with Centennial School, need to be encouraged. In addition, stewardship initiatives which focus on riparian protection, maintaining water quality, preventing stream encroachments, improving fish access, managing recreational access, discouraging unauthorized instream works, fostering community outreach and increasing public awareness of the fisheries values and conflicts in this watershed, are required.
- Replacement of the culvert on the downstream portion of this creek would improve the habitat of the lower sections of the creek, thus allowing more salmon to successfully travel upstream. Replacement of the culvert with a bridge is another solution to this situation.

Noons Creek



Watershed Code: 900-0453-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0300
TRIM Map: 92G026 and 92G036

STATUS:

Endangered - Noons Creek has been impacted by urbanization (i.e. high rate of effective impermeable area).

Physiography

Drainage Area

The total watershed area of Noons Creek is 4.7 km^2. Noons Creek flows south into Burrard Inlet, Port Moody Arm at Shoreline Park.

Stream Description

Noons Creek is about 11.5 kilometres long, and flows from Cypress Lake in Port Moody Conservation Reserve down the mountainside through a young second growth forest, a golf course, and several housing developments before entering Shoreline Park in Port Moody. Noons Creek runs through a number of culverts (there are more than 30 crossings over the creek), including the culvert at Panorama Road under Heritage Mountain Bridge, and another culvert at Ioco Road. Deep pools and undercut banks are prevalent throughout some mid-sections of the creek. The mouth of Noons Creek is a fertile estuary, tidal mudflat and marsh of approximately 86 ha.

Hydrology

Noons Creek experiences low flows from July through September. It has a mean velocity of 0.2m/s, and its average discharge is 0.13m^3/s.

Channel Stability Assessment (Preliminary)

The channel is composed of 30% gravels and 70% boulder and cobble. The average stream bank height is approximately 1 m, and up to 20% of the bank is considered unstable.

Fisheries Resource

Fish Access

Anadromous fish have access up to a water intake (below Panorama Drive) (for hatchery at Ioco Road) located approximately 2 km upstream from the mouth of the creek.

Fish Stocks

Noons Creek supports populations of coho and chum salmon, and small runs of cutthroat and steelhead trout.

Restoration/Enhancement

There have been several stream clean-ups and spawning habitat improvement projects in the stream, sponsored by public interest groups since 1979. A hatchery run by the Port Moody Ecological Society is located downstream of Ioco Road. Two rearing ponds were created in 1978 and later, in 1991, a third rearing pond was built approximately 500 m upstream. In the fall of 1993, a hatchery was built beside the pond built in 1991. There are plans to enhance cutthroat stocks on the creek in the future. Improvements to the system have begun with removal of large organic debris which was totally obstructing salmonid migration (1996/1997). The small organic debris piles should remain to preserve the pools. New spawning gravels have been placed in the creek downstream of Ioco Road. An old dam on Cypress Lake is being restored with through the Urban Salmon Habitat Program with a valve system in order to make more water available for Noons Creek for spawning coho. Cypress Lake has been stocked with rainbow trout in the past.

Fish Production

Coho and chum are released into Noons Creek from the hatchery. Good spawning habitat for coho exists in the upper part of Noons Creek. It has been estimated that Noons Creek provides natural spawning habitat for approximately 125 pairs of returning coho salmon. The salmonid population has been recovering over the last decade, due in large part to enhancement efforts.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

The Noons Creek watershed was intensively logged prior to 1920. Small scale logging (for cedar shakes, etc.) occurred in the 1960's, and much of the lower watershed has been cleared to accommodate urban development.

Secondary Industry/Commercial

Commercial development is largely limited to that which supports residential development (i.e. retail).

Linear Development

In total, there are over 30 crossings on Noons Creek. The creek is crossed in the lower watershed by Ioco Road, Heritage Mountain Blvd. and by several BC Hydro transmission lines. There is an old 4x4 trail that runs across Noons Creek in the mid-reaches; the banks of this trail have eroded considerably. In addition, there are several logging roads, three gas pipelines, several footbridges, a railway bridge, and a bike path.

Urban Development

Noons Creek flows through several residential neighbourhoods (i.e. Heritage Mountain, Eagle Ridge) and a golf course. The community rink caused a significant fish kill in 1983 by spilling ammonia into the storm sewer.

Government

Noons Creek is in the City of Port Moody and the City of Coquitlam (Greater Vancouver Regional District). Parts of the upper reaches of the creek are on Crown Land.

Designated Lands

Several municipal parks including Shoreline and Town Center Park are located near the mouth of Noons Creek.

Watershed Planning Issues

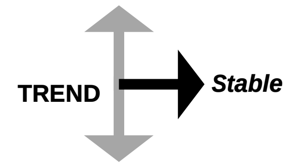
Management Concerns

- Noons Creek experiences low flows between July and September, which has been exacerbated by urban development and increased effective impervious area.
- There are numerous creek crossings, which compromise fish habitat.
- Intensive development (current and planned) in the watershed increases the risk of altering hydrology and water quality from stormwater runoff, contaminant discharges and spills, unauthorized instream works, bank alterations and riparian vegetation removal.

Management Prescriptions

- Municipal policies, bylaws and/or development permit designations which prevent watercourse contamination, restrict riparian vegetation removal, improve erosion control, reduce effective impervious area and maintain unobstructed fish passage are required.
- Innovative approaches to stormwater management including infiltration trenches need to be explored in association with new developments in order to augment baseflows in Noons Creek.
- Community groups active in protecting and restoring Noons Creek need to be supported.
- Continued stewardship initiatives which focus on improving water quality, riparian protection/re-establishment, preventing stream encroachments, managing access, discouraging unauthorized instream works, fostering community outreach and increasing public awareness about fisheries values and conflicts in this watershed, are required.

Suter Brook



Watershed Code: 900-unavailable Burrard Inlet tributary
RAB Code: Unavailable
TRIM Map: 92G026

STATUS:

Endangered - Suter Brook has been severely impacted by urbanization (high effective impermeable area, poor water quality, channelization).

Physiography

Drainage Area

The watershed area of Suter Brook is unknown. The creek flows north entering the easternmost end of Burrard Inlet at Shoreline Park, Port Moody.

Stream Description

Suter Brook is a small, low gradient groundwater fed system with consistent water velocities and good gravel substrate. The headwaters of Suter Brook are believed to originate near Mundy Lake in Coquitlam. The lower reaches of Suter Brook were relocated 50 m west of the original channel when the Port Moody Engineering Works Yard was constructed. It now runs through a channel to prevent it from meandering. Suter Brook discharges into an estuarine wetland in Shoreline Park.

Hydrology

Suter Brook has an average discharge of 0.07 m^3/s and an average velocity of 0.32 m/s.

Channel Stability Assessment (Preliminary)

The channel is considered stable and has a relatively constant stream velocity. Gravel accounts for 70% of the substrate.

Fisheries Resource

Fish Access

Anadromous fish access have access to the headwaters.

Fish Stocks

Suter Brook supports populations of coho and chum salmon, and cutthroat trout.

Restoration/Enhancement

Major daylighting projects have been completed along Suter Brook. Enhancement activities have also included the stocking of chum from Mossom Creek and coho from Noons Creek. A culvert with baffles aids the passage of fish under the railway tracks and into the Port Moody Engineering Works Yard. There are some good enhancement opportunities (pools, gravel, large organic debris exist in the system).

Fish Production

The lower reaches of Suter Brook, just above Shoreline Park, have excellent spawning habitat potential for chum. The steeper reaches adjacent to Coquitlam are best suited for coho and cutthroat spawning.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

There has been significant clearing in the watershed to accommodate residential and commercial development.

Secondary Industry/Commercial

Suter Brook flows through the City of Port Moody Works Yard. There is significant commercial development in the watershed including many retail operations.

Linear Development

Suter Brook is crossed by numerous municipal roads and streets as well as the Canadian Pacific Railway.

Urban Development

Extensive urban development has occurred within the watershed and is expected to continue. Greater than 20% of the watershed had been developed by 1997. A large area (referred to as the Greystone property) located east of the Ioco CPR spur line and bounded by Murray St. to the north, Ioco Road to the east, and the CPR tracks to the south, is to be developed. Erosion upstream of a tributary to Suter Brook (commonly referred to as “stormwater Suter Brook”) has increased sediment discharges to Suter Brook. Stormwater from stormwater Suter Brook now discharges to the sanitary sewage system. Stormwater from a percentage of north shore developments have since the early 1990’s been diverted into the Suter Brook storm channel.

Government

Suter Brook is in the City of Port Moody and the City of Coquitlam (Greater Vancouver Regional District).

Designated Lands

The headwaters of Suter Brook are believed to be located in Mundy Park (Coquitlam). The mouth of Suter Brook is located in Shoreline Park.

Watershed Planning Issues

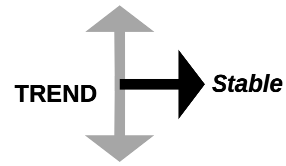
Management Concerns

- Suter Brook is a small productive stream that is under great pressure and can be further degraded if new development does not take a different approach to address impervious area and stormwater runoff.
- Runoff from roads and railroad tracks in the upstream areas and the steep slopes of Coquitlam raise water quality concerns. The Port Moody Engineering Works Yard is located very close to Suter Brook and may pose water quality issues.
- The existing and proposed development in the watershed increases the risks of pollution, spills, riparian loss, encroachment, unauthorized stream bed and bank alterations, access conflicts, and stormwater impacts to both water quality and quantity (including baseflows).

Management Prescriptions

- Suter Brook needs an assertive protection program.
- Improved erosion control measures are required for any new developments in this watershed.
- Stewardship activities are required on this system which focus on protecting and enhancing riparian areas, preventing stream encroachments, addressing access management issues, reducing non-point sources of pollution and spills, removing debris jams that obstruct fish passage, monitoring water quality, erecting stream signage, increasing public awareness about the fisheries values in this system, and advocacy.
- Municipal policies, bylaws or development permit area designations could and should be used on systems like Suter Brook to maintain water quality, prohibit riparian vegetation removal, improve erosion control, reduce effective impervious surface areas, and maintain ‘open’ streams with unobstructed access for fish during development.
- Coquitlam and Port Moody should coordinate their planning and regulation efforts to adequately protect the entire watershed
- Carry out spawner and fry enumerations to assess current fish populations to acquire baseline data and assess past stocking successes.

Pidgeon Creek



Watershed Code: 900-unavailable Burrard Inlet tributary
RAB Code: Unavailable
TRIM Map: 92G026

STATUS:

Endangered - Pidgeon Creek has been culverted in sections and has poor water quality.

Physiography

Drainage Area

The watershed area of Pidgeon Creek is unknown. The creek flows north entering the head of Burrard Inlet 400 meters west of the Ioco spur line of the CPR in Inlet Park, Port Moody Arm.

Stream Description

Pidgeon Creek originates in a developed area of Port Moody, and is culverted at various locations. It is a slow moving, low gradient, groundwater fed system. The creek flows onto the Port Moody foreshore, a tidal wetland of approximately 86 ha.

Hydrology

The mean annual flow of Pidgeon Creek is unknown.

Channel Stability Assessment (Preliminary)

Much of the system is culverted and largely controlled, and would therefore be considered unnaturally stable.

Fisheries Resource

Fish Access

Anadromous fish have access to the lower reaches of Pidgeon Creek.

Fish Stocks

Pidgeon Creek supports chum salmon, anadromous cutthroat trout, sticklebacks, and sculpins.

Restoration/Enhancement

The culverted sections of the stream including those on the IPSCO property should be daylighted.

Fish Production

Spawning chum have been identified in the bottom end of Pidgeon Creek (1997).

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

Considerable clearing has occurred to accommodate residential, commercial and industrial development.

Secondary Industry/Commercial

The creek flows in a culvert through the IPSCO property which is expected to be redeveloped. The lower reaches are open from St. Johns Street to the IPSCO property, except for two culverts under the CP Railway and Railway Spurline. The area upstream upstream of St. Johns Street has been extensively developed with parking lots, restaurants, auto shops and retail stores.

Linear Development

The stream is crossed by the CPR tracks and St. Johns Street. There are numerous city streets and roads in the watershed.

Urban Development

The creek flows through a well established residential area, and a GVRD housing project; however, a significant portion of it has been culverted in industrial areas.

Government

Pidgeon Creek is in the City of Port Moody (Greater Vancouver Regional District).

Designated Lands

None.

Watershed Planning Issues

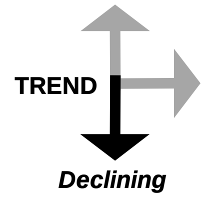
Management Concerns

- The watershed has been extensively developed, and the stream significantly altered.
- Significant portions of the creek have been culverted.

Management Prescriptions

- Sections of the stream should be ‘daylighted’, and an assertive program implemented to improve and protect water quality, riparian habitat and streambed and banks.
- Additional information on fish production potential and limiting factors would be required to develop precise prescriptions for this system.
- An municipal open streams policy by the municipality would prevent the loss of streams such as Pidgeon Creek, and complement the Fisheries Act.

Slaughterhouse Creek



Watershed Code: 900-unavailable Burrard Inlet tributary
RAB Code: Unavailable
TRIM Map: 92G026

STATUS:

Endangered: - Slaughterhouse Creek has been impacted by urbanization (i.e. poor water quality, culverting, and high effective impermeable area).

Physiography

Drainage Area

The total watershed area of Slaughterhouse Creek is unknown. The creek flows north entering Burrard Inlet at Port Moody near the east end of Rocky Point Park.

Stream Description

Slaughterhouse Creek is a slow moving, low gradient, groundwater fed system that originates in the Chines Hillside. The creek flows onto the Port Moody foreshore into a tidal wetland of approximately 86 ha. The wetland is classified as 97% tidal water and 3% estuarine low marsh.

Hydrology

There is no hydrology information available on this system; however, there are at least 4 or 5 lost tributaries to Slaughterhouse Creek which are now part of the municipal storm sewer system.

Channel Stability Assessment

There is no information available.

Fisheries Resource

Fish Access

Anadromous fish have access to the upper reaches of Slaughterhouse Creek and a small west flowing tributary. Long culverts including those under the West Coast Express parking lot may deter fish from moving upstream.

Fish Stocks

Slaughterhouse Creek supports populations of chum and coho salmon, and cutthroat trout.

Restoration/Enhancement

The construction of rearing channels near the mouth of the creek has been identified as a possible enhancement opportunity. Daylighting sections of the stream which have been culverted would also increase the productive capacity of the system.

Fish Production

Coho fry have been observed in the lower reaches of the system.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

While there is no commercial logging in the watershed a significant portion of the drainage has been cleared to accommodate development.

Secondary Industry/Commercial

There is substantial industrial/commercial activity in the watershed. The station and parking lot for the West Coast Express rapid transit line is located 200-300 m upstream of the mouth. Various warehousing, manufacturing and retail operations are located between the estuary and the West Coast Express station. There are numerous commercial operations including restaurants, autorepair and retail shops on St. Johns Street.

Linear Development

Slaughterhouse Creek is crossed by several roads including Highway 7A, St. Johns Street, and the Canadian Pacific Railway.

Urban Development

The lower reaches flow through a well established residential neighbourhood. The mid reaches are surrounded by a high density residential development known as Cascadia. There is no development in the upper headwaters as the area is geotechnically unstable and the available land is municipally dedicated and protected.

Government

Slaughterhouse Creek is in the City of Port Moody and the City of Coquitlam (Greater Vancouver Regional District).

Designated Lands

The headwaters are in designated municipal lands that are protected.

Watershed Planning Issues

Management Concerns

- The system is experiencing infilling and erosion caused by urban development and increasing industrial/commercial activity.
- There have been several fish kills in the system which appear to be the result of industrial washwaters and effluent discharges to the creek.
- Significant portions of the creek were buried under the West Coast Express station and parking lot.
- The extensive development (existing and proposed) in this watershed increases the risk of pollution, riparian vegetation removal, erosion, unauthorized instream and bank works, and encroachment.
- Slaughterhouse Creek is part of an extensive stormwater management and drainage system, and is managed largely for stormwater conveyance.

Management Prescriptions

- Local government and industrial landowners must show greater leadership to initiate stream protection and stewardship.
- Stewardship activities are required on this system which focus on daylighting culverted sections of stream, replanting and protecting riparian areas, preventing further stream encroachments, addressing access management issues, improving water quality, erecting stream signage, increasing public awareness about the fisheries values in this system, and advocacy.
- Municipal policies, bylaws or development permit area designations should be used to maintain water quality, prohibit further riparian vegetation removal, improve erosion control, reduce effective impervious surface areas, and maintain ‘open’ streams with unobstructed access for fish.

Schoolhouse Creek (South)

TREND
Declining

Watershed Code: 900-0443-000-000-000-000-000-000-000-000-000-000
RAB Code: 90-0320
TRIM Map: 92G026

STATUS:

Endangered - Schoolhouse Creek (South) is impacted by the effects of urbanization (i.e. high effective impervious area, poor water quality).

Physiography

Drainage Area

The total watershed area of Schoolhouse (Andres) Creek (South) is approximately 4.2 km^2. The creek originates in the Chines Hillside area in Coquitlam and flows north discharging into the Port Moody arm of Burrard Inlet.

Stream Description

Schoolhouse Creek (South) starts on a hillside and flows into Burrard Inlet. The mouth of Schoolhouse Creek (South) contributes to a wetland of approximately 19 ha. The wetland is classified as 80% tidal water and 20% estuarine low marsh. The reach downstream of the Barnet Highway was relocated in 1978.

Hydrology

The ten year flood flows range from 6.10 to 10.76 m^3/s, and the 100 year flood flows range from 8.31 to 14.60 m^3/s. An extensive storm sewer system empties into the creek. As a result, the discharge of the creek increases significantly during precipitation events.

Channel Stability Assessment (Preliminary)

Regularly occurring floods that fill the channel to bankfull stage have created a fairly stable stream channel. A grizzley is in place to catch large debris.

Fisheries Resource

Fish Access

Anadromous fish have access to a pipeline crossing at Spring Street which acts as a partial obstruction during low flows.

Fish Stocks

Schoolhouse Creek (South) supports populations of chum (lower reaches) and coho salmon, and cutthroat trout (middle/upper reaches).

Restoration/Enhancement

The lower reaches of this creek have been extensively managed and rehabilitated to maintain anadromous fish access. The tidal marsh at the mouth of the creek is being actively remediated by Pacific Coast Terminals Ltd. (have planted 18,500 marsh plugs). Two fishways have been constructed to enhance migration; one is located at St. Johns Street (the Denil fishway) and the other at Clarke Street. The Denil fishway is frequently blocked with debris, rendering it impassable. Volunteers from the Port Moody Ecological Society and Noons Creek Hatchery removed debris annually. Concrete control weirs were installed at six locations along Schoolhouse Creek. However, the pools adjacent to the weirs often fill with silt and debris restricting fish passage. Two box culverts situated under Clarke and Rupert Streets have been fitted with baffles to improve fish passage. It has been recommended that a concrete berm installed by DFO in the 1960’s be removed as it may actually be creating a barrier. An aerator has also been installed to improve dissolved oxygen concentrations. Centennial School has outplanted coho and chum to Schoolhouse Creek. The Port Moody Ecological Society and Noons Creek Hatchery also stock the creek (35,000 chum in 1997, 1998; coho in headwaters near Miller Park).

Fish Production

No specific fish production information is available.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

As the area is developed there has been significant clearing in this watershed to accommodate development.

Secondary Industry/Commercial

There is significant commercial development on St. Johns Street and retail commercial activities which support residential development (i.e. retail) are scattered throughout the watershed. Several significant industrial developments are also in the watershed including Andres wines, Reichold Chemicals, and Pacific Coast Terminals which is located at the mouth of the stream. These industries have caused water quality problems in the past.

Linear Development

The creek is crossed by the Barnet Highway (Highway 7A), a number of city streets, and the Canadian Pacific Railway. The riparian vegetation that was removed in conjunction with the widening of the Barnet Highway has since been replanted, although the plantings have had a high mortality rate.

Urban Development

Schoolhouse Creek (South) originates in the residential Chines Hillside area in Coquitlam. The lower reaches are bordered by development in Port Moody. The watershed is fully built out.

Government

Schoolhouse Creek (South) is in the City of Port Moody and the City of Coquitlam (Greater Vancouver Regional District).

Designated Lands

The headwaters of the creek originate in Miller Park (a small municipal park).

Watershed Planning Issues

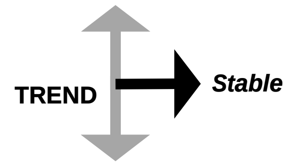
Management Concerns

- Poor water quality, removal of riparian vegetation and encroachments have degraded the creek.
- The lower reaches of the channel have been excessively altered, and there is large amount of impervious area in the watershed.
- Unstable slopes on the escarpment southwest of the Senior Secondary School have slumped, and eroded material from the slide has impacted the stream.
- A proposed ALRT route from Clark Road into Port Moody through the Miller Park Ravine is a concern.

Management Prescriptions

- Any new transportation corridor should avoid sensitive ravines and stream corridors.
- Stewardship activities are required which focus on replanting and protecting riparian areas, preventing stream encroachments, addressing access management issues, improving water quality, erecting stream signage, increasing public awareness about the fisheries values in this system, and advocacy.
- Municipal policies, bylaws or development permit area designations could and should be used to protect water quality, prohibit riparian vegetation removal, improve erosion control, reduce effective impervious surface areas, and maintain ‘open’ streams with unobstructed access for fish.
- A fishway could be installed at Spring Street to improve access.

Simon Creek



Watershed Code: 900-unavailable Burrard Inlet tributary
RAB Code: Unavailable
TRIM Map: 92G026

STATUS:

Endangered - Simon Creek has been impacted by channelization and riparian vegetation removal in the lower reaches.

Physiography

Drainage Area

The total watershed area of Simon Creek is unknown. The creek flows north into Burrard Inlet just west of Burnaby Mountain.

Stream Description

The creek is a small mountain fed system, approximately 700 m long, with headwaters on the lower slopes of Burnaby Mountain at an elevation of approximately 150 m. An unnamed tributary flows into Simon Creek above the Barnet Highway. Simon Creek is one of the largest streams among the approximately thirteen streams draining north along Burnaby Mountain into Burrard Inlet.

Hydrology

The annual average flows is approximately 3 m^3/s. The Burnaby Fish and Game Club has a water licence on Simon Creek to withdraw water (at a rate of .95 ft^3/sec) for an enhancement project on the rifle range near the creek (chinook rearing pens).

Channel Stability Assessment (Preliminary)

The channel stability is low, due to the high bedload of the stream associated with natural, unstable steep slopes (glacial tills, etc.) on the north side of Burnaby Mountain. Where it flows through the Burnaby Fish and Game Club property, the creek is naturally channelized.

Fisheries Resource

Fish Access

Anadromous fish have access to the mainstem above Barnet Highway. Velocity breakers in the culvert under the Barnet Highway are filled with gravel making the culvert currently impassable curing low flows to fish. Jump pools on the Burnaby Mountain side of the highway were constructed during the building of the Barnet Highway to ensure access to the watercourse for fish. The pools have filled with gravel due to various reasons, including highway construction and natural erosion. The pools have been cleaned out by the contractor a number of times, but fill in again due to erosion.

Fish Stocks

Simon Creek supports chum and coho salmon and cutthroat trout.

Restoration/Enhancement

The Burnaby Fish and Game Club is rearing chinook in troughs on the rifle range for transfer to seapens near Reed Point Marina in Port Moody and at TransMountain (foot of Willingdon).

Fish Production

No specific fish production information is available.

Activities and Land Use

Agriculture

None.

Mining

None.

Forestry

None.

Secondary Industry/Commercial

One rifle range is located within the Simon Creek drainage area. It has recently been closed, as have all rifle ranges in Burnaby.

Linear Development

The creek is crossed by the Barnet Highway and transmission lines along the highway, and the Canadian Pacific Railway.

Urban Development

There is no residential development in the Simon Creek watershed.

Government

Simon Creek is in the City of Burnaby (Greater Vancouver Regional District).

Designated Lands

Simon Creek is located within the Burnaby Mountain Conservation Area (recently established) and flows into Burrard Inlet at Barnet Marine Park. The City of Burnaby is currently conducting studies on streams and other natural features in the Burnaby Mountain Conservation Area; a trail system is planned.

Watershed Planning Issues

Management Concerns

- There is a question as to whether there may be water quality (lead) problems associated with runoff from the rifle range. DFO has recently tested Simon Creek, and the water quality is good; surface water may have a leaching effect.
- Fish access under Barnet Highway should be investigated.
- Erosion of the headwater banks and high bedload movement associated with natural erosion and slope instability are a concern.
- The demand for public access to the Burnaby Mountain area (and Simon Creek watershed) may increase since it is now part of the municipally managed Burnaby Mountain Conservation Area.

Management Prescriptions

- The jump pools next to the Barnet Highway (on the Burnaby Mountain side) require periodic maintenance (i.e. gravel removal).
- Riparian vegetation should be re-established in areas where it has been removed.
- Access plans for trails through the area should be designed to protect aquatic features.
- Stewardship activities and partnerships can be implemented that focus on replanting and protecting riparian areas, preventing stream encroachments, addressing access management issues, improving water quality, erecting stream signage, increasing public awareness about the fisheries values in this system, and advocacy.

Appendices

APPENDIX 1- WATERSHED CODES

This appendix contains the stream systems and many of their named tributaries included in the **Strategic Review**. The stream systems are arranged in alphabetical order, and tributaries to that system are arranged in watershed code order. Aliases, where known, are included in brackets after the gazetted name. The staggered indentations indicate the succession of tributaries. The watershed codes indicate which tributary feeds into which stream system.

System ordering:

100 - enters the Fraser River

900 - enters Burrard Inlet

110 - enters Harrison River

970 - enters the Nooksack River

Note: This is not an exhaustive list of stream systems and their tributaries in the Lower Fraser Valley. It represents the major systems and many of their major named tributaries.

Stream Name (alphabetically ordered by stream system)	Watershed Code
Albion Creek (Albion Brook)	100-0400-000-000-000-000-000-000-000-000-000
Anderson Creek	100-0894-000-000-000-000-000-000-000-000-000
Bridal (Popkum) Creek	100-0894-071-891-000-000-000-000-000-000-000
Annieville Creek	100-unavailable (Fraser River Tributary)
Barker (Bolivar) Creek	100-0219-000-000-000-000-000-000-000-000-000
Barnes Creek	100-0724-000-000-000-000-000-000-000-000-000
Bath Slough	100-unavailable (Fraser River Tributary)
Beaver Creek	900-0355-000-000-000-000-000-000-000-000-000
Bell Slough	100-0781-000-000-000-000-000-000-000-000-000
Bonaccord (Port Mann) Creek	100-0242-000-000-000-000-000-000-000-000-000
Brunette River	100-0201-000-000-000-000-000-000-000-000-000
Stoney Creek	100-0201-566-000-000-000-000-000-000-000-000
Eagle Creek	100-0201-791-000-000-000-000-000-000-000-000
Unnamed Creek	100-0201-791-794-000-000-000-000-000-000-000
Unnamed Creek	100-0201-791-872-000-000-000-000-000-000-000
Robert Burnaby Creek	100-0201-803-000-000-000-000-000-000-000-000
Deer Lake Creek	100-0201-923-000-000-000-000-000-000-000-000
Buckingham Creek	100-0201-923-410-000-000-000-000-000-000-000
Still Creek	100-0201-951-000-000-000-000-000-000-000-000
Unnamed Creek	100-0201-951-303-000-000-000-000-000-000-000
Unnamed Creek	100-0201-951-568-000-000-000-000-000-000-000
Buntzen Creek	900-0524-000-000-000-000-000-000-000-000-000
Annore Creek	900-0524-427-000-000-000-000-000-000-000-000
Byrne Creek	100-0120-000-000-000-000-000-000-000-000-000
Nelson Creek	100-0120-098-000-000-000-000-000-000-000-000
Froggers (Hollis, Trusle) Creek	100-0120-354-000-000-000-000-000-000-000-000
John Matthews Creek	100-0120-616-000-000-000-000-000-000-000-000
Gray Creek	100-0120-unavailable (Byrne Creek Tributary)
Campbell River	900-0005-000-000-000-000-000-000-000-000-000
McNalley Creek	900-0005-044-000-000-000-000-000-000-000-000
Fergus (Ferguson) Creek	900-0005-099-000-000-000-000-000-000-000-000
Sam Hill Creek	900-0005-223-000-000-000-000-000-000-000-000
Latimer Pond	900-0005-460-000-000-000-000-000-000-000-000
Gray Creek	900-0005-unavailable (Campbell River Tributary)
Jenkins Creek	900-0005-unavailable (Campbell River Tributary)
Jacobsen Creek	900-0005-unavailable (Campbell River Tributary)
Camson Creek	100-0497-000-000-000-000-000-000-000-000-000
Capilano River	900-0711-000-000-000-000-000-000-000-000-000
Vinson Creek	900-0711-006-000-000-000-000-000-000-000-000
Brothers Creek	900-0711-034-000-000-000-000-000-000-000-000
Hadden Creek	900-0711-034-215-000-000-000-000-000-000-000
Brothers Creek, West	900-0711-034-289-000-000-000-000-000-000-000
Houlgate Creek	900-0711-147-000-000-000-000-000-000-000-000
Crown Creek	900-0711-263-000-000-000-000-000-000-000-000
Fellowes Creek	900-0711-289-000-000-000-000-000-000-000-000
Nickey Creek	900-0711-326-000-000-000-000-000-000-000-000
Sisters Creek	900-0711-369-000-000-000-000-000-000-000-000
Strachan Creek	900-0711-369-162-000-000-000-000-000-000-000
Lembke Creek	900-0711-369-587-000-000-000-000-000-000-000
Dean Creek	900-0711-412-000-000-000-000-000-000-000-000
Healmond Creek	900-0711-506-000-000-000-000-000-000-000-000
Eastcap Creek	900-0711-548-000-000-000-000-000-000-000-000
Palisade Creek	900-0711-548-411-000-000-000-000-000-000-000
Hesketh Creek	900-0711-639-000-000-000-000-000-000-000-000
Enchantment Creek	900-0711-711-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Connolly Creek	900-0711-711-476-000-000-000-000-000-000-000
Macklin Creek	900-0711-711-476-317-000-000-000-000-000-000
Daniels Creek	900-0711-750-000-000-000-000-000-000-000-000
Hanover Creek	900-0711-857-000-000-000-000-000-000-000-000
Andrews Creek	900-0711-886-000-000-000-000-000-000-000-000
Windsor Creek	900-0711-913-000-000-000-000-000-000-000-000
Centre Creek (West Barnston, Bloomfield Brook)	100-0290-000-000-000-000-000-000-000-000-000
Chawuthen Creek	100-1090-000-000-000-000-000-000-000-000-000
Cheam Slough	100-0864-000-000-000-000-000-000-000-000-000
Agassiz Slough	100-0864-458-000-000-000-000-000-000-000-000
Chester Creek	100-0493-000-000-000-000-000-000-000-000-000
Chilliwack (Little Chilliwack) Creek	100-0718-000-000-000-000-000-000-000-000-000
Atchelitz Creek	100-0718-163-000-000-000-000-000-000-000-000
Luckakuck Creek	100-0718-424-000-000-000-000-000-000-000-000
Semmihault Creek	100-0718-701-000-000-000-000-000-000-000-000
Marblehill Creek	100-0718-701-814-000-000-000-000-000-000-000
Calkins Creek	100-0718-701-993-000-000-000-000-000-000-000
Coco-oppelo Slough	100-0737-000-000-000-000-000-000-000-000-000
Cohilukthan Slough	100-0052-000-000-000-000-000-000-000-000-000
Coligny Creek	100-unavailable (Fraser River Tributary)
Collings (White) Creek	100-unavailable (Fraser River Tributary)
Como (Schoolhouse) Creek	100-0222-000-000-000-000-000-000-000-000-000
Booth (Laurentian) Creek	100-0222-356-000-000-000-000-000-000-000-000
MacDonald (Popeye) Creek	100-0222-356-253-000-000-000-000-000-000-000
Coquihalla River	100-1154-000-000-000-000-000-000-000-000-000
Kawkawa (Sucker) Creek	100-1154-031-000-000-000-000-000-000-000-000
Thacker Creek	100-1154-067-000-000-000-000-000-000-000-000
Two Mile Creek	100-1154-079-000-000-000-000-000-000-000-000
Alexander Creek	100-1154-092-000-000-000-000-000-000-000-000
Nicolum Creek	100-1154-126-000-000-000-000-000-000-000-000
Berkey Creek	100-1154-126-345-000-000-000-000-000-000-000
Eight Mile Creek	100-1154-126-346-000-000-000-000-000-000-000
Wray Creek	100-1154-126-502-000-000-000-000-000-000-000
Eleven Mile Creek	100-1154-126-675-000-000-000-000-000-000-000
Peers Creek	100-1154-225-000-000-000-000-000-000-000-000
Railway Creek	100-1154-264-000-000-000-000-000-000-000-000
Nine Mile Creek	100-1154-292-000-000-000-000-000-000-000-000
Ten Mile Creek	100-1154-328-000-000-000-000-000-000-000-000
Ophelia Creek	100-1154-330-000-000-000-000-000-000-000-000
Deneau Creek	100-1154-344-000-000-000-000-000-000-000-000
Sowaqua Creek	100-1154-387-000-000-000-000-000-000-000-000
Colvile Creek	100-1154-387-355-000-000-000-000-000-000-000
Montigny Creek	100-1154-387-452-000-000-000-000-000-000-000
Richmond Creek	100-1154-387-467-000-000-000-000-000-000-000
Chevreuil Creek	100-1154-387-566-000-000-000-000-000-000-000
Bushby Creek	100-1154-387-591-000-000-000-000-000-000-000
Angus Creek	100-1154-387-595-000-000-000-000-000-000-000
O'Reilly Creek	100-1154-387-619-000-000-000-000-000-000-000
Matthew Creek	100-1154-387-627-000-000-000-000-000-000-000
Rice Creek	100-1154-387-647-000-000-000-000-000-000-000
Ghostpass Creek	100-1154-387-771-000-000-000-000-000-000-000
Prospectors Creek	100-1154-387-889-000-000-000-000-000-000-000
Fifteen Mile Creek	100-1154-455-000-000-000-000-000-000-000-000
Dewdney Creek	100-1154-457-000-000-000-000-000-000-000-000
Cedar Flat Creek	100-1154-457-307-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Ladner Creek	100-1154-501-000-000-000-000-000-000-000-000
Boston Bar Creek	100-1154-540-000-000-000-000-000-000-000-000
Carry Creek	100-1154-615-000-000-000-000-000-000-000-000
Karen Creek	100-1154-unavailable (Coquihalla River Tributary)
Watercress Creek	100-1154-unavailable (Coquihalla River Tributary)
Coquitlam River	100-0245-000-000-000-000-000-000-000-000-000
Mundy (Munday) Creek	100-0245-046-939-367-000-000-000-000-000-000
Scott Creek	100-0245-110-000-000-000-000-000-000-000-000
Hoy Creek	100-0245-110-310-000-000-000-000-000-000-000
South Hoy Creek	100-0245-110-310-637-000-000-000-000-000-000
Marquart (Moquart, "M") Creek	100-0245-274-000-000-000-000-000-000-000-000
Pritchett (Crystal) Creek	100-0245-280-000-000-000-000-000-000-000-000
Partridge Creek	100-0245-293-000-000-000-000-000-000-000-000
Mantle Creek	100-0245-309-000-000-000-000-000-000-000-000
Steelhead Creek	100-0245-330-000-000-000-000-000-000-000-000
Unnamed Creek	100-0245-330-619-000-000-000-000-000-000-000
Or Creek	100-0245-348-000-000-000-000-000-000-000-000
Coho Creek	100-0245-unavailable (Coquitlam River Tributary)
Maple Creek	100-0245-unavailable (Coquitlam River Tributary)
Slade Creek	100-0245-unavailable (Coquitlam River Tributary)
Cougar Canyon Creek	100-0145-000-000-000-000-000-000-000-000-000
Unnamed Creek	100-0145-169-000-000-000-000-000-000-000-000
Crescent (Horseshoe) Slough	100-0060-000-000-000-000-000-000-000-000-000
Cypress Creek	900-0735-000-000-000-000-000-000-000-000-000
Deas Slough	100-unavailable (Fraser River Tributary)
Deroche (Crazy) Creek	100-0702-000-000-000-000-000-000-000-000-000
Morton Creek	100-0702-195-000-000-000-000-000-000-000-000
D'Herbomez Creek	100-0567-000-000-000-000-000-000-000-000-000
Eagle Creek	900-0753-000-000-000-000-000-000-000-000-000
Wood Creek	900-0753-unavailable (Eagle Creek Tributary)
Eugene Brook	900-0072-000-000-000-000-000-000-000-000-000
Ewen Slough	100-unavailable (Fraser River Tributary)
Fraserview (Vivian) Creek	100-unavailable (Fraser River Tributary)
Galerius Creek	100-unavailable (Fraser River Tributary)
Gilmour Slough	100-unavailable (Fraser River Tributary)
Greyell Slough	100-unavailable (lateral channel of the Fraser River)
Hanna Creek	100-0501-000-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-135-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-136-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-205-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-247-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-247-204-000-000-000-000-000-000-000
Unnamed Creek	100-0501-278-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-311-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-362-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-456-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-536-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-612-000-000-000-000-000-000-000-000
Unnamed Creek	100-0501-612-204-000-000-000-000-000-000-000
Unnamed Creek	100-0501-612-677-000-000-000-000-000-000-000
Unnamed Creek	100-0501-655-000-000-000-000-000-000-000-000
Harrison River	110-0000-000-000-000-000-000-000-000-000-000
Squakum Creek	110-0369-000-000-000-000-000-000-000-000-000
Lake Errock	110-0369-000-000-000-000-000-000-000-000-000
Holatchten Creek	110-0369-865-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Sasin Creek	110-0415-000-000-000-000-000-000-000-000-000-000
Bateson Slough	110-0681-000-000-000-000-000-000-000-000-000-000
Duncan Slough	110-0710-000-000-000-000-000-000-000-000-000-000
Elbow Creek	110-0762-000-000-000-000-000-000-000-000-000-000
Chehalis River	110-0902-000-000-000-000-000-000-000-000-000-000
Pretty Creek	110-0902-050-000-000-000-000-000-000-000-000-000
Statlu Creek	110-0902-293-000-000-000-000-000-000-000-000-000
Span Creek	110-0902-293-122-000-000-000-000-000-000-000-000
Margaret Creek	110-0902-293-183-000-000-000-000-000-000-000-000
Alf Creek	110-0902-293-201-000-000-000-000-000-000-000-000
South Statlu Creek	110-0902-293-469-000-000-000-000-000-000-000-000
Blacklock Creek	110-0902-293-496-000-000-000-000-000-000-000-000
Tessaro Creek	110-0902-293-796-000-000-000-000-000-000-000-000
Vaughan Creek	110-0902-319-000-000-000-000-000-000-000-000-000
Maisal Creek	110-0902-429-000-000-000-000-000-000-000-000-000
Skwellepil Creek	110-0902-624-000-000-000-000-000-000-000-000-000
Middle Creek	110-0902-624-066-000-000-000-000-000-000-000-000
Gerry Creek	110-0902-624-385-000-000-000-000-000-000-000-000
Eagle Creek	110-0902-807-000-000-000-000-000-000-000-000-000
Coho Creek	110-0902-unavailable (Chehalis River Tributary)
Morris Creek	110-1492-000-000-000-000-000-000-000-000-000-000
Connor Creek	110-1492-686-000-000-000-000-000-000-000-000-000
Weaver Creek	110-1492-854-000-000-000-000-000-000-000-000-000
Sakwi Creek	110-1492-854-356-000-000-000-000-000-000-000-000
Evans Creek	110-1492-854-unavailable (Weaver Creek Tributary)
East Creek	110-1492-unavailable (Morris Creek Tributary)
Miami Creek	110-2321-000-000-000-000-000-000-000-000-000-000
Hot Springs Slough	110-2321-unavailable (Miami Creek Tributary)
Sasquatch Creek	110-2457-000-000-000-000-000-000-000-000-000-000
Thunderbird Creek	110-2506-000-000-000-000-000-000-000-000-000-000
Trout Lake Creek	110-2590-000-000-000-000-000-000-000-000-000-000
Slollicum Creek	110-3277-000-000-000-000-000-000-000-000-000-000
Cartmell Creek	110-3654-000-000-000-000-000-000-000-000-000-000
Brett Creek	110-3654-178-000-000-000-000-000-000-000-000-000
Simms Creek	110-4073-000-000-000-000-000-000-000-000-000-000
Walian Creek	110-4198-000-000-000-000-000-000-000-000-000-000
Hale Creek	110-4430-000-000-000-000-000-000-000-000-000-000
Bear Creek	110-4588-000-000-000-000-000-000-000-000-000-000
Cogburn (Fifteen Mile)Creek	110-5351-000-000-000-000-000-000-000-000-000-000
Talc Creek	110-5351-071-000-000-000-000-000-000-000-000-000
Settler Creek	110-5351-361-000-000-000-000-000-000-000-000-000
Mystery Creek	110-5819-000-000-000-000-000-000-000-000-000-000
Lookout Lake Creek	110-5819-162-000-000-000-000-000-000-000-000-000
Twenty Mile Creek	110-5880-000-000-000-000-000-000-000-000-000-000
Big Silver Creek	110-5990-000-000-000-000-000-000-000-000-000-000
Hornet Creek	110-5990-086-000-000-000-000-000-000-000-000-000
Clear Creek	110-5990-197-000-000-000-000-000-000-000-000-000
Kirkland Creek	110-6671-000-000-000-000-000-000-000-000-000-000
Stokke Creek	110-8600-000-000-000-000-000-000-000-000-000-000
Hatzic Slough	100-0585-000-000-000-000-000-000-000-000-000-000
Draper Creek	100-0585-343-000-000-000-000-000-000-000-000-000
Wharton Creek	100-0585-343-591-000-000-000-000-000-000-000-000
Chilqua Slough (Creek)	100-0585-469-000-000-000-000-000-000-000-000-000
Madill Creek	100-0585-469-303-000-000-000-000-000-000-000-000
Scorey (Rouleau) Creek	100-0585-584-000-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Currie Creek	100-0585-711-000-000-000-000-000-000-000-000
Unnamed Creek	100-0585-711-301-000-000-000-000-000-000-000
Kenworthy Creek	100-0585-840-000-000-000-000-000-000-000-000
Bouchier Creek	100-0585-840-130-000-000-000-000-000-000-000
Lagace Creek & Allen Lake	100-0585-847-000-000-000-000-000-000-000-000
Oru Creek	100-0585-847-234-000-000-000-000-000-000-000
Belcharton Creek	100-0585-847-234-206-000-000-000-000-000-000
Durieux Creek	100-0585-847-234-206-081-000-000-000-000-000
Seux Creek	100-0585-847-234-206-168-000-000-000-000-000
Pattison Creek	100-0585-847-483-000-000-000-000-000-000-000
Pattison Lake	100-0585-847-483-360-000-000-000-000-000-000
Unnamed Creek	100-0585-847-833-000-000-000-000-000-000-000
MacNab Creek	100-0585-847-866-000-000-000-000-000-000-000
North Hereford Creek	100-0585-911-000-000-000-000-000-000-000-000
Unnamed Creek	100-0585-911-013-000-000-000-000-000-000-000
Hett Creek	900-0460-000-000-000-000-000-000-000-000-000
Hope Slough	100-0741-000-000-000-000-000-000-000-000-000
Gravel Slough	100-0741-287-000-000-000-000-000-000-000-000
Camp Slough	100-0741-287-504-000-000-000-000-000-000-000
Elk Brook	100-0741-367-000-000-000-000-000-000-000-000
Elk Creek	100-0741-367-815-000-000-000-000-000-000-000
Ford Creek	100-0741-367-815-123-000-000-000-000-000-000
Dunville Creek	100-0741-689-000-000-000-000-000-000-000-000
Nevin Creek	100-0741-689-659-000-000-000-000-000-000-000
Hunter Creek	100-1064-000-000-000-000-000-000-000-000-000
Indian River	900-0560-000-000-000-000-000-000-000-000-000
Johnsons Slough	100-1019-000-000-000-000-000-000-000-000-000
Mahood (Gallagher, Johnson) Creek	100-1019-792-000-000-000-000-000-000-000-000
Kanaka Creek	100-0374-000-000-000-000-000-000-000-000-000
Unnamed Creek #34	100-0374-046-000-000-000-000-000-000-000-000
Spencer Creek	100-0374-063-000-000-000-000-000-000-000-000
Salamander Creek	100-0374-070-000-000-000-000-000-000-000-000
Cottonwood Creek	100-0374-073-000-000-000-000-000-000-000-000
Horseshoe Creek	100-0374-109-000-000-000-000-000-000-000-000
Rainbow Creek	100-0374-131-000-000-000-000-000-000-000-000
Unknown Creek	100-0374-175-the creek that Magee Creek is a trib to
Magee Creek	100-0374-175-397-000-000-000-000-000-000-000
Seigie Creek	100-0374-200-000-000-000-000-000-000-000-000
Donovan Creek (Dunlop Brook)	100-0374-202-000-000-000-000-000-000-000-000
Thornvale Creek	100-0374-220-000-000-000-000-000-000-000-000
Unknown Creek	100-0374-332-the creek that Martin Creek is a trib to
Martin Creek	100-0374-332-385-000-000-000-000-000-000-000
Unknown Creek	100-0374-441-the creek that McFadden Creek is a trib to
McFadden Creek	100-0374-441-500-000-000-000-000-000-000-000
Kaymar Creek	100-unavailable (Fraser River Tributary)
Knudson Creek	100-unavailable (Fraser River Tributary)
Lighthall Creek	900-0537-000-000-000-000-000-000-000-000-000
London Slough	100-0025-000-000-000-000-000-000-000-000-000
Lorenzetta Creek	100-1020-000-000-000-000-000-000-000-000-000
Lynn Creek	900-0669-000-000-000-000-000-000-000-000-000
Morten Creek	099-0669-unavailable (Lynn Creek Tributary)
Keith Creek	900-0669-065-000-000-000-000-000-000-000-000
Hastings Creek	900-0669-155-000-000-000-000-000-000-000-000
Thames Creek	900-0669-155-unavailable (Hastings Creek Tributary)
Kennedy Creek	900-0669-608-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Wickenden Creek	900-0669-660-000-000-000-000-000-000-000-000
Norvan Creek	900-0669-731-000-000-000-000-000-000-000-000
Hanes Creek	900-0669-781-000-000-000-000-000-000-000-000
Coliseum Creek	900-0669-840-000-000-000-000-000-000-000-000
MacKay Creek	900-0693-000-000-000-000-000-000-000-000-000
Mandale Slough (Lane Creek)	100-0532-000-000-000-000-000-000-000-000-000
Windebank Creek	100-0532-115-000-000-000-000-000-000-000-000
Horne Creek	100-0532-421-000-000-000-000-000-000-000-000
Manson Canal (Hanson Ditch)	100-0185-000-000-000-000-000-000-000-000-000
Scott Creek	100-0185-448-000-000-000-000-000-000-000-000
Robson Creek	100-0185-489-000-000-000-000-000-000-000-000
Maria Slough	100-0916-000-000-000-000-000-000-000-000-000
Hicks Creek (Kamp Slough)	100-0916-613-000-000-000-000-000-000-000-000
Matsqui Slough (Kelly Creek)	100-0543-000-000-000-000-000-000-000-000-000
Unnamed Creek	100-0543-102-000-000-000-000-000-000-000-000
Unnamed Creek	100-0543-102-202-000-000-000-000-000-000-000
Page Creek	100-0543-222-000-000-000-000-000-000-000-000
Unnamed Creek	100-0543-222-392-000-000-000-000-000-000-000
Unnamed Creek	100-0543-222-448-000-000-000-000-000-000-000
Unnamed Creek	100-0543-385-000-000-000-000-000-000-000-000
Unnamed Creek	100-0543-446-000-000-000-000-000-000-000-000
Willband Creek	100-0543-534-000-000-000-000-000-000-000-000
Unnamed Creek	100-0543-534-713-000-000-000-000-000-000-000
Unnamed Creek	100-0543-534-953-000-000-000-000-000-000-000
Stoney Creek	100-0543-566-000-000-000-000-000-000-000-000
Poignant Creek	100-0543-809-000-000-000-000-000-000-000-000
Unnamed Creek	100-0543-809-207-000-000-000-000-000-000-000
Unnamed Creek	100-0543-893-000-000-000-000-000-000-000-000
Caleb Creek	100-0543-unavailable (Matsqui Slough Tributary)
Clayburn Creek	100-0543-unavailable (Matsqui Slough Tributary)
McAdam (Howell) Creek	100-0158-000-000-000-000-000-000-000-000-000
McCartney Creek	900-0644-000-000-000-000-000-000-000-000-000
McLennan Creek	100-0536-000-000-000-000-000-000-000-000-000
Gifford Slough	100-0536-358-000-000-000-000-000-000-000-000
Downes Creek	100-0536-358-709-000-000-000-000-000-000-000
Unnamed Creek	100-0536-358-861-000-000-000-000-000-000-000
Unnamed Creek	100-0536-779-000-000-000-000-000-000-000-000
Mosquito Creek	900-0690-000-000-000-000-000-000-000-000-000
Wagg Creek	900-0690-063-000-000-000-000-000-000-000-000
Thain Creek	900-0690-063-263-000-000-000-000-000-000-000
Mission Creek	900-0690-251-000-000-000-000-000-000-000-000
Mossom Creek	900-0463-000-000-000-000-000-000-000-000-000
Mountain Slough	100-0836-000-000-000-000-000-000-000-000-000
Hogg Slough	100-0836-433-000-000-000-000-000-000-000-000
McCallum Ditch	100-0836-681-000-000-000-000-000-000-000-000
Stacey Lake	100-0836-974-000-000-000-000-000-000-000-000
Mud Slough	100-0636-000-000-000-000-000-000-000-000-000
Musqueam (Tin Can) Creek	100-0005-000-000-000-000-000-000-000-000-000
Cutthroat Creek	100-0005-unavailable (Musqueam Creek Tributary)
Nathan (Glen, Beaver) Creek	100-0437-000-000-000-000-000-000-000-000-000
Nathan Slough	100-0452-000-000-000-000-000-000-000-000-000
Benson Canal	100-0452-188-000-000-000-000-000-000-000-000
Nelson Creek	100-0110-000-000-000-000-000-000-000-000-000
Nelson Creek	100-0214-000-000-000-000-000-000-000-000-000
Nelson Creek	900-0755-000-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Nelson Slough	100-0788-000-000-000-000-000-000-000-000-000
Nicomekl River	900-0043-000-000-000-000-000-000-000-000-000
Chantrell Creek	900-0043-068-000-000-000-000-000-000-000-000
Mackereth (Barbara) Creek	900-0043-137-000-000-000-000-000-000-000-000
Elgin Creek	900-0043-163-000-000-000-000-000-000-000-000
Little Anderson Creek	900-0043-183-000-000-000-000-000-000-000-000
Morgan Creek	900-0043-267-000-000-000-000-000-000-000-000
Old Logging Ditch (Kensington Creek)	900-0043-288-000-000-000-000-000-000-000-000
Burrows Ditch	900-0043-373-000-000-000-000-000-000-000-000
176th Street Creek	900-0043-397-000-000-000-000-000-000-000-000
Erickson Creek	900-0043-423-000-000-000-000-000-000-000-000
Laughin Brook	900-0043-423-313-000-000-000-000-000-000-000
Anderson Creek	900-0043-540-000-000-000-000-000-000-000-000
McLennan (Weirs) Creek	900-0043-542-000-000-000-000-000-000-000-000
Baldy Creek	900-0043-555-000-000-000-000-000-000-000-000
MacDonald Brook	900-0043-556-000-000-000-000-000-000-000-000
Unnamed Creek	900-0043-556-523-000-000-000-000-000-000-000
Willock Brook	900-0043-579-000-000-000-000-000-000-000-000
Muckle Creek	900-0043-600-000-000-000-000-000-000-000-000
Pleasantdale Creek	900-0043-615-000-000-000-000-000-000-000-000
Unnamed Creek	900-0043-615-615-000-000-000-000-000-000-000
Langley Creek	900-0043-619-000-000-000-000-000-000-000-000
Unnamed	900-0043-632-000-000-000-000-000-000-000-000
Newlands Brook	900-0043-645-000-000-000-000-000-000-000-000
Unnamed Creek	900-0043-645-104-000-000-000-000-000-000-000
Murray Creek	900-0043-666-000-000-000-000-000-000-000-000
Best (Trigg) Creek	900-0043-666-310-000-000-000-000-000-000-000
MacInnis Creek	900-0043-666-517-000-000-000-000-000-000-000
Fraser Creek	900-0043-677-000-000-000-000-000-000-000-000
Logan Creek	900-0043-701-000-000-000-000-000-000-000-000
Jeffrey Creek	900-0043-701-415-000-000-000-000-000-000-000
Airport Creek	900-0043-714-000-000-000-000-000-000-000-000
North Creek	900-0043-724-000-000-000-000-000-000-000-000
Nicomen Slough	100-unavailable (blind channel of the Fraser River)
Inches Creek	100-unavailable (Nicomen Slough Tributary)
Worth Creek	100-unavailable (Nicomen Slough Tributary)
Hawkins Creek	100-unavailable (Nicomen Slough Tributary)
Brousseau Creek	100-unavailable (Nicomen Slough Tributary)
Railway (Pothole) Creek	100-unavailable (Nicomen Slough Tributary)
Nicomen Slough, North	100-unavailable (Nicomen Slough Tributary)
North Nicomen Creek	100-unavailable (Nicomen Slough Tributary)
Mud Creek	100-unavailable (Nicomen Slough Tributary)
No. #7 Road Slough	100-unavailable (Fraser River Tributary)
Nooksack River	970-0468- headwaters in the U.S.A.
Cave Creek	970-0468-252-435-000-000-000-000-000-000-000
Howes Creek	970-0468-252-435-552-000-000-000-000-000-000
Bori Creek	970-0468-252-435-707-000-000-000-000-000-000
Bertrand Creek	970-0468-252-443-000-000-000-000-000-000-000
McNair Creek	970-0468-252-443-817-000-000-000-000-000-000
Fishtrap Creek	970-0468-264-000-000-000-000-000-000-000-000
Pepin Creek	970-0468-264-387-000-000-000-000-000-000-000
Enn's Brook	970-0468-264-820-000-000-000-000-000-000-000
Lock Creek	947-0468-unavailable (Nooksack River Tributary)
Waechter Creek	947-0468-unavailable (Nooksack River Tributary)
Noons Creek	900-0453-000-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Noons Creek, West	900-0453-171-000-000-000-000-000-000-000-000
Norrish (Suicide) Creek	100-0640-000-000-000-000-000-000-000-000-000
Rose Creek	100-0640-396-000-000-000-000-000-000-000-000
Norrish Creek, West	100-0640-698-000-000-000-000-000-000-000-000
Dickson Creek	100-0640-736-000-000-000-000-000-000-000-000
Oliver Creek	100-unavailable (Fraser River Tributary)
Oliver Slough	100-unavailable (Fraser River Tributary)
Palmateer (Williams, Armstrong, East) Creek	100-0418-000-000-000-000-000-000-000-000-000
Parkside Creek	900-unavailable (Burrard Inlet Tributary)
Pidgeon Creek	900-unavailable (Burrard Inlet Tributary)
Pitt River	100-0267-000-000-000-000-000-000-000-000-000
Baker Creek	100-0267-001-000-000-000-000-000-000-000-000
Katzie Slough	100-0267-028-000-000-000-000-000-000-000-000
Cranberry Slough	100-0267-028-020-000-000-000-000-000-000-000
Cook Slough	100-0267-028-206-000-000-000-000-000-000-000
Tulley Slough	100-0267-028-241-000-000-000-000-000-000-000
Tulley Slough	100-0267-028-241-435-000-000-000-000-000-000
Alouette River, South	100-0267-060-000-000-000-000-000-000-000-000
Fenton Road Slough	100-0267-060-059-000-000-000-000-000-000-000
Alouette River, North	100-0267-060-064-000-000-000-000-000-000-000
Blaney Creek	100-0267-060-064-086-000-000-000-000-000-000
McKenzie Creek	100-0267-060-064-086-116-000-000-000-000-000
Donegani Creek	100-0267-060-064-086-286-000-000-000-000-000
Spring Creek	100-0267-060-064-086-319-000-000-000-000-000
Loon Creek	100-0267-060-064-086-654-000-000-000-000-000
Mirror Lake Creek	100-0267-060-064-557-000-000-000-000-000-000
Jacobs Creek	100-0267-060-064-671-000-000-000-000-000-000
Mayfly Creek	100-0267-060-064-671-433-000-000-000-000-000
Gwendoline Creek	100-0267-060-064-671-654-000-000-000-000-000
McKenny (Mckinney)Creek	100-0267-060-155-000-000-000-000-000-000-000
Unnamed Creek	100-0267-060-173-000-000-000-000-000-000-000
Coho (Balabanian)Creek	100-0267-060-215-000-000-000-000-000-000-000
Millionaire Creek	100-0267-060-283-000-000-000-000-000-000-000
Mike Lake Creek	100-0267-060-385-000-000-000-000-000-000-000
Viking Creek	100-0267-060-589-000-000-000-000-000-000-000
Gold Creek	100-0267-060-609-000-000-000-000-000-000-000
Evans Creek	100-0267-060-609-101-000-000-000-000-000-000
Moyer Creek	100-0267-060-686-000-000-000-000-000-000-000
Dominion Avenue Slough	100-0267-061-000-000-000-000-000-000-000-000
De Boville Slough	100-0267-072-000-000-000-000-000-000-000-000
Hyde Creek	100-0267-072-977-000-000-000-000-000-000-000
Smiling Creek	100-0267-072-977-152-000-000-000-000-000-000
Partington (Cedar, Yule) Creek	100-0267-072-985-000-000-000-000-000-000-000
Cedar Ditch	100-0267-072-unavailable (DeBoville Slough Tributary)
Irvine Creek	100-0267-073-000-000-000-000-000-000-000-000
McLean Creek	100-0267-076-000-000-000-000-000-000-000-000
Sturgeon Slough	100-0267-116-000-000-000-000-000-000-000-000
MacIntyre Creek	100-0267-137-000-000-000-000-000-000-000-000
Deiner Creek	100-0267-137-425-000-000-000-000-000-000-000
Munro Creek	100-0267-152-000-000-000-000-000-000-000-000
Stuart Creek	100-0267-174-000-000-000-000-000-000-000-000
Catbird Slough	100-0267-191-000-000-000-000-000-000-000-000
Widgeon Creek	100-0267-193-000-000-000-000-000-000-000-000
Widgeon Lake Creek	100-0267-193-492-000-000-000-000-000-000-000
Eloise Creek	100-0267-219-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Stephenson Creek	100-0267-228-000-000-000-000-000-000-000-000
Raven Creek	100-0267-275-000-000-000-000-000-000-000-000
Dark Creek	100-0267-287-000-000-000-000-000-000-000-000
McSween Creek	100-0267-312-000-000-000-000-000-000-000-000
Neill Creek	100-0267-317-000-000-000-000-000-000-000-000
Williams Creek	100-0267-323-000-000-000-000-000-000-000-000
Defrauder Creek	100-0267-326-000-000-000-000-000-000-000-000
Osprey Creek	100-0267-344-000-000-000-000-000-000-000-000
Gurney Creek	100-0267-366-000-000-000-000-000-000-000-000
Ashby Creek	100-0267-376-000-000-000-000-000-000-000-000
Isabel Lake Creek	100-0267-384-000-000-000-000-000-000-000-000
Debeck Creek	100-0267-408-000-000-000-000-000-000-000-000
Unnamed Creek	100-0267-408-603-000-000-000-000-000-000-000
Fish Hatchery Creek	100-0267-549-000-000-000-000-000-000-000-000
Corbold Creek	100-0267-564-000-000-000-000-000-000-000-000
Boise Creek	100-0267-574-000-000-000-000-000-000-000-000
Homer Creek	100-0267-627-000-000-000-000-000-000-000-000
Pinecone Creek	100-0267-667-000-000-000-000-000-000-000-000
Shale Creek	100-0267-707-000-000-000-000-000-000-000-000
Bucklin Creek	100-0267-710-000-000-000-000-000-000-000-000
Blue Creek	100-0267-717-000-000-000-000-000-000-000-000
Brassy Creek	100-0267-unavailable (Pitt River Tributary)
Garibaldi Creek	100-0267-unavailable (Pitt River Tributary)
Quarry Slough	100-0267-unavailable (Pitt River Tributary)
Forestry Creek	100-0267-unavailable (Pitt River Tributary)
Pye Creek	100-0720-000-000-000-000-000-000-000-000-000
Quaamitch Slough	100-0688-000-000-000-000-000-000-000-000-000
Richards (Buntzen) Creek	900-0527-000-000-000-000-000-000-000-000-000
Rodgers Creek	900-0723-000-000-000-000-000-000-000-000-000
Ruby Creek	100-1047-000-000-000-000-000-000-000-000-000
Garnet Creek	100-1047-366-000-000-000-000-000-000-000-000
Salmon (Deleeuw) River	100-0388-000-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-018-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-020-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-062-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-064-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-098-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-129-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-142-000-000-000-000-000-000-000-000
Davidson (Ditch) Creek	100-0388-155-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-204-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-268-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-280-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-353-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-362-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-383-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-409-000-000-000-000-000-000-000-000
Coghlan Creek	100-0388-430-000-000-000-000-000-000-000-000
Union Creek	100-0388-535-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-540-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-600-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-615-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-624-000-000-000-000-000-000-000-000
Pond Creek	100-0388-660-000-000-000-000-000-000-000-000
Unnamed Creek	100-0388-683-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Unnamed Creek	100-0388-713-000-000-000-000-000-000-000-000
Tyre Creek	100-0388-702-000-000-000-000-000-000-000-000
Schkam Creek	100-1151-000-000-000-000-000-000-000-000-000
Schoolhouse (Andres) Creek, South	900-0443-000-000-000-000-000-000-000-000-000
Melrose Creek	900-0443-unavailable (Schoolhouse Creek Tributary)
Schoolhouse, North	900-unavailable (Burrard Inlet Tributary)
Serpentine River (Tynehead Creek)	900-0055-000-000-000-000-000-000-000-000-000
Hyland Creek	900-0055-458-000-000-000-000-000-000-000-000
Archibald Creek	900-0055-458-unavailable Hyland Creek tributary
Mahood (Bear) Creek	900-0055-481-000-000-000-000-000-000-000-000
Damsite Creek	900-0055-481-360-000-000-000-000-000-000-000
Enver Creek	900-0055-481-403-000-000-000-000-000-000-000
Quibble Creek	900-0055-481-750-000-000-000-000-000-000-000
Lay Creek	900-0055-481-750-622-000-000-000-000-000-000
King Creek	900-0055-481-unavailable (Mahood Creek Tributary)
Latimer Creek	900-0055-689-000-000-000-000-000-000-000-000
Seymour River	900-0661-000-000-000-000-000-000-000-000-000
Rice Lake	900-0661-222-000-000-000-000-000-000-000-000
Hydraulic Creek	900-0661-280-000-000-000-000-000-000-000-000
Paton (Patton) Creek	900-0661-419-000-000-000-000-000-000-000-000
Gibbens Creek	900-0661-493-000-000-000-000-000-000-000-000
Burwell Creek	900-0661-497-000-000-000-000-000-000-000-000
Cathedral Creek	900-0661-497-331-000-000-000-000-000-000-000
Fannin Creek	900-0661-533-000-000-000-000-000-000-000-000
Orchid Creek	900-0661-735-000-000-000-000-000-000-000-000
Junior Creek	900-0661-unavailable (Seymour River Tributary)
Maplewood Creek	900-0661-unavailable (Seymour River Tributary)
First Lake Creek	900-0661-unavailable (Seymour River Tributary)
Shera Creek	900-0661-unavailable (Seymour River Tributary)
Belfour Creek	900-0661-unavailable (Seymour River Tributary)
Boulder Creek	900-0661-unavailable (Seymour River Tributary)
Clipper Creek	900-0661-unavailable (Seymour River Tributary)
Shefford Slough	100-0748-000-000-000-000-000-000-000-000-000
Siddle (Bell, Tathum) Creek	100-0728-000-000-000-000-000-000-000-000-000
Silverdale (Silver) Creek	100-0519-000-000-000-000-000-000-000-000-000
Proud Creek	100-0519-611-000-000-000-000-000-000-000-000
Gaudin Creek	100-0519-647-000-000-000-000-000-000-000-000
Nicholson Creek	100-0519-unavailable (Silverdale Creek Tributary)
Saunders Creek	100-0519-unavailable (Silverdale Creek Tributary)
Gilbert Brook	100-0519-unavailable (Silverdale Creek Tributary)
Ammon Brook	100-0519-unavailable (Silverdale Creek Tributary)
Sterns Brook	100-0519-unavailable (Silverdale Creek Tributary)
Swift Slough	100-0519-unavailable (Silverdale Creek Tributary)
Silverhope Creek	100-1129-000-000-000-000-000-000-000-000-000
Eureka Creek	100-1129-083-000-000-000-000-000-000-000-000
Sowerby Creek	100-1129-179-000-000-000-000-000-000-000-000
Maimen Creek	100-1129-312-000-000-000-000-000-000-000-000
Simon (Gun Club) Creek	900-unavailable (Burrard Inlet Tributary)
Skwawolt Creek	100-1054-000-000-000-000-000-000-000-000-000
Slaughterhouse Creek	900-unavailable (Burrard Inlet Tributary)
Southslope Creek	100-unavailable (Fraser River Tributary)
Sprott Creek	100-0425-000-000-000-000-000-000-000-000-000
Stave River & Hayward Lake	100-0471-000-000-000-000-000-000-000-000-000
Hairsine Creek	100-0471-043-000-000-000-000-000-000-000-000
Steelhead Creek	100-0471-091-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Rolley Creek	100-0471-124-000-000-000-000-000-000-000-000
Hoover Lake Creek	100-0471-155-000-000-000-000-000-000-000-000
Seventynine Creek	100-0471-166-000-000-000-000-000-000-000-000
Isle Slough	100-0471-171-000-000-000-000-000-000-000-000
Kearsley Creek	100-0471-185-000-000-000-000-000-000-000-000
Sayres Lake Creek & Sayres Lake	100-0471-206-000-000-000-000-000-000-000-000
Cardinalis Creek	100-0471-216-000-000-000-000-000-000-000-000
Cannell Lake Creek	100-0471-216-780-000-000-000-000-000-000-000
Cascade Creek	100-0471-221-000-000-000-000-000-000-000-000
Weatherhead Creek	100-0471-243-000-000-000-000-000-000-000-000
Lost Creek	100-0471-251-000-000-000-000-000-000-000-000
Twin Lakes Creek	100-0471-251-343-000-000-000-000-000-000-000
Salsbury Creek	100-0471-311-000-000-000-000-000-000-000-000
Terepocki Creek	100-0471-311-257-000-000-000-000-000-000-000
Kenyon Lake Creek	100-0471-311-257-392-000-000-000-000-000-000
Glacier Creek	100-0471-378-000-000-000-000-000-000-000-000
Tingle Creek	100-0471-396-000-000-000-000-000-000-000-000
Winslow Creek	100-0471-463-000-000-000-000-000-000-000-000
Papp Creek	100-0471-472-000-000-000-000-000-000-000-000
Donatelli Creek	100-0471-unavailable (Stave River Tributary)
Silvermere Lake	100-0471-unavailable (Stave River Tributary)
Blind Slough	100-0471-unavailable (Stave River Tributary)
Stockholm Creek	100-1145-000-000-000-000-000-000-000-000-000
Sumas River	100-0657-000-000-000-000-000-000-000-000-000
Unnamed Creek	100-0657-022-000-000-000-000-000-000-000-000
Miller Slough	100-0657-093-000-000-000-000-000-000-000-000
McGillivary Slough	100-0657-093-374-000-000-000-000-000-000-000
Unnamed Creek	100-0657-093-374-164-000-000-000-000-000-000
Unnamed Creek	100-0657-093-374-164-408-000-000-000-000-000
Unnamed Creek	100-0657-093-374-164-502-000-000-000-000-000
Unnamed Creek	100-0657-093-374-164-684-000-000-000-000-000
Unnamed Creek	100-0657-093-374-272-000-000-000-000-000-000
Unnamed Creek	100-0657-093-374-328-000-000-000-000-000-000
Unnamed Creek	100-0657-093-374-400-000-000-000-000-000-000
Unnamed Creek	100-0657-093-374-475-000-000-000-000-000-000
Unnamed Creek	100-0657-093-374-597-000-000-000-000-000-000
Unnamed Creek	100-0657-093-374-865-000-000-000-000-000-000
Chilliwack River and Lake, Vedder Canal	100-0657-097-000-000-000-000-000-000-000-000
Lewis Slough	100-0657-097-061-000-000-000-000-000-000-000
Unnamed Creek	100-0657-097-061-429-000-000-000-000-000-000
Unnamed Creek	100-0657-097-061-582-000-000-000-000-000-000
Unnamed Creek	100-0657-097-061-896-000-000-000-000-000-000
Salwein Creek	100-0657-097-066-000-000-000-000-000-000-000
Street Creek (Hopedale Slough)	100-0657-097-074-000-000-000-000-000-000-000
Unnamed Creek	100-0657-097-074-615-000-000-000-000-000-000
Sweltzer River & Cultus Lake	100-0657-097-133-000-000-000-000-000-000-000
Hatchery Creek	100-0657-097-133-293-000-000-000-000-000-000
Wells Creek	100-0657-097-133-389-000-000-000-000-000-000
Fin Creek	100-0657-097-133-492-000-000-000-000-000-000
Smith Falls Creek	100-0657-097-133-515-000-000-000-000-000-000
Laurel Creek	100-0657-097-133-529-000-000-000-000-000-000
Windfall Creek	100-0657-097-133-537-000-000-000-000-000-000
Ascaphus Creek	100-0657-097-133-574-000-000-000-000-000-000
Clear Creek	100-0657-097-133-690-000-000-000-000-000-000
Teapot Creek	100-0657-097-133-844-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Watt Creek	100-0657-097-133-913-000-000-000-000-000-000
Amadis Creek	100-0657-097-133-913-259-000-000-000-000-000
Unnamed (end of the Lake)	100-0657-097-133-967-000-000-000-000-000-000
Frosst Creek	100-0657-097-133-976-000-000-000-000-000-000
Unnamed Creek	100-0657-097-133-976-667-000-000-000-000-000
Unnamed Creek	100-0657-097-133-976-867-000-000-000-000-000
Unnamed Creek	100-0657-097-133-976-911-000-000-000-000-000
Midgley Creek	100-0657-097-160-000-000-000-000-000-000-000
Liumchen Creek	100-0657-097-177-000-000-000-000-000-000-000
East Liumchen Creek	100-0657-097-177-435-000-000-000-000-000-000
Ryder Creek	100-0657-097-210-000-000-000-000-000-000-000
Wingfield Creek	100-0657-097-219-000-000-000-000-000-000-000
Little Tamihi Creek	100-0657-097-240-000-000-000-000-000-000-000
Young Creek	100-0657-097-245-000-000-000-000-000-000-000
Tamihi Creek	100-0657-097-248-000-000-000-000-000-000-000
Seedling Creek	100-0657-097-339-000-000-000-000-000-000-000
Thurston Creek	100-0657-097-347-000-000-000-000-000-000-000
Borden Creek	100-0657-097-357-000-000-000-000-000-000-000
Nursery Creek	100-0657-097-362-000-000-000-000-000-000-000
Slesse Creek	100-0657-097-380-000-000-000-000-000-000-000
Buxton Creek	100-0657-097-380-025-000-000-000-000-000-000
Pierce Creek	100-0657-097-403-000-000-000-000-000-000-000
Chipmunk Creek	100-0657-097-450-000-000-000-000-000-000-000
Foley Creek	100-0657-097-458-000-000-000-000-000-000-000
Airplane Creek	100-0657-097-458-199-000-000-000-000-000-000
Williamson Creek	100-0657-097-458-316-000-000-000-000-000-000
Nesakwatch (Middle) Creek	100-0657-097-507-000-000-000-000-000-000-000
Centre Creek	100-0657-097-562-000-000-000-000-000-000-000
Post Creek	100-0657-097-619-000-000-000-000-000-000-000
Radium Creek	100-0657-097-625-000-000-000-000-000-000-000
Paleface Creek	100-0657-097-706-000-000-000-000-000-000-000
Depot Creek	100-0657-097-723-000-000-000-000-000-000-000
Fifteen Mile Creek	100-0657-097-unavailable Lower Chilliwack R. Tributary
Fourteen Mile Creek	100-0657-097-unavailable Lower Chilliwack R. Tributary
Barrett Creek	100-0657-097-unavailable Lower Chilliwack R. Tributary
Peach Creek	100-0657-097-unavailable Lower Chilliwack R. Tributary
Little Fork Creek	100-0657-097-unavailable Upper Chilliwack R. Tributary
Indian Creek	100-0657-097-unavailable Upper Chilliwack R. Tributary
Brush Creek	100-0657-097-unavailable Upper Chilliwack R. Tributary
Easy Creek	100-0657-097-unavailable Upper Chilliwack R. Tributary
Sumas Lake Canal & Sumas Lake Creek	100-0657-151-000-000-000-000-000-000-000-000
Unnamed Creek	100-0657-151-103-000-000-000-000-000-000-000
Unnamed Creek	100-0657-151-223-000-000-000-000-000-000-000
Unnamed Creek	100-0657-151-377-000-000-000-000-000-000-000
Unnamed Creek	100-0657-151-378-000-000-000-000-000-000-000
Stewart Slough	100-0657-151-515-000-000-000-000-000-000-000
Unnamed Creek	100-0657-151-515-343-000-000-000-000-000-000
Unnamed Creek	100-0657-151-515-343-340-000-000-000-000-000
Unnamed Creek	100-0657-151-515-575-000-000-000-000-000-000
Unnamed Creek	100-0657-151-515-786-000-000-000-000-000-000
Unnamed Creek	100-0657-151-515-876-000-000-000-000-000-000
Unnamed Creek	100-0657-151-515-950-000-000-000-000-000-000
Unnamed Creek	100-0657-151-651-000-000-000-000-000-000-000
Unnamed Creek	100-0657-151-652-000-000-000-000-000-000-000
Unnamed Creek	100-0657-151-758-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Unnamed Creek	100-0657-151-785-000-000-000-000-000-000-000
Unnamed Creek	100-0657-151-785-220-000-000-000-000-000-000
Unnamed Creek	100-0657-151-785-472-000-000-000-000-000-000
Unnamed Creek	100-0657-151-785-472-108-000-000-000-000-000
Unnamed Creek	100-0657-151-785-544-000-000-000-000-000-000
Unnamed Creek	100-0657-151-785-889-000-000-000-000-000-000
Unnamed Creek	100-0657-177-000-000-000-000-000-000-000-000
Unnamed Creek	100-0657-301-000-000-000-000-000-000-000-000
Unnamed Creek	100-0657-301-634-000-000-000-000-000-000-000
Unnamed Creek	100-0657-351-000-000-000-000-000-000-000-000
Unnamed Creek	100-0657-378-000-000-000-000-000-000-000-000
Lonzo (Marshall)Creek	100-0657-439-000-000-000-000-000-000-000-000
Kilgard Creek	100-0657-439-101-000-000-000-000-000-000-000
Unnamed Creek	100-0657-439-604-000-000-000-000-000-000-000
Unnamed Creek	100-0657-439-736-000-000-000-000-000-000-000
Unnamed Creek	100-0657-439-736-038-000-000-000-000-000-000
Unnamed Creek	100-0657-439-736-223-000-000-000-000-000-000
Unnamed Creek	100-0657-439-893-000-000-000-000-000-000-000
Unnamed Creek	100-0657-439-965-000-000-000-000-000-000-000
Unnamed Creek	100-0657-455-000-000-000-000-000-000-000-000
Unnamed Creek	100-0657-455-201-000-000-000-000-000-000-000
Unnamed Creek	100-0657-455-836-000-000-000-000-000-000-000
Saar Creek	100-0657-483-000-000-000-000-000-000-000-000
Arnold Slough	100-0657-483-404-000-000-000-000-000-000-000
Unnamed Creek	100-0657-483-404-544-000-000-000-000-000-000
Unnamed Creek	100-0657-483-404-661-000-000-000-000-000-000
Unnamed Creek	100-0657-483-680-000-000-000-000-000-000-000
Sussex Creek	Between Nelson & Kaymar Creeks
Suter Brook	900-unavailable (Burrard Inlet Tributary)
Tamboline Slough	100-0026-000-000-000-000-000-000-000-000-000
Tilbury Slough	100-unavailable (Fraser River Tributary)
Tones Creek	100-0522-000-000-000-000-000-000-000-000-000
Unnamed Creek (between McAdam Ck & Manson Canl	100-0162-000-000-000-000-000-000-000-000-000
Unnamed Creek (btwn McAdam Ck & Manson Canal)	100-0176-000-000-000-000-000-000-000-000-000
Unnamed Creek (btwn Brunette R. & Nelson Ck)	100-0210-000-000-000-000-000-000-000-000-000
Unnamed Creek	100-0210-095-000-000-000-000-000-000-000-000
Unnamed Creek # 32	100-0359-000-000-000-000-000-000-000-000-000
Unnamed Creek Between # 32 & # 33	100-0364-000-000-000-000-000-000-000-000-000
Unnamed Creek # 33	100-0367-000-000-000-000-000-000-000-000-000
Unnamed Creek in IR #5	100-0414-000-000-000-000-000-000-000-000-000
Unnamed Creek	900-0548-000-000-000-000-000-000-000-000-000
Wades Creek	100-0623-000-000-000-000-000-000-000-000-000
Chadsey (Cox) Creek	100-0623-025-000-000-000-000-000-000-000-000
Unnamed Creek	100-0623-266-000-000-000-000-000-000-000-000
Unnamed Creek	100-0623-419-000-000-000-000-000-000-000-000
Wahleach (Jones) Creek	100-1018-000-000-000-000-000-000-000-000-000
Boulder Creek	100-1018-552-000-000-000-000-000-000-000-000
Wahleach Slough	100-unavailable (Fraser River Tributary)
West Creek	100-0416-000-000-000-000-000-000-000-000-000
Whonnock Creek	100-0453-000-000-000-000-000-000-000-000-000
Wilson Slough	100-0692-000-000-000-000-000-000-000-000-000
Windermere Creek	900-0505-000-000-000-000-000-000-000-000-000
Woodward Slough	100-unavailable (Fraser River Tributary)
York Creek	100-0450-000-000-000-000-000-000-000-000-000
Yorkson (Jenkins, Telegraph Trail) Creek	100-0333-000-000-000-000-000-000-000-000-000

Stream Name (alphabetically ordered by stream system)	Watershed Code
Munday Creek	100-0333-484-000-000-000-000-000-000-000-000
Zaitscullachan Slough	100-0713-000-000-000-000-000-000-000-000-000

APPENDIX 2 – HYDROGRAPHS

The hydrographs[1] contained in Appendix 2 have been adapted from the work of Rood and Hamilton's series (see References) on hydrology and water use for salmon streams in the habitat management areas of the Lower Fraser River, which include:

- Fraser River Delta
- Chilliwack/Lower Fraser
- Pitt/Stave
- Harrison
- Middle Fraser

Note: Not all systems in the **Strategic Review** have a hydrograph since they were not included in the Rood and Hamilton reports. Hydrographs are included for the following streams:

Alouette River
Bonaccord Creek
Bridal Creek
Brunette River
Byrne Creek
Campbell River
Chehalis River
Chilliwack Creek
Chilliwack River (Lower)
Chilliwack River (Upper)
Coligny Creek
Como Creek
Coquihalla River
Coquitlam River
Cougar Canyon Creek
Gifford Slough (tributary to McLennan Creek)
Hanna Creek
Harrison River
Hatzic Slough
Hope Slough
Hunter Creek
Kanaka Creek
Lorenzetta Creek
Mahood Creek
Maria Slough
Matsqui Slough
McLennan Creek
Morris Creek
Musqueam Creek
Nathan Creek
Nicomekl River
Nicomen Slough
Pitt River
Ruby Creek
Salmon River
Scott Creek
Serpentine River
Silverdale Creek
Silverhope Creek
Sumas River
Wades Creek
Wahleach Creek
Wahleach Slough
West Creek
Whonnock Creek
Yorkson Creek

[1] The mean annual hydrograph is an average of the flow recorded on each day for all complete years of record. The mean annual flow is noted on the hydrograph; this, together with the percent values on the vertical axis, allows estimation of the flows for various times of the year. For unguaged streams, the mean annual hydrograph is transferred from a hydrologically similar, nearby stream.

APPENDIX 3 – ESCAPEMENT

Escapement[1] data has been compiled from Fish Habitat Inventory and Information Program Stream Summary Catalogues and Pacific Biological Station DFO (Nanaimo) records.

Availability

Escapement data is available for a limited number of streams; many of these are enhanced systems (i.e. stocked with hatchery fish). In a number of streams, not all of the species present may be ennumerated (thus data for only one species is available for these streams).

Reliability

There are many gaps in the data and counts have been done in a variety of ways. There are many factors that make this escapement data useful only as an indicator of salmon returns to the stream. This information alone should not be used for management decisions. It must be appreciated that the fish population of each stream may be exploited to varying degrees by legal and illegal fishing pressures. The stream escapement data only relates to the fish that survive that fishery and return to the stream to spawn.

Close monitoring of individual systems by DFO has declined over the past years. Many areas have stopped doing fish counts on stream systems since the mid 1980s to the early 1990s due to decreased resources. The current approach is to use key indicator streams (counting fences have been constructed on some of these), which are used to indicate escapement trends for streams in the area with similar characteristics. Escapement data is available and has been included for the following streams:

Alouette River	Hunter Creek	Salmon River
Campbell River	Kanaka Creek	Serpentine River
Capilano River	Lorenzetta Creek	Seymour River
Chehalis River	Lynn Creek	Silverdale Creek
Chilliwack River (Lower)	Mahood Creek	Silverhope Creek
Chilliwack River (Upper)	Maria Slough	Stave River
Coquihalla River	Nathan Creek	Sumas River
Coquitlam River	Nicomekl River	Wahleach Creek
Harrison River	Nicomen Slough	West Creek
Hatzic Slough	Pitt River	Whonnock Creek
Hope Slough	Ruby Creek	Yorkson Creek

[1] Escapement refers to the number of fish returning to their natal stream (i.e. surviving in the ocean, escaping the fishery, etc.)

APPENDIX 2 – HYDROGRAPHS

The hydrographs[1] contained in Appendix 2 have been adapted from the work of Rood and Hamilton's series *Hydrology and Water Use for Salmon Streams* (see References) on hydrology and water use for salmon streams in the habitat management areas of the Lower Fraser River, which include:

- Fraser River Delta
- Chilliwack/Lower Fraser
- Pitt/Stave
- Harrison
- Middle Fraser

Note: Not all systems in the **Strategic Review** have a hydrograph since they were not included in the Rood and Hamilton reports. Hydrographs are included for the following streams:

Alouette River
Bonaccord Creek
Bridal Creek
Brunette River
Byrne Creek
Campbell River
Chehalis River
Chilliwack Creek
Chilliwack River (Lower)
Chilliwack River (Upper)
Coligny Creek
Como Creek
Coquihalla River
Coquitlam River
Cougar Canyon Creek
Gifford Slough (tributary to McLennan Creek)
Hanna Creek
Harrison River
Hatzic Slough
Hope Slough
Hunter Creek
Kanaka Creek
Lorenzetta Creek
Mahood Creek
Maria Slough
Matsqui Slough
McLennan Creek
Morris Creek
Musqueam Creek
Nathan Creek
Nicomekl River
Nicomen Slough
Pitt River
Ruby Creek
Salmon River
Scott Creek
Serpentine River
Silverdale Creek
Silverhope Creek
Sumas River
Wades Creek
Wahleach Creek
Wahleach Slough
West Creek
Whonnock Creek
Yorkson Creek

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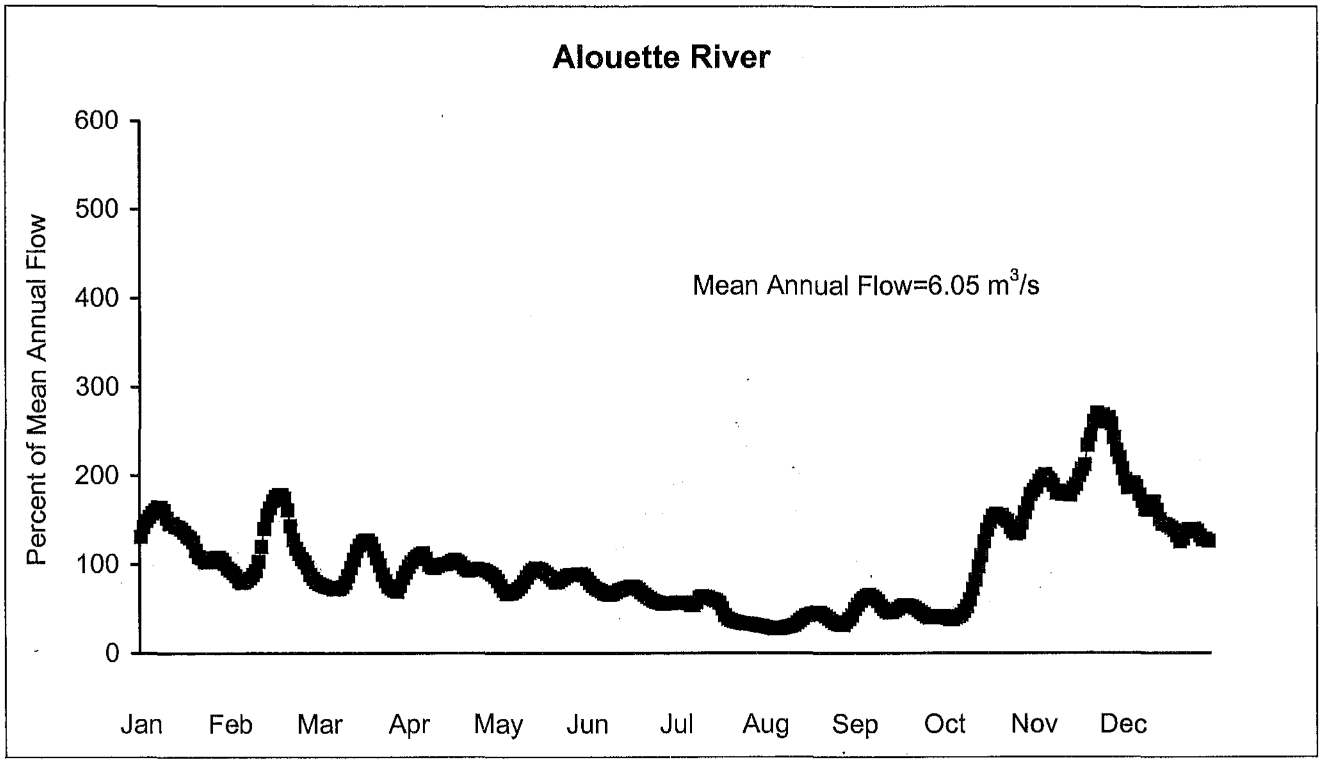
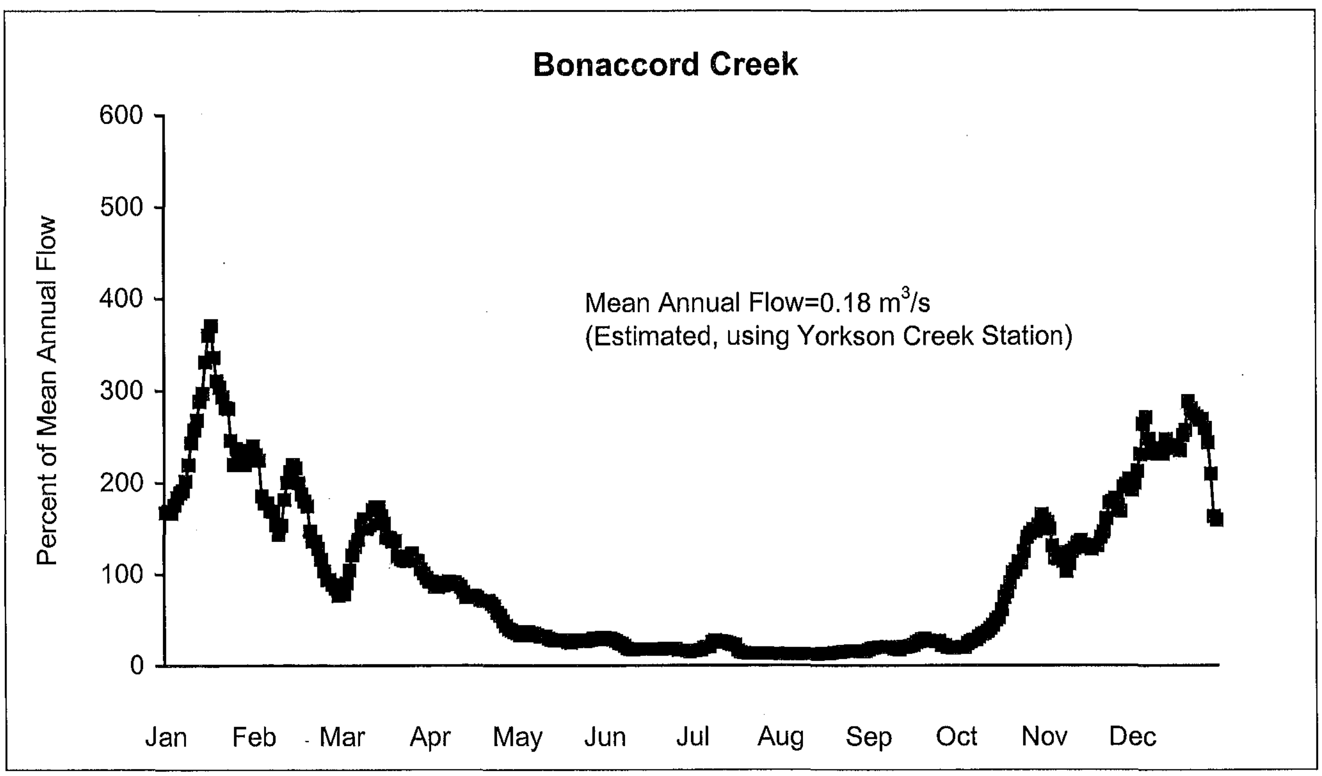
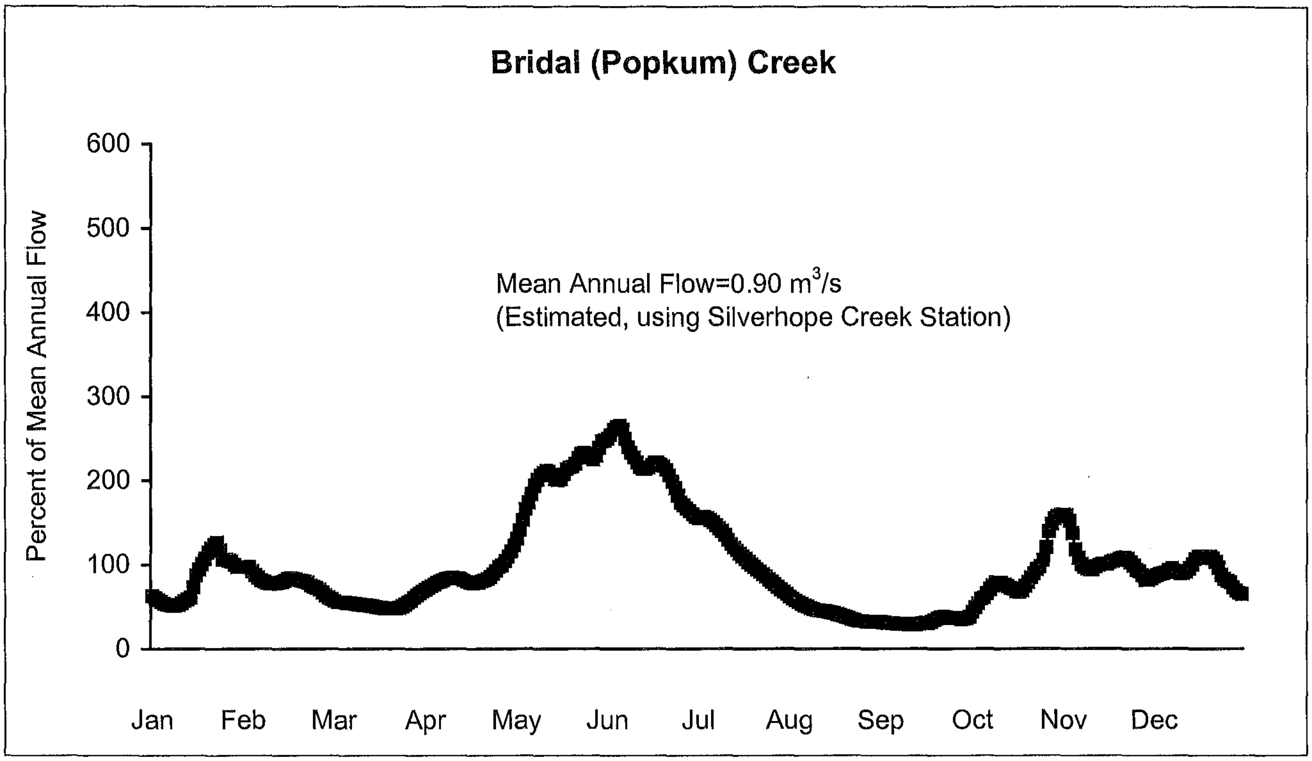
[1] The mean annual hydrograph is an average of the flow recorded on each day for all complete years of record. The mean annual flow is noted on the hydrograph; this, together with the percent values on the vertical axis, allows estimation of the flows for various times of the year. For unguaged streams, the mean annual hydrograph is transferred from a hydrologically similar, nearby stream.

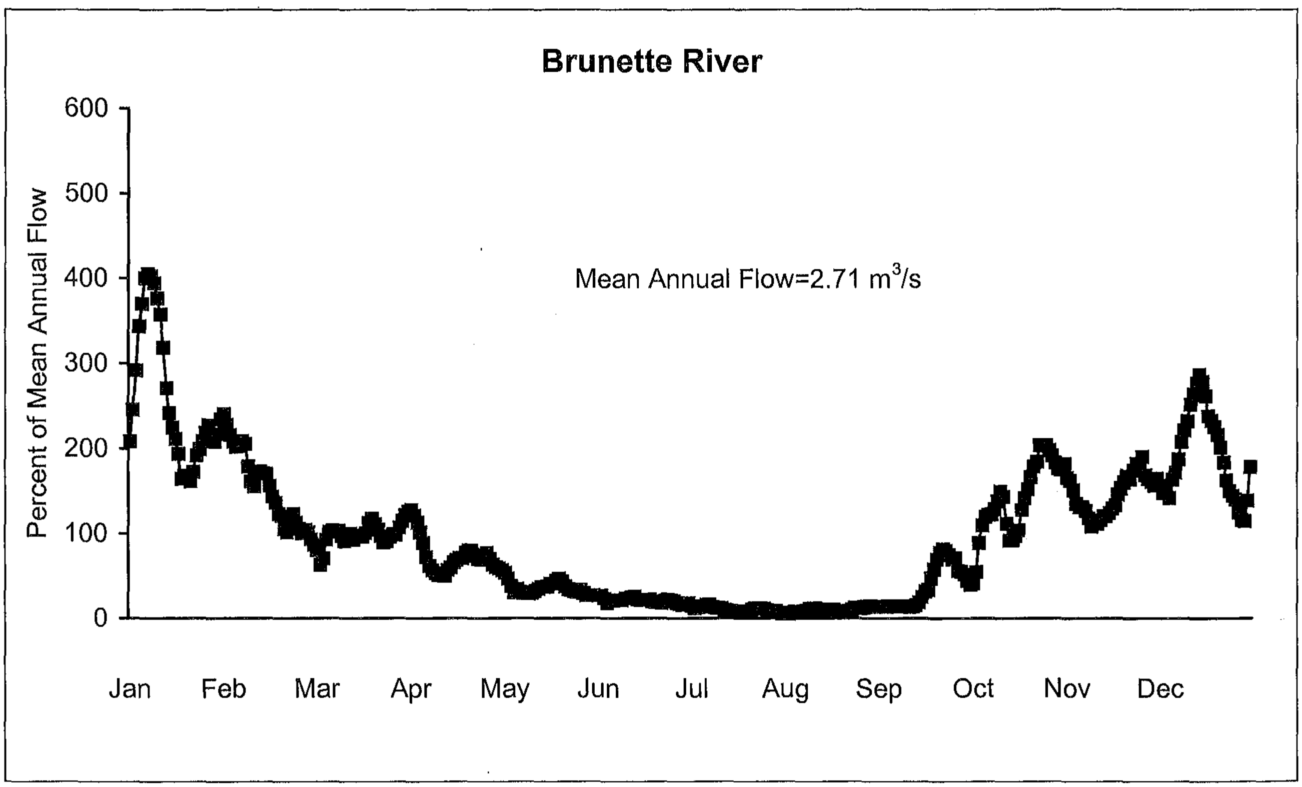


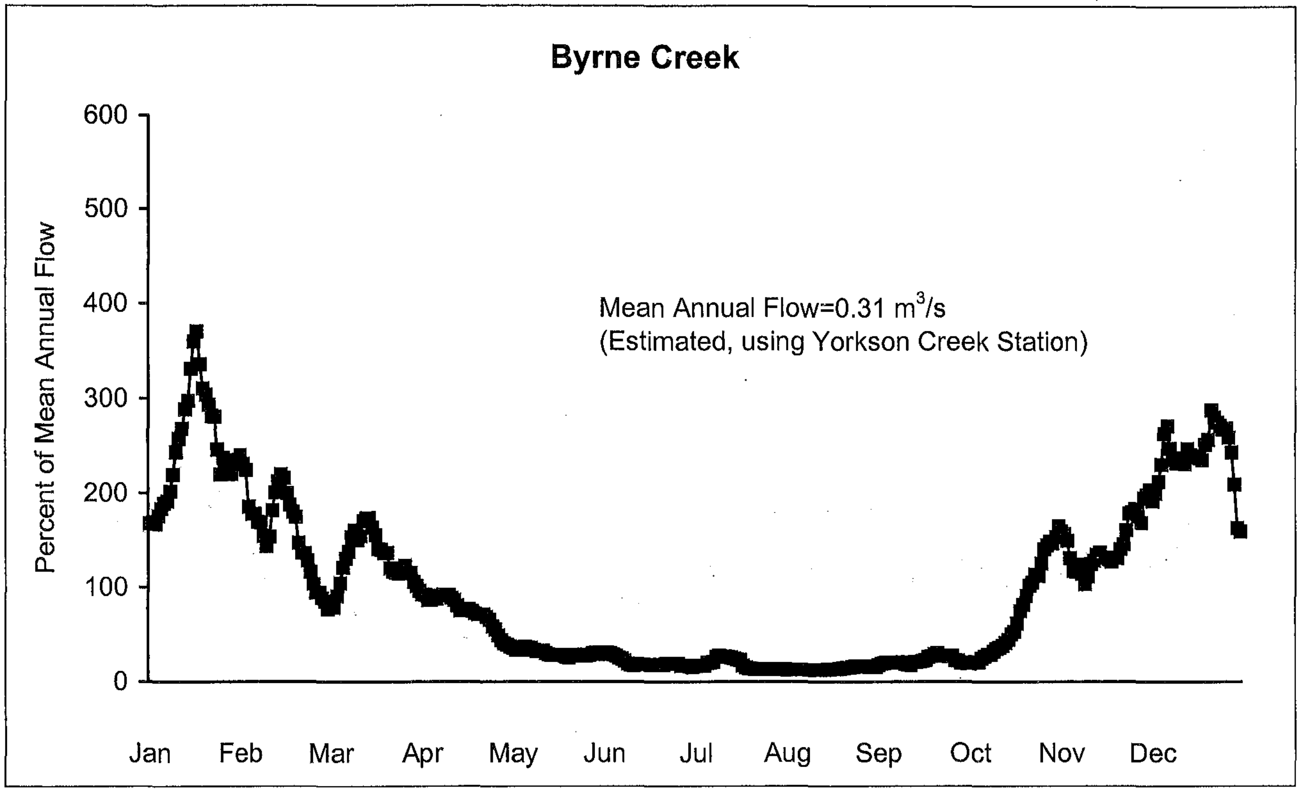
Alouette River
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=6.05 m³/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

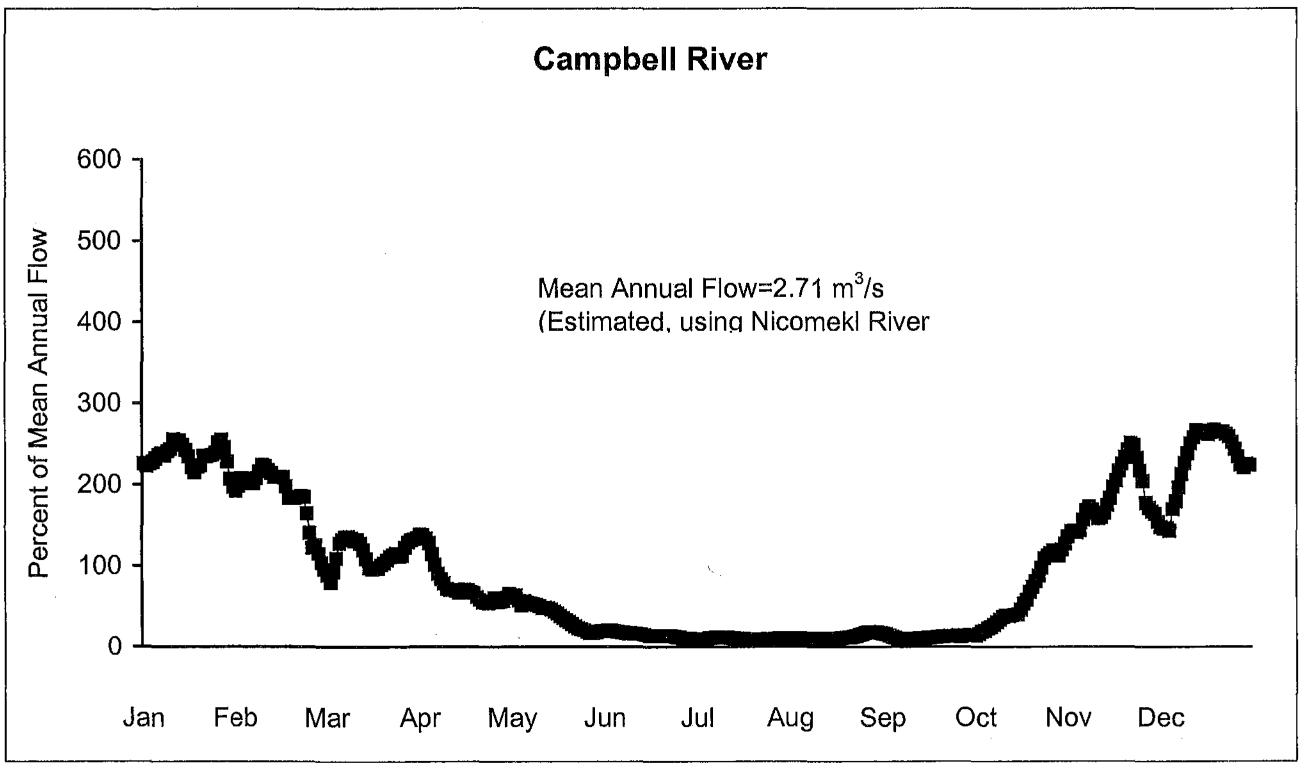


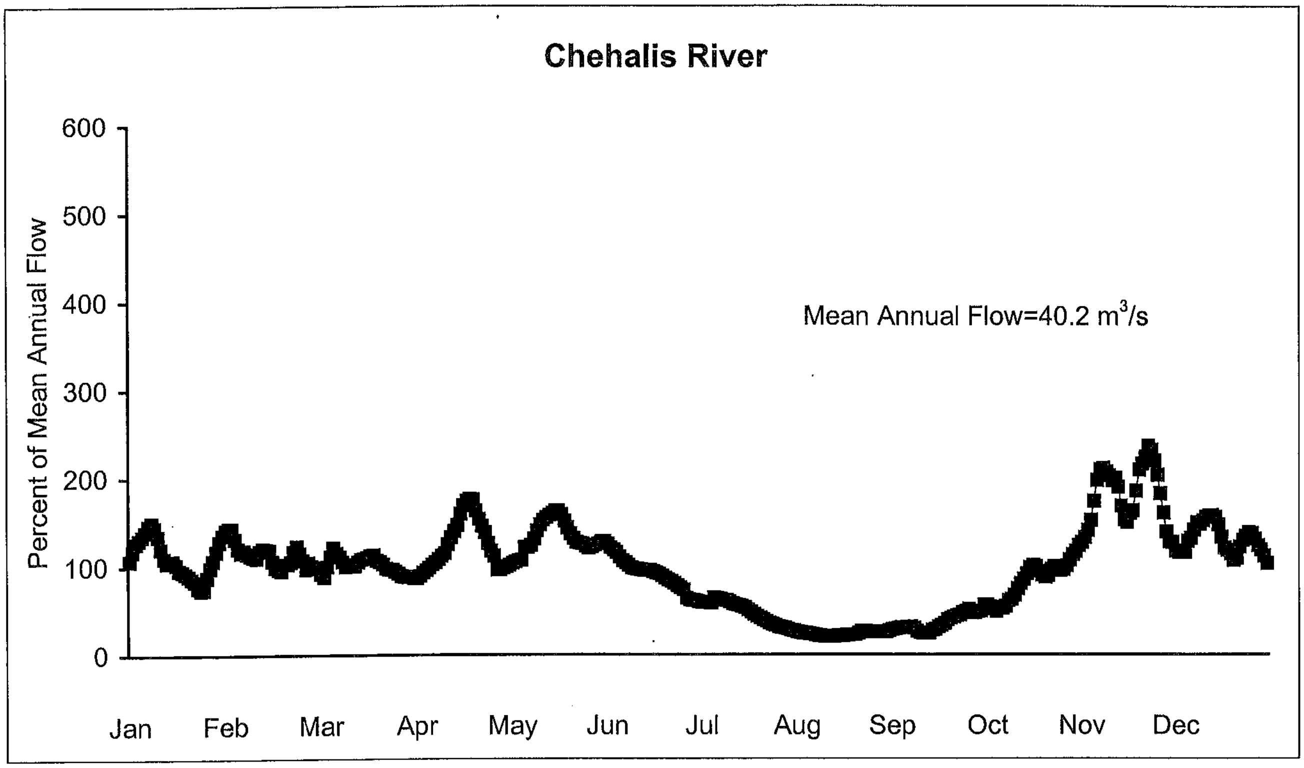
Bonaccord Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.18 m³/s
(Estimated, using Yorkson Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

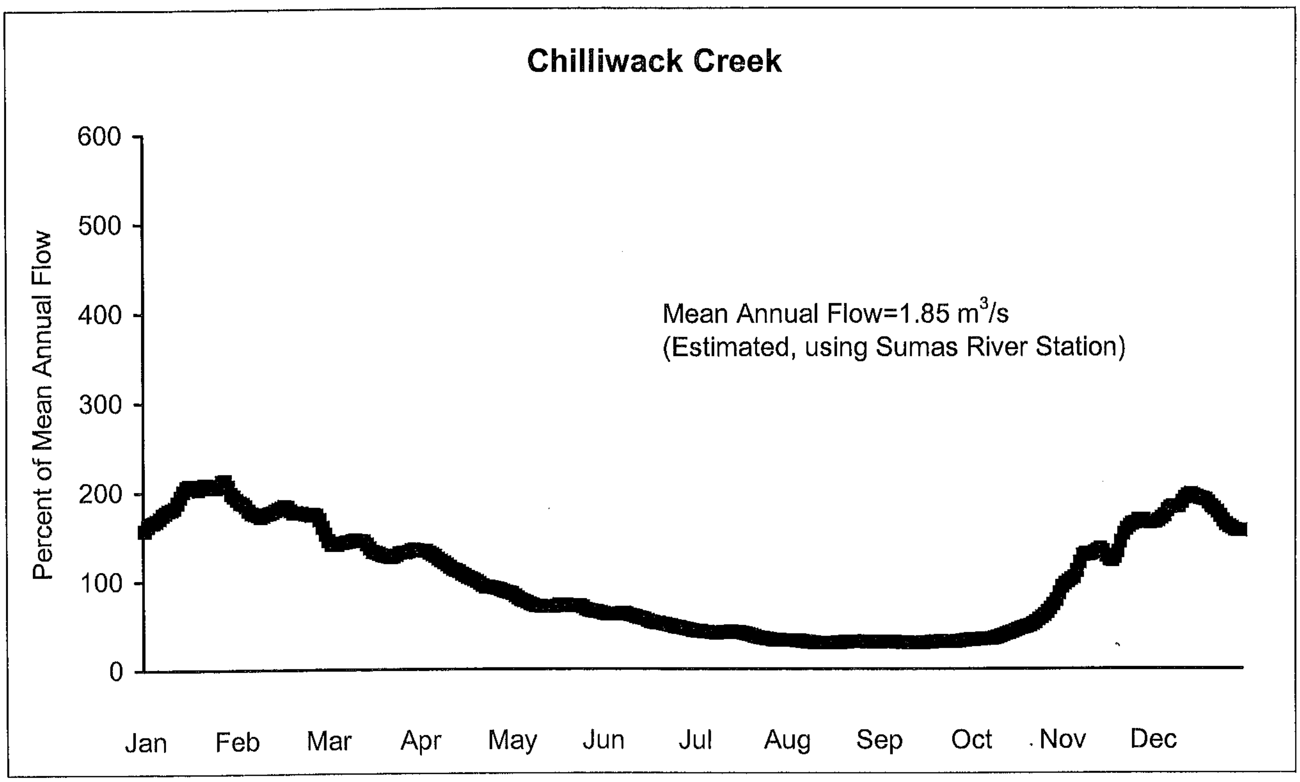

Bridal (Popkum) Creek
Mean Annual Flow=0.90 m³/s
(Estimated, using Silverhope Creek Station)
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

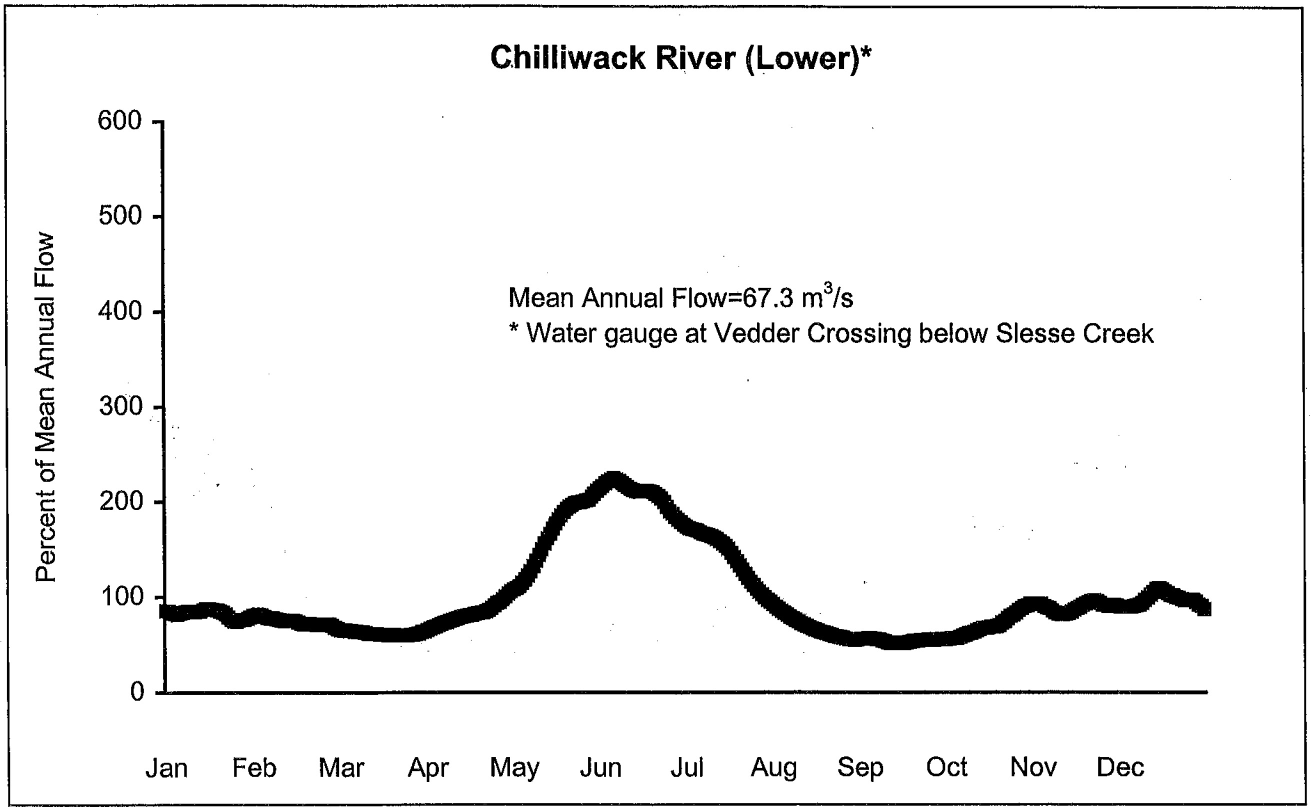

Brunette River
Mean Annual Flow=2.71 m³/s
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

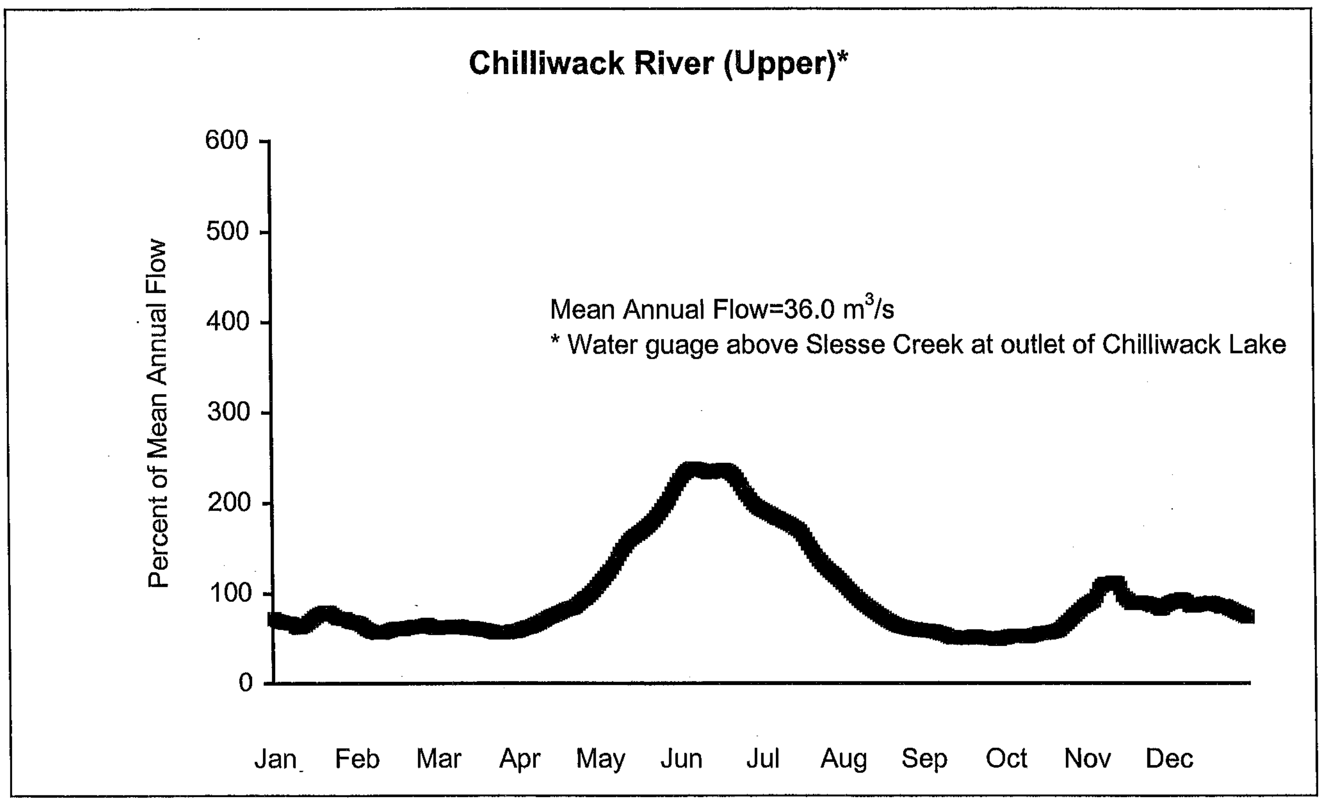

Byrne Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.31 m3/s
(Estimated, using Yorkson Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

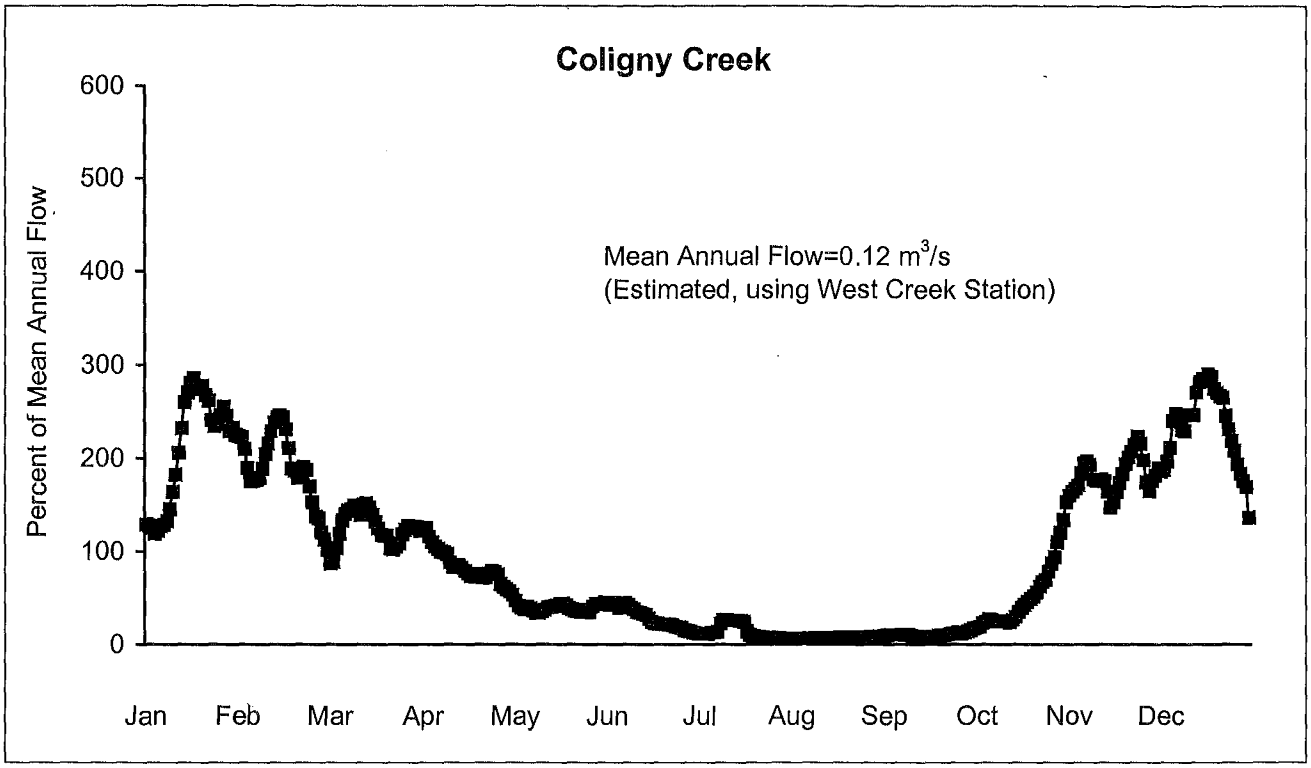

Campbell River
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=2.71 m3/s
(Estimated, using Nicomekl River
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

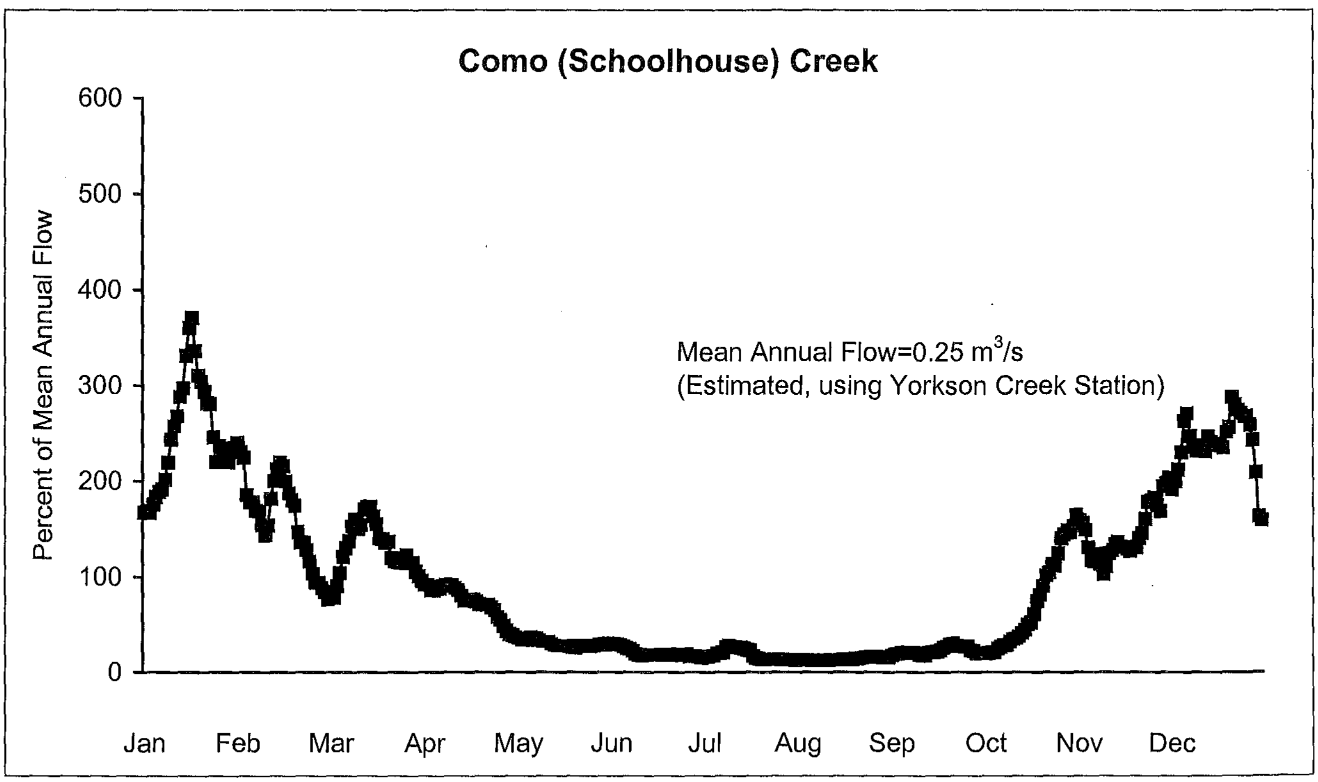

Chehalis River
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=40.2 m3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Chilliwack Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=1.85 m3/s
(Estimated, using Sumas River Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Chilliwack River (Lower)*
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=67.3 m3/s
* Water gauge at Vedder Crossing below Slesse Creek
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Chilliwack River (Upper)*
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=36.0 m3/s
* Water guage above Slesse Creek at outlet of Chilliwack Lake
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Coligny Creek
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=0.12 m3/s
(Estimated, using West Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Como (Schoolhouse) Creek
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=0.25 m3/s
(Estimated, using Yorkson Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
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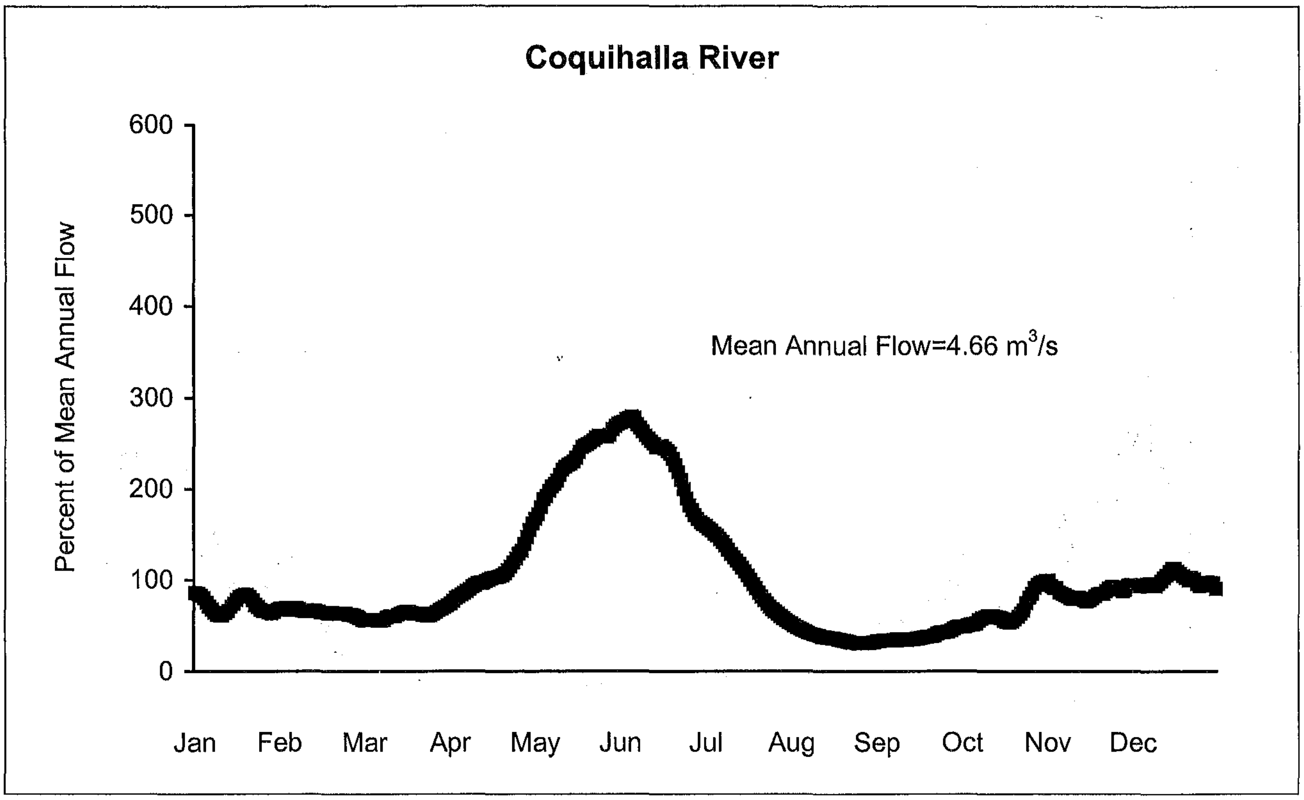
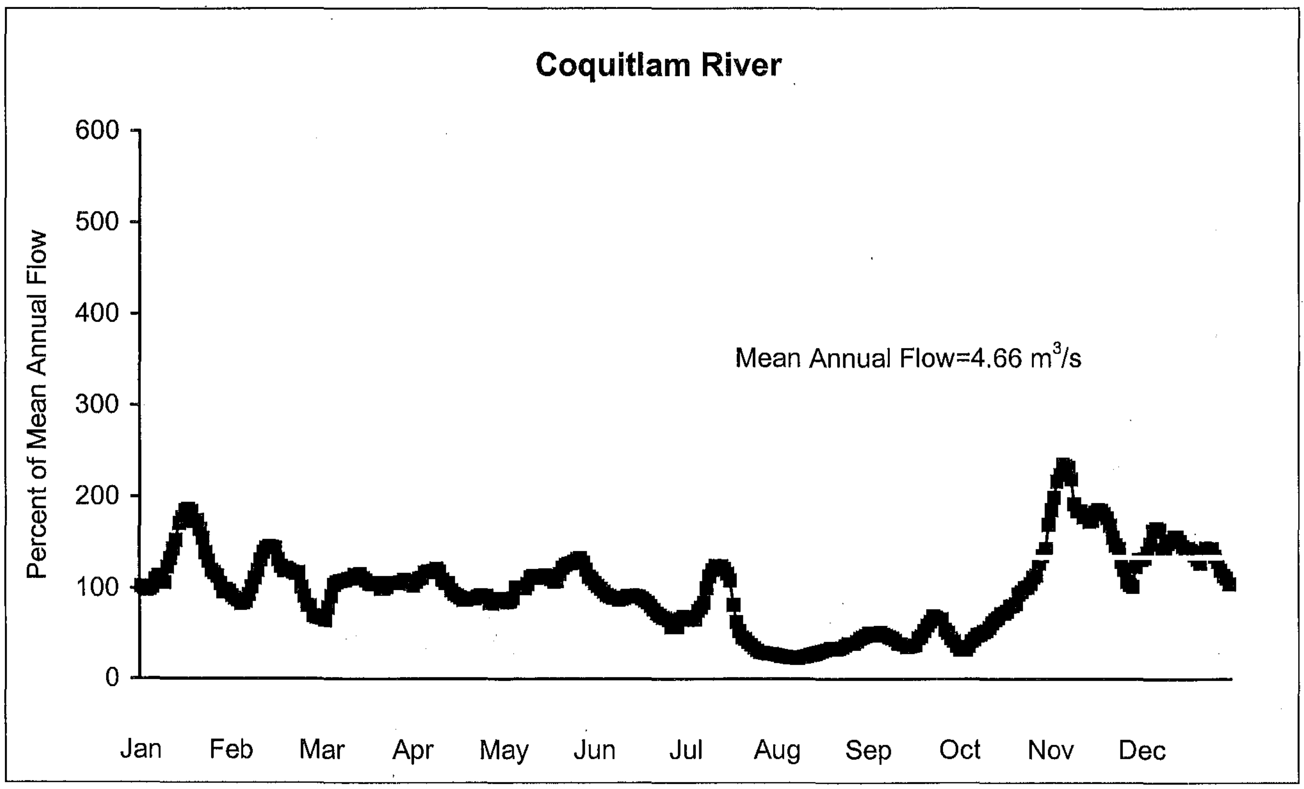
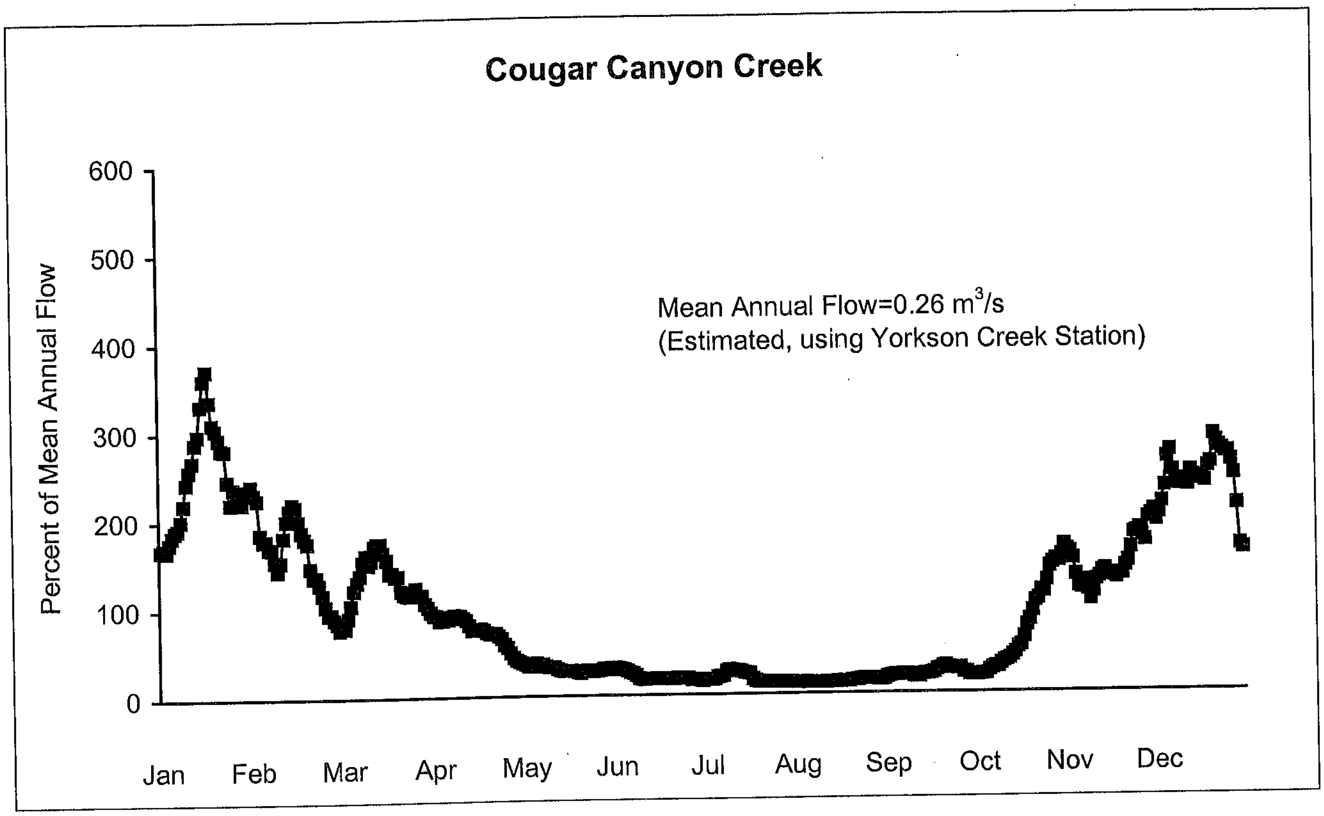
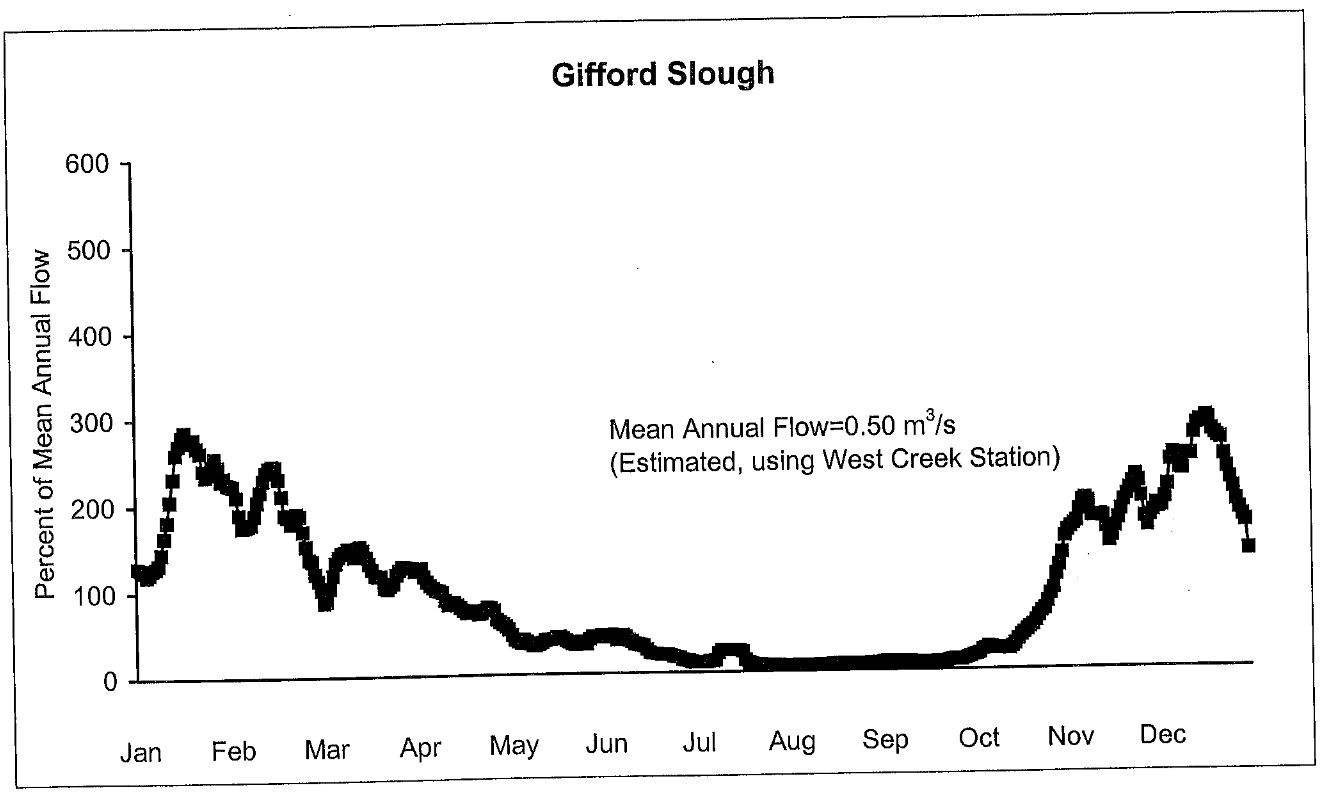
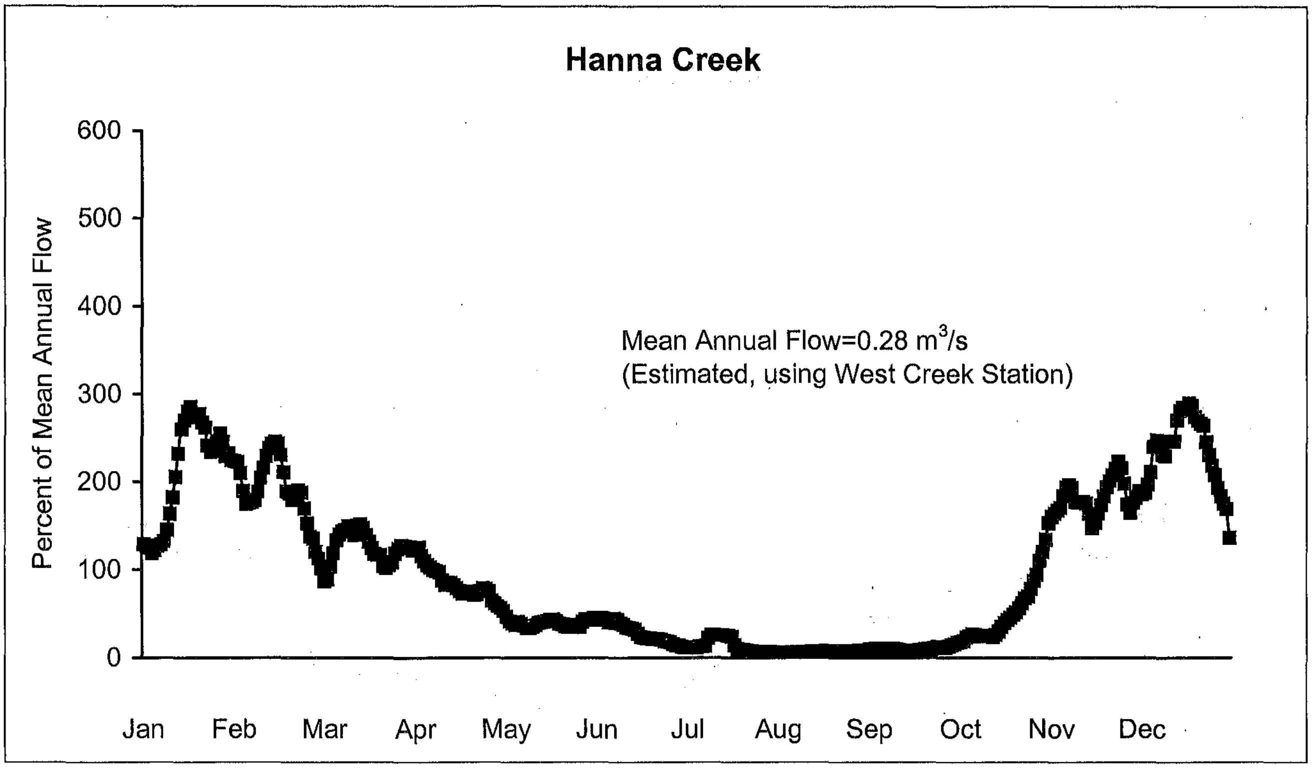
Sep
Oct
Nov
Dec

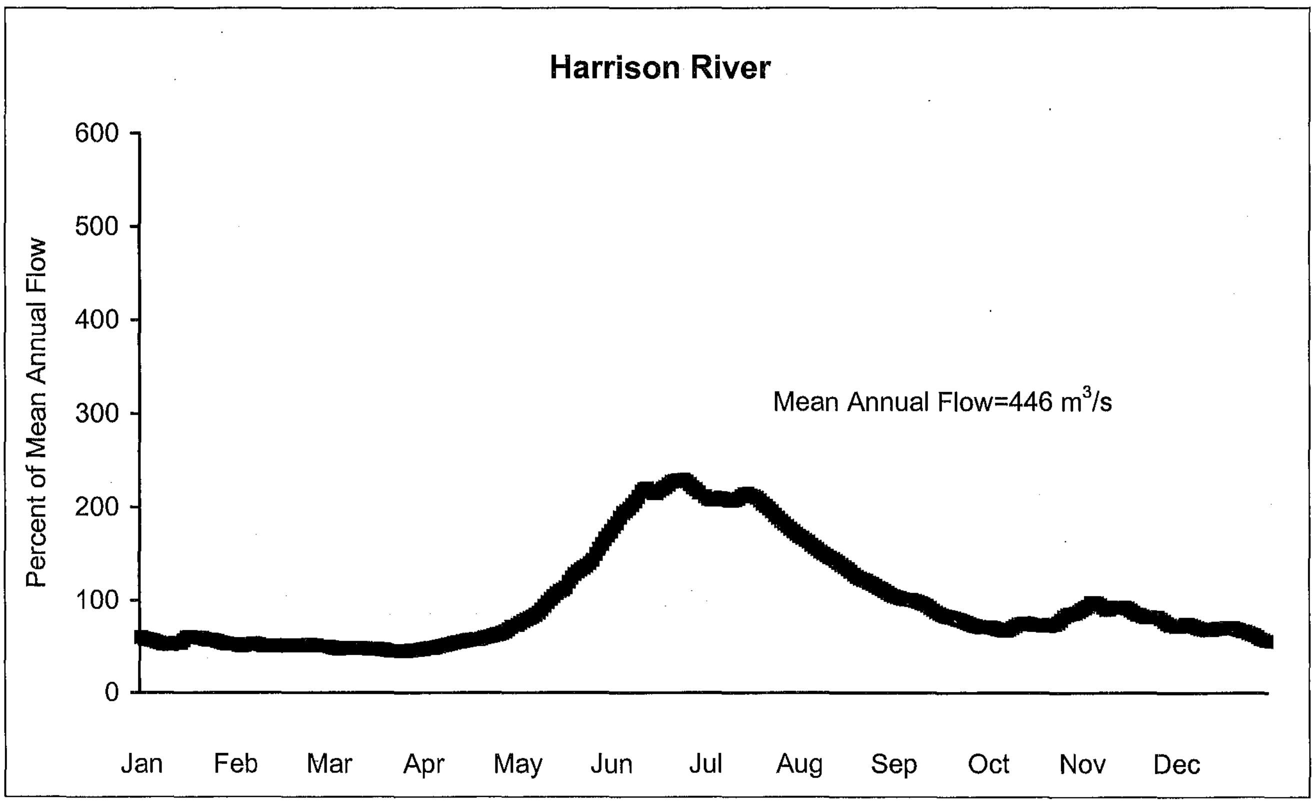

Coquihalla River
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=4.66 m³/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

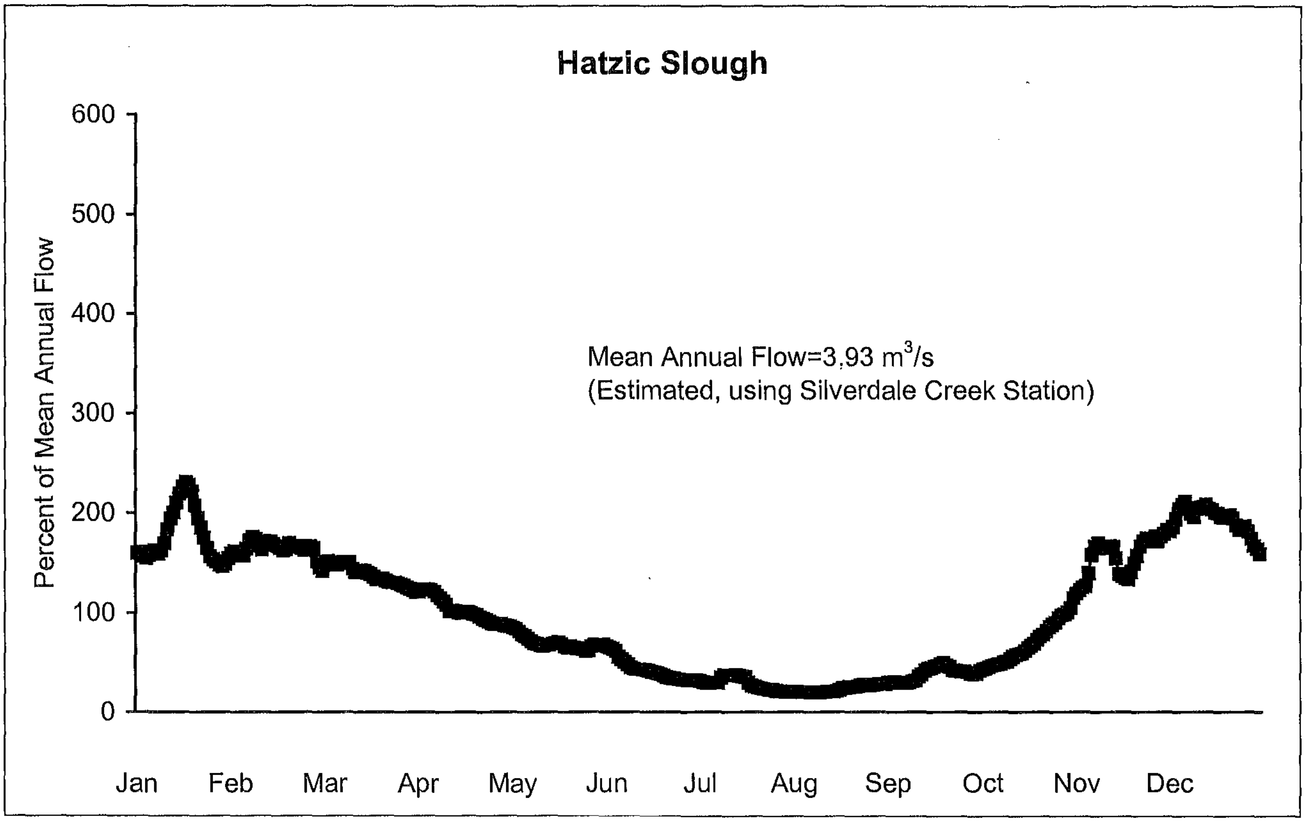

Coquitlam River
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=4.66 m³/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

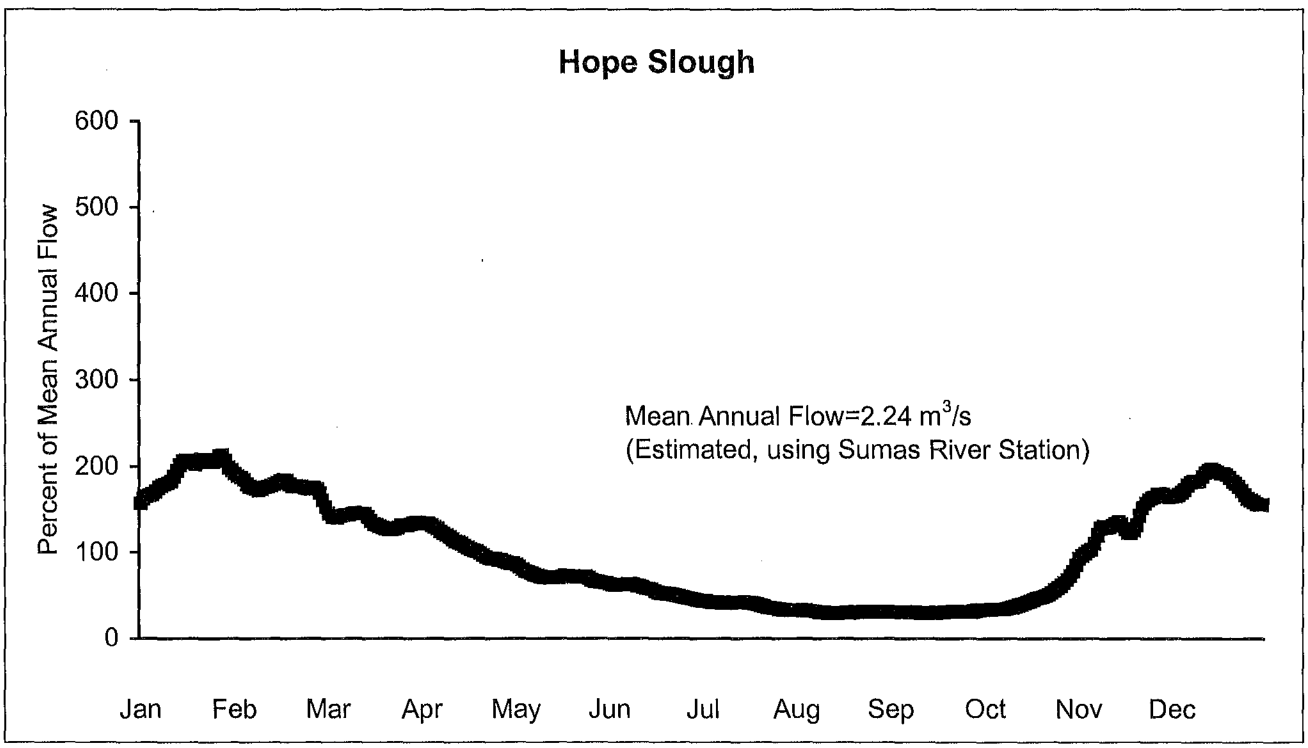

Cougar Canyon Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.26 m³/s
(Estimated, using Yorkson Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

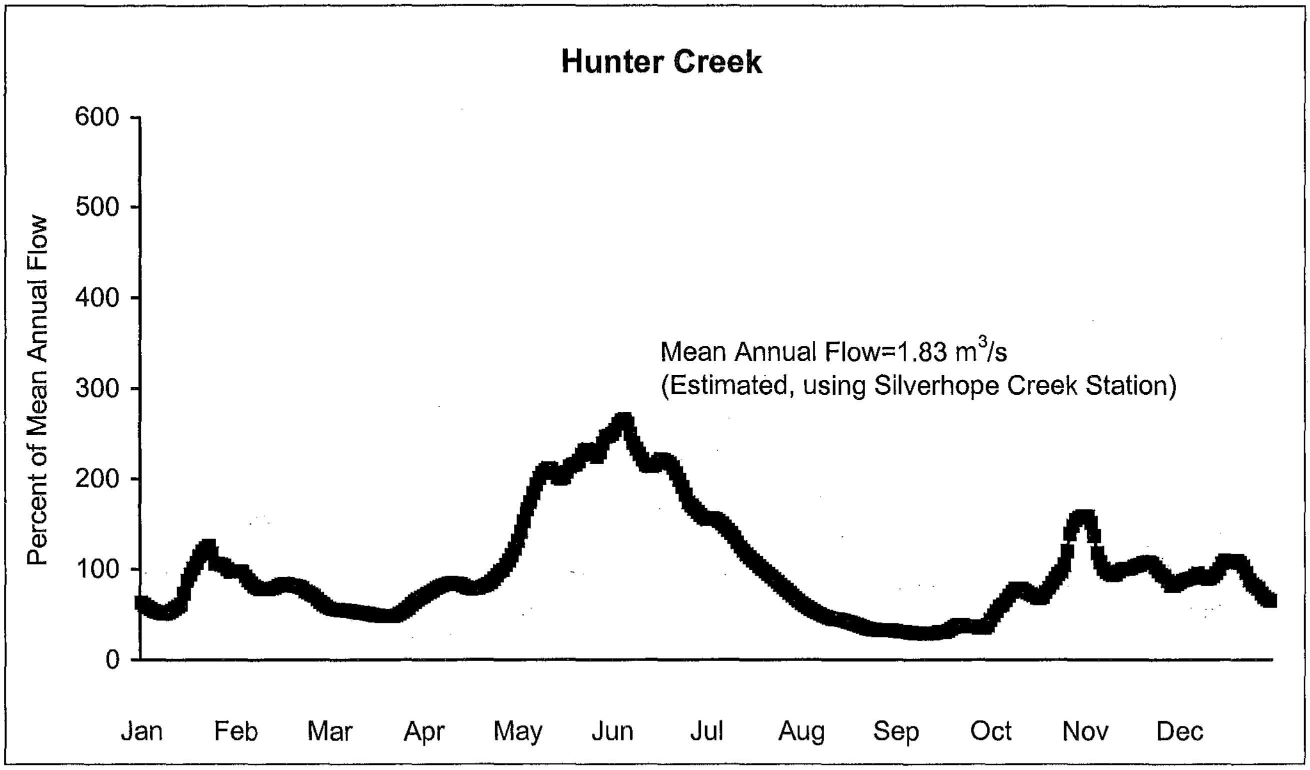

Gifford Slough
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.50 m³/s
(Estimated, using West Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

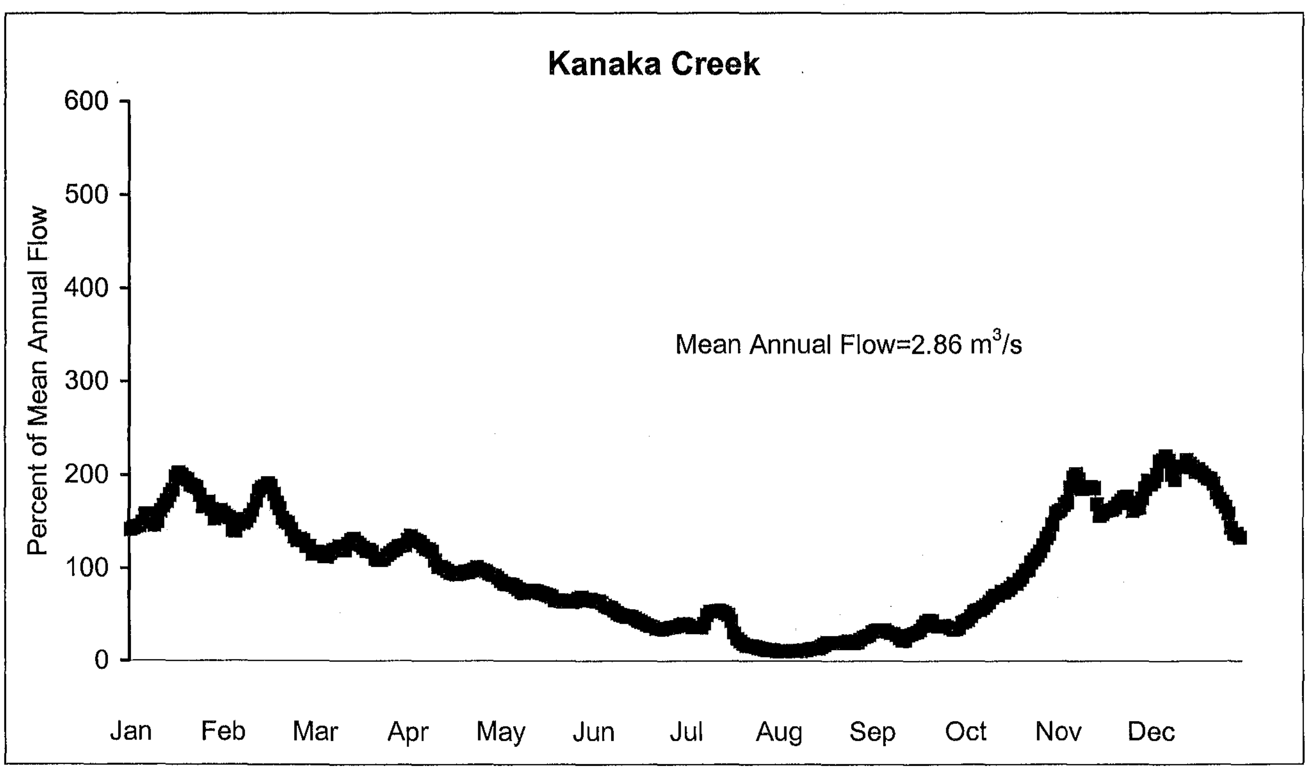

Hanna Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.28 m3/s
(Estimated, using West Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

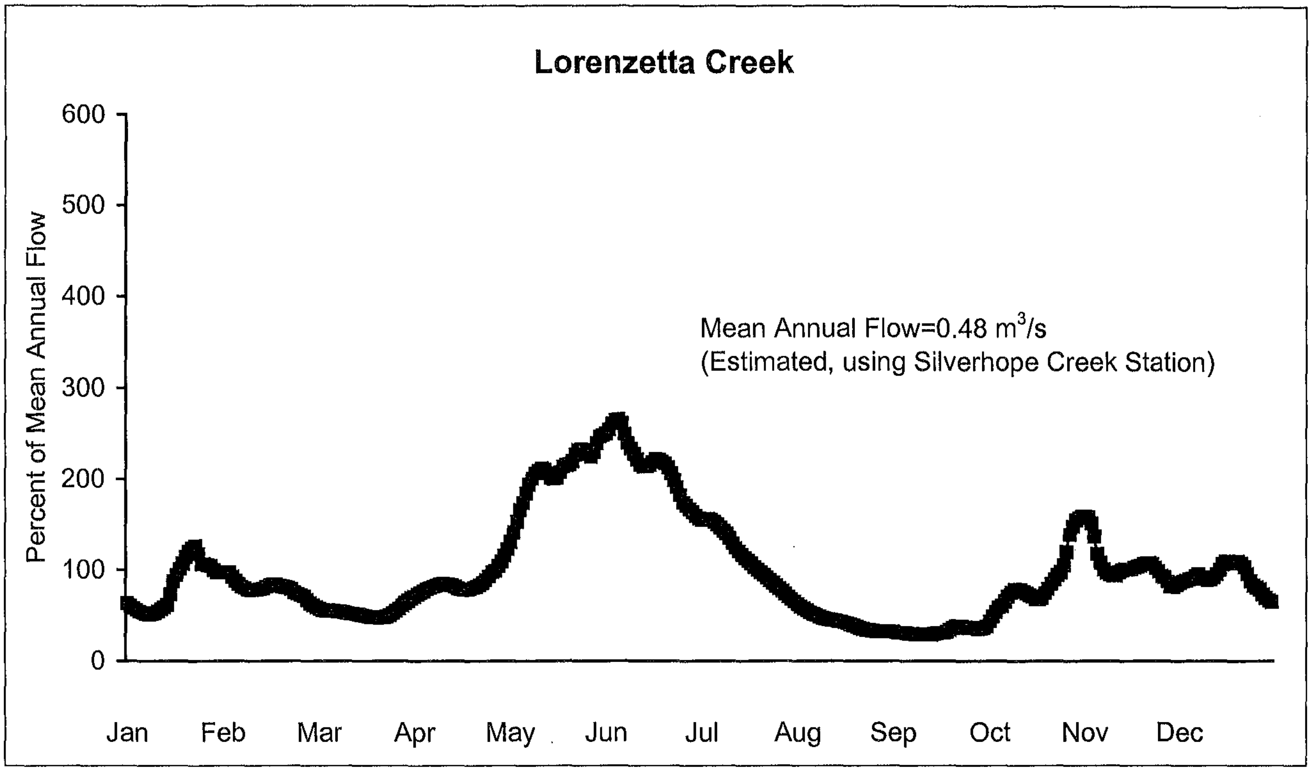

Harrison River
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=446 m3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

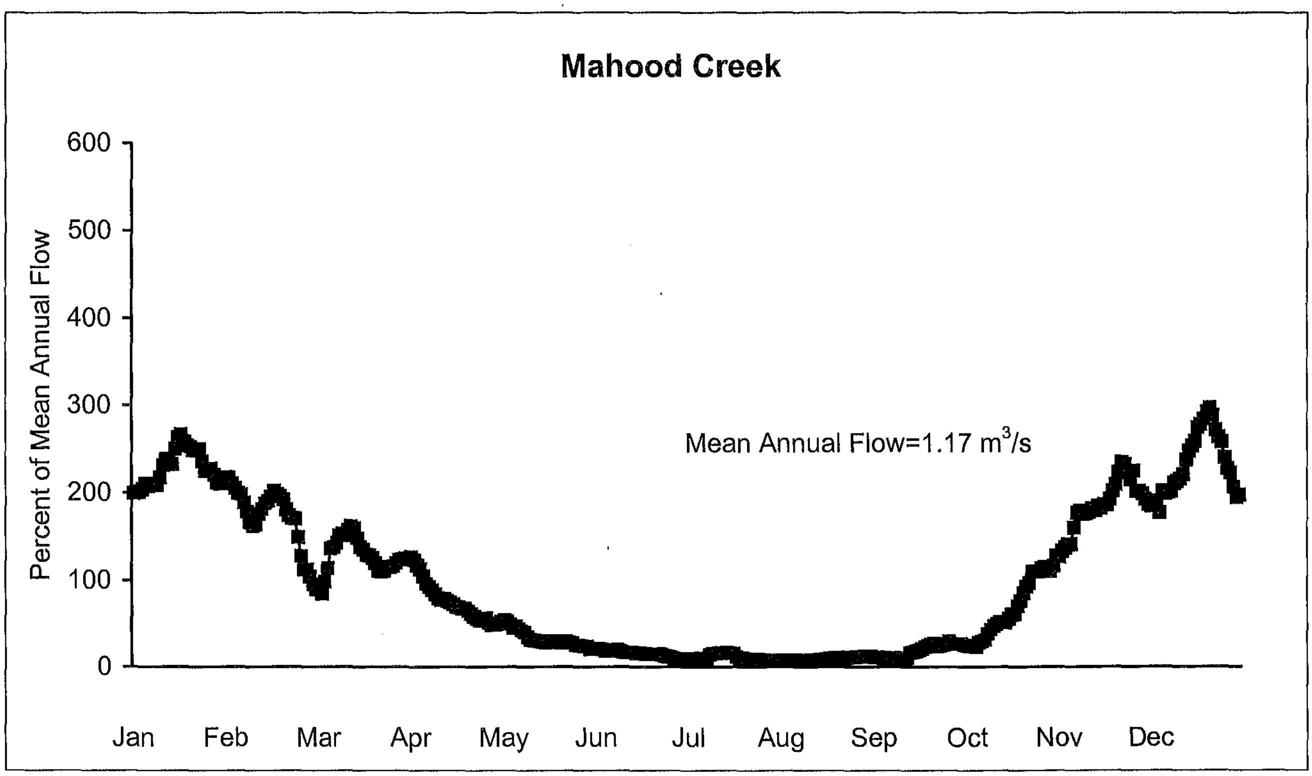

Hatzic Slough
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=3.93 m3/s
(Estimated, using Silverdale Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

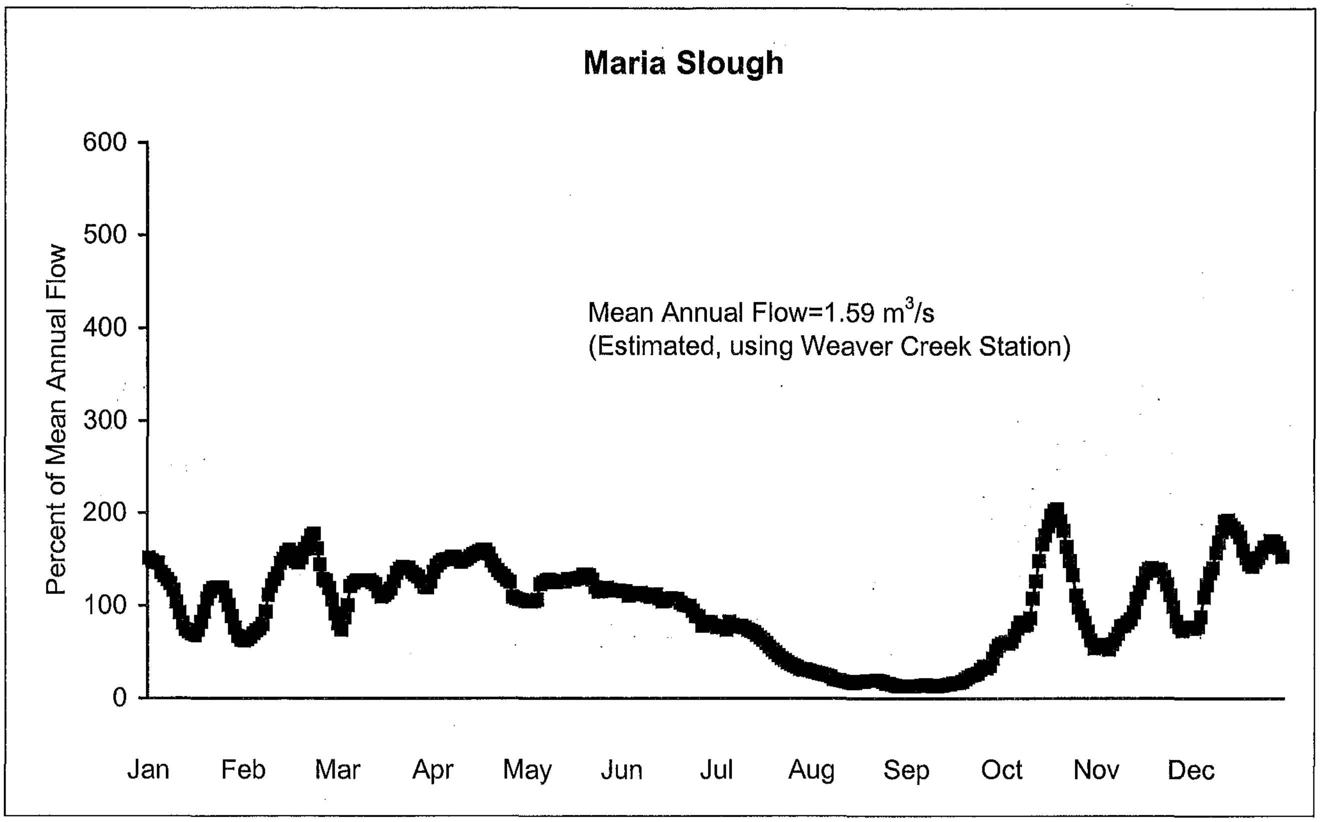

Hope Slough
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=2.24 m3/s
(Estimated, using Sumas River Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

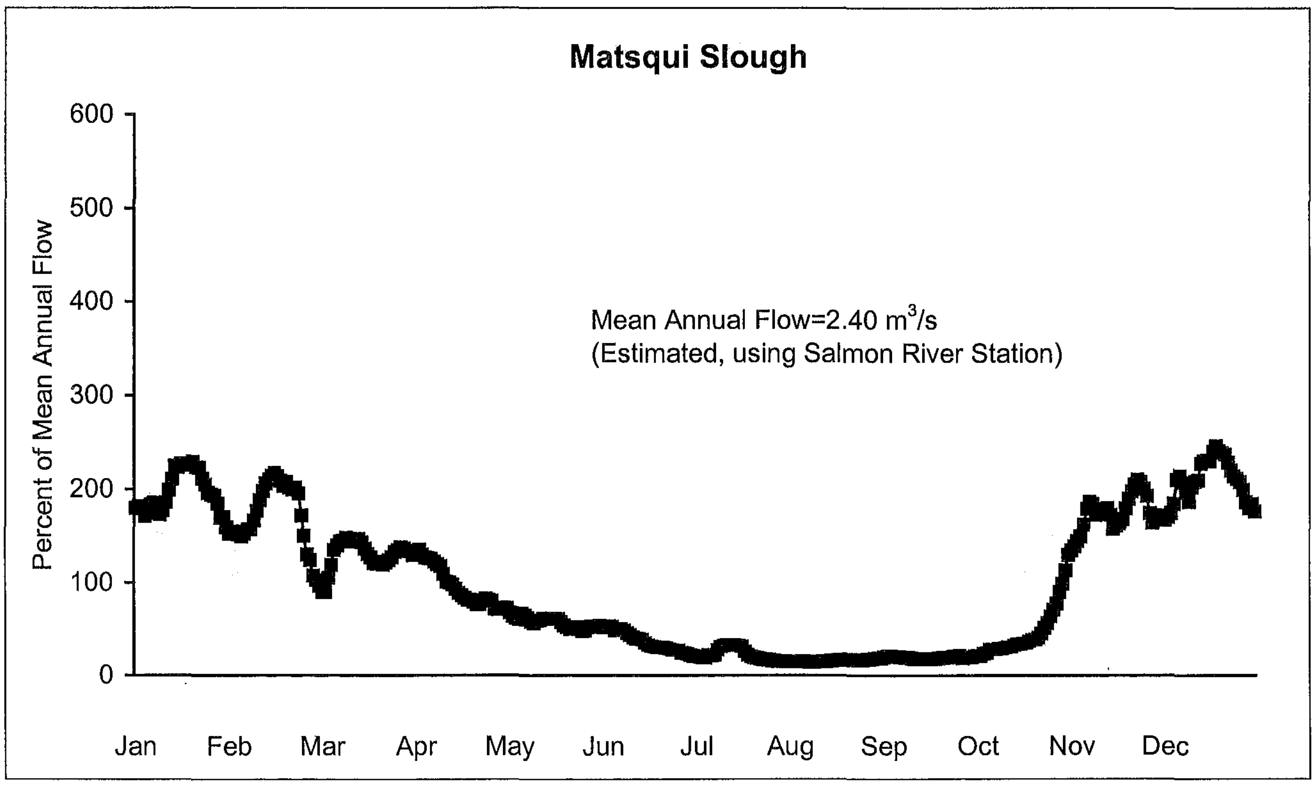

Hunter Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=1.83 m3/s
(Estimated, using Silverhope Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

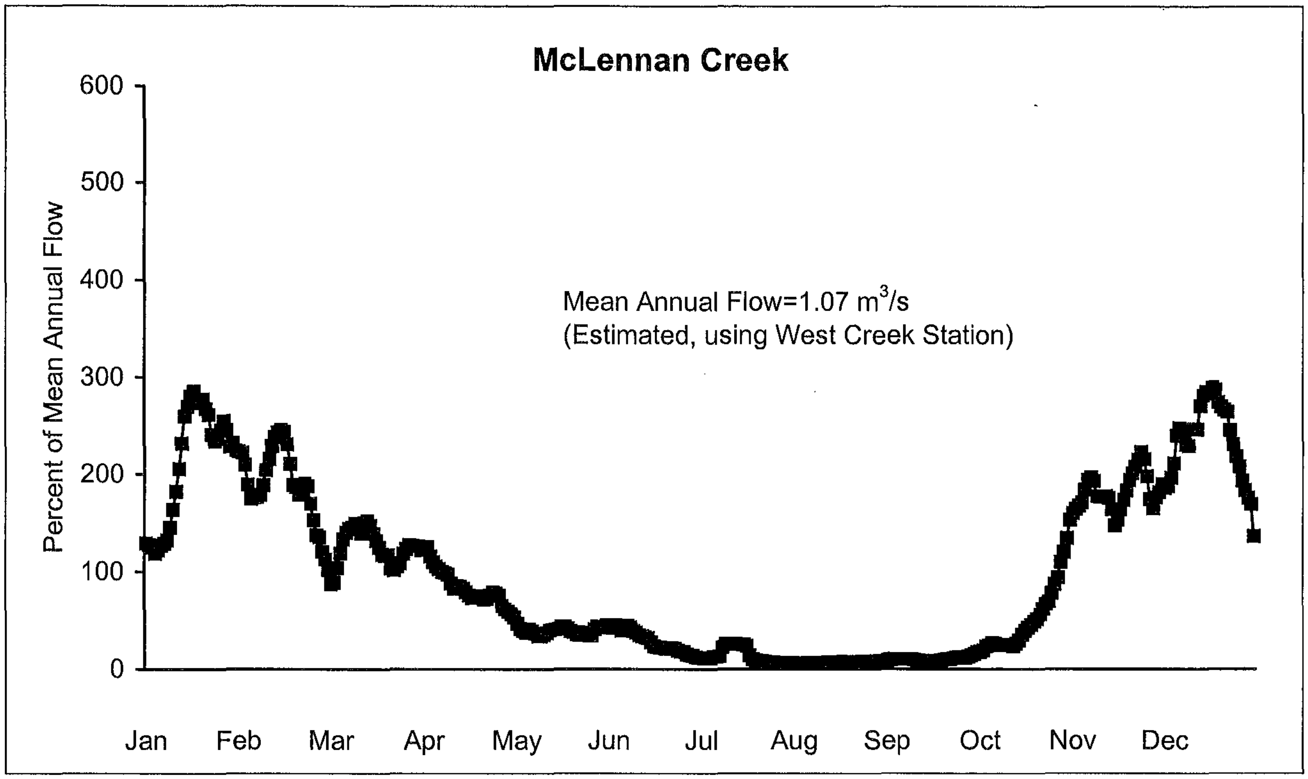

Kanaka Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=2.86 m3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

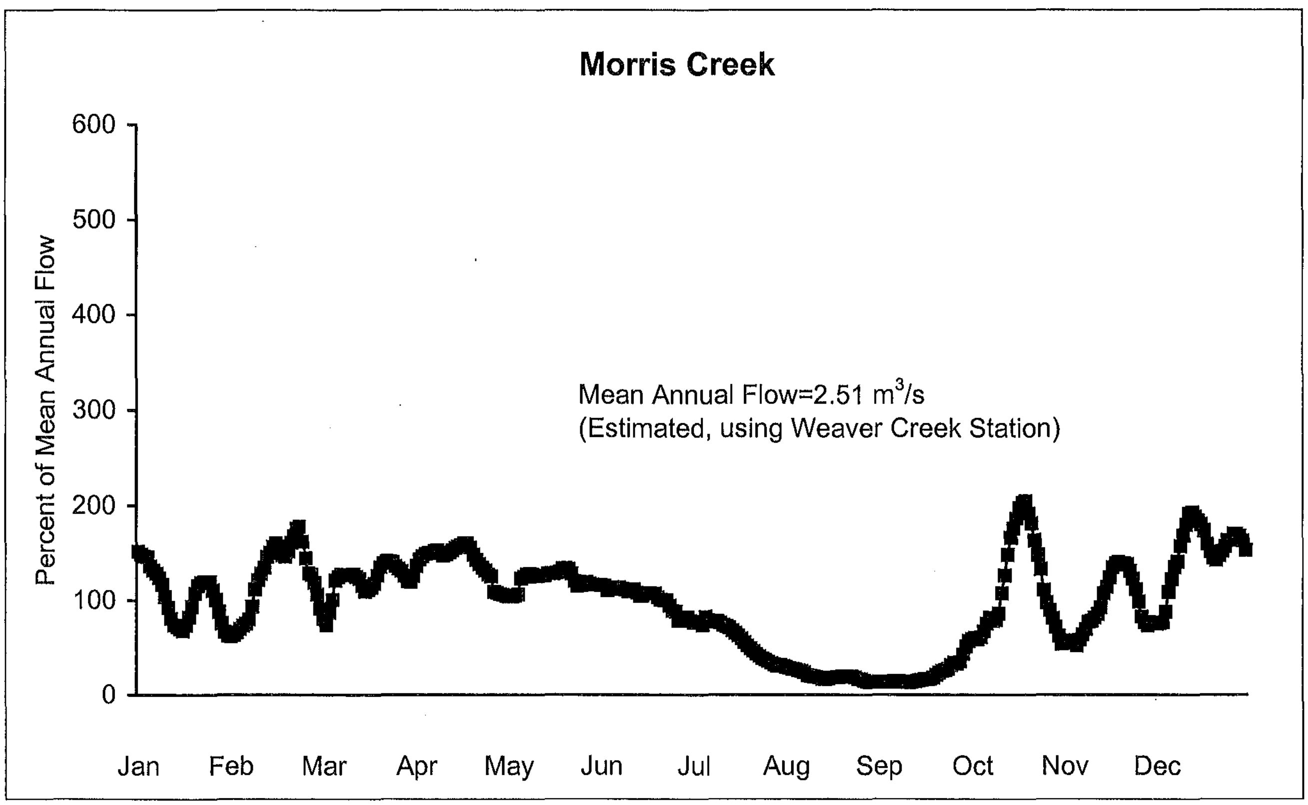

Lorenzetta Creek
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=0.48 m3/s
(Estimated, using Silverhope Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

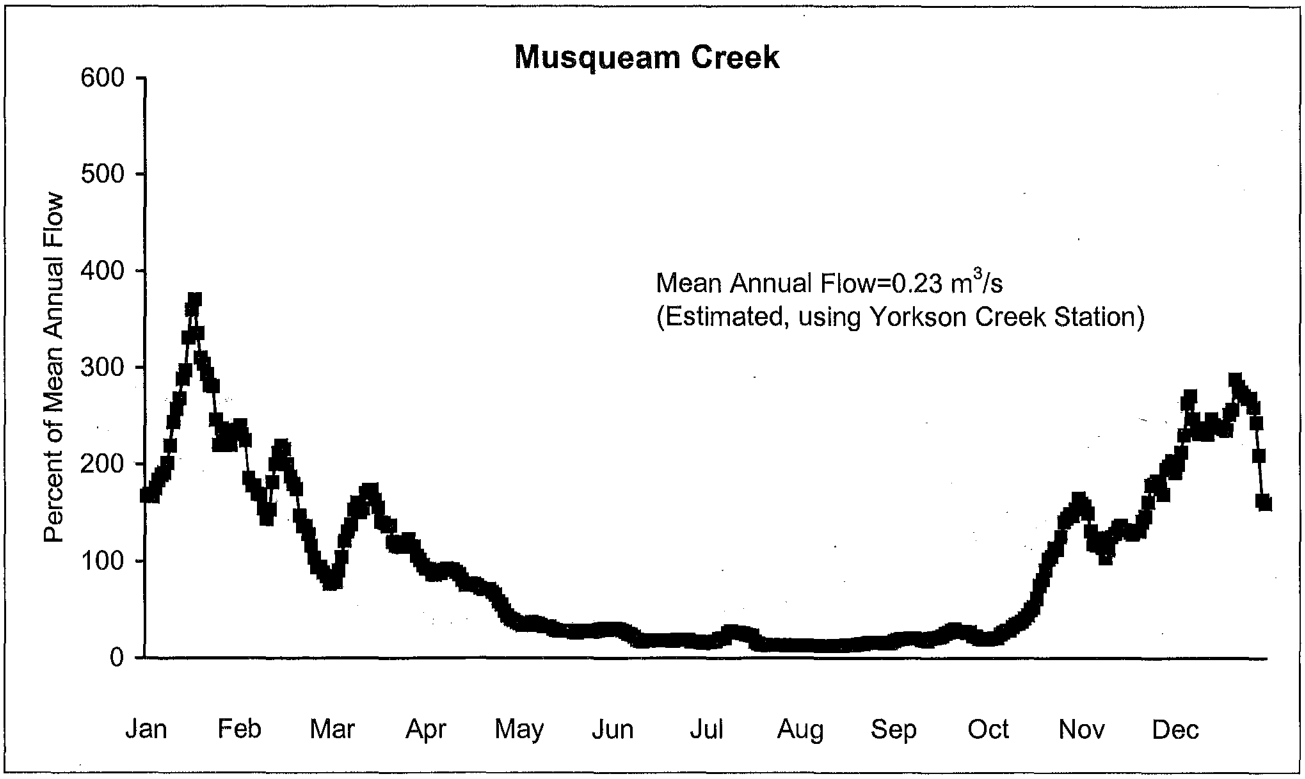

Mahood Creek
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=1.17 m3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

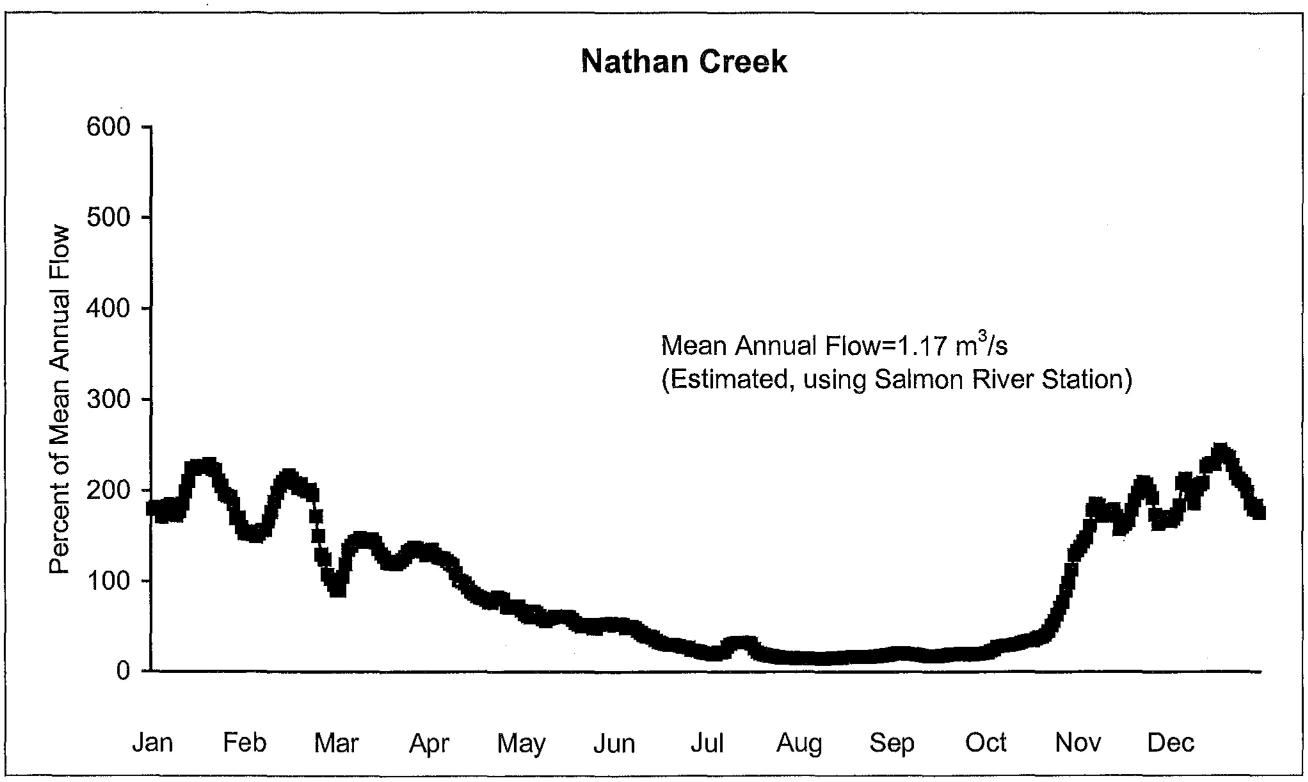

Maria Slough
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=1.59 m3/s
(Estimated, using Weaver Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

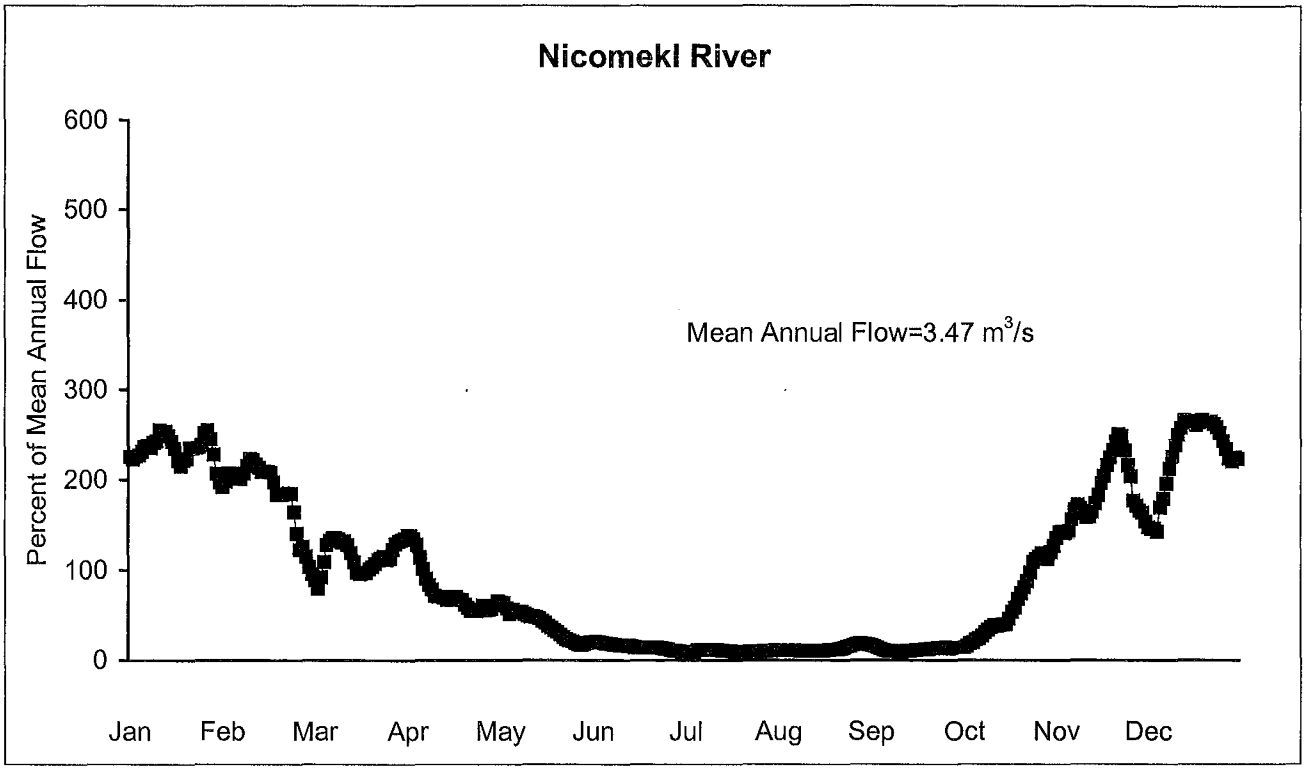

Matsqui Slough
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=2.40 m3/s
(Estimated, using Salmon River Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

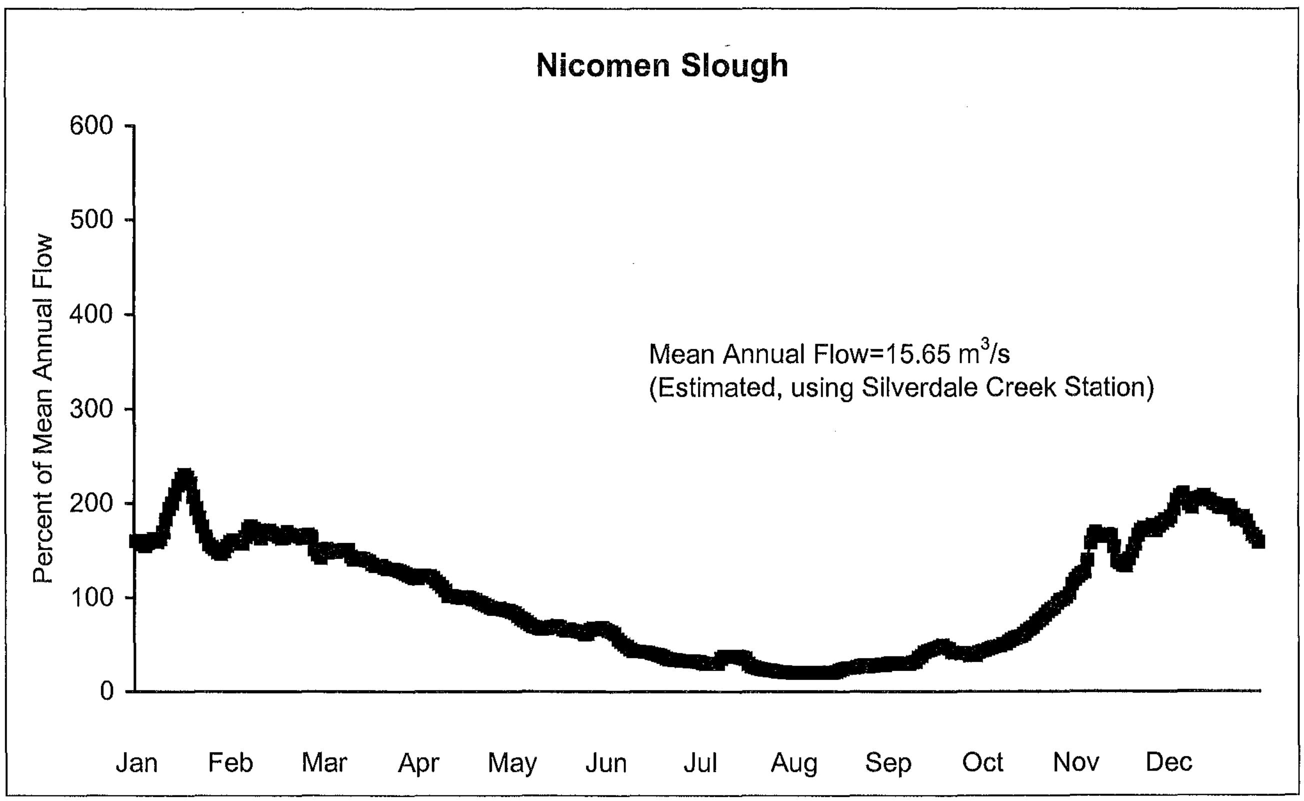

McLennan Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=1.07 m3/s
(Estimated, using West Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Morris Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=2.51 m3/s
(Estimated, using Weaver Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Musqueam Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.23 m3/s
(Estimated, using Yorkson Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Nathan Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=1.17 m3/s
(Estimated, using Salmon River Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Nicomekl River
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=3.47 m3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Nicomen Slough
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=15.65 m3/s
(Estimated, using Silverdale Creek Station)
Jan
Feb
Mar
Apr
May
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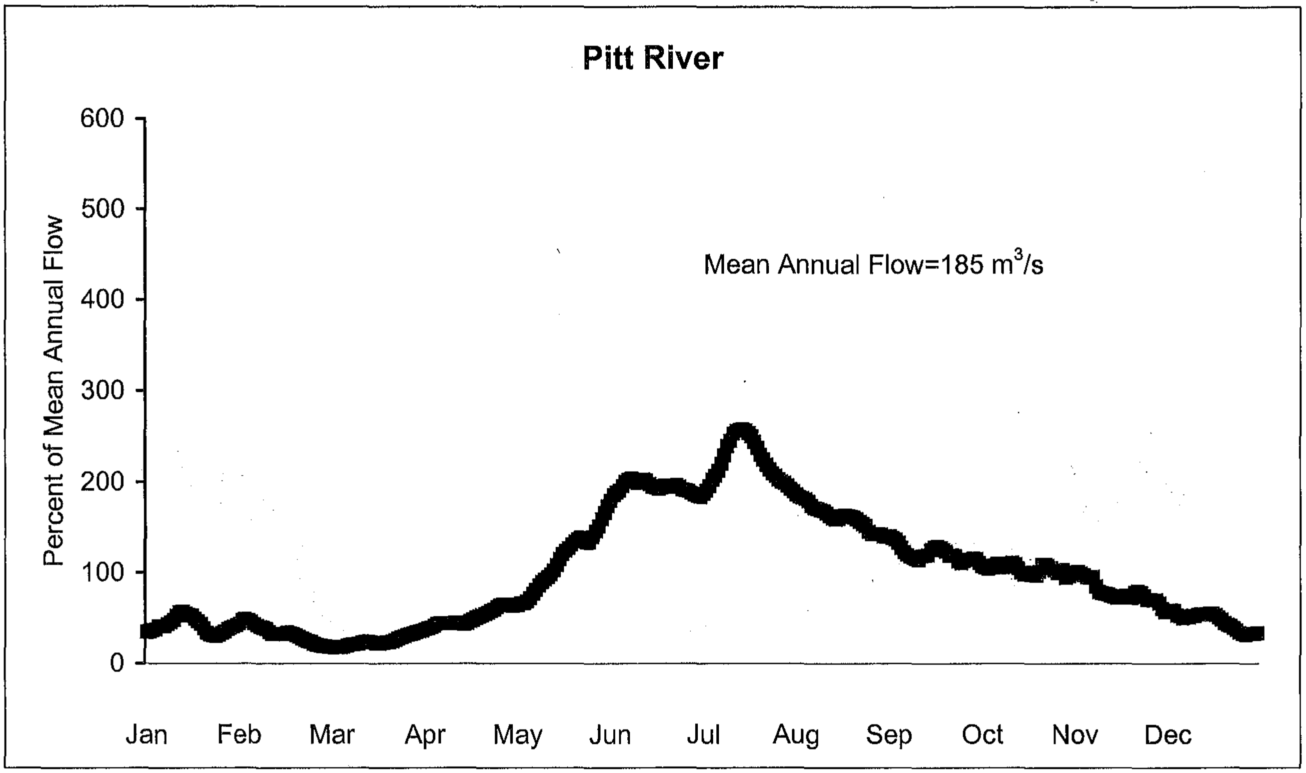
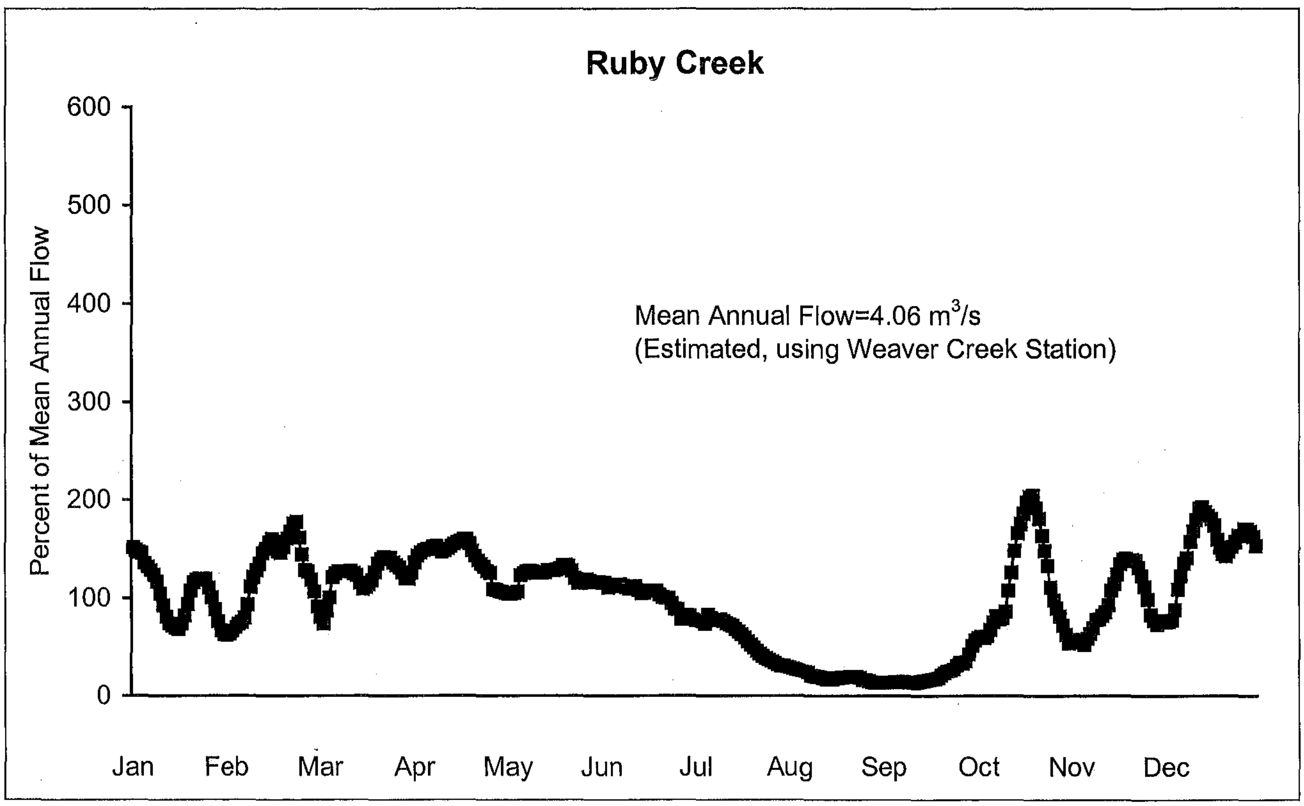
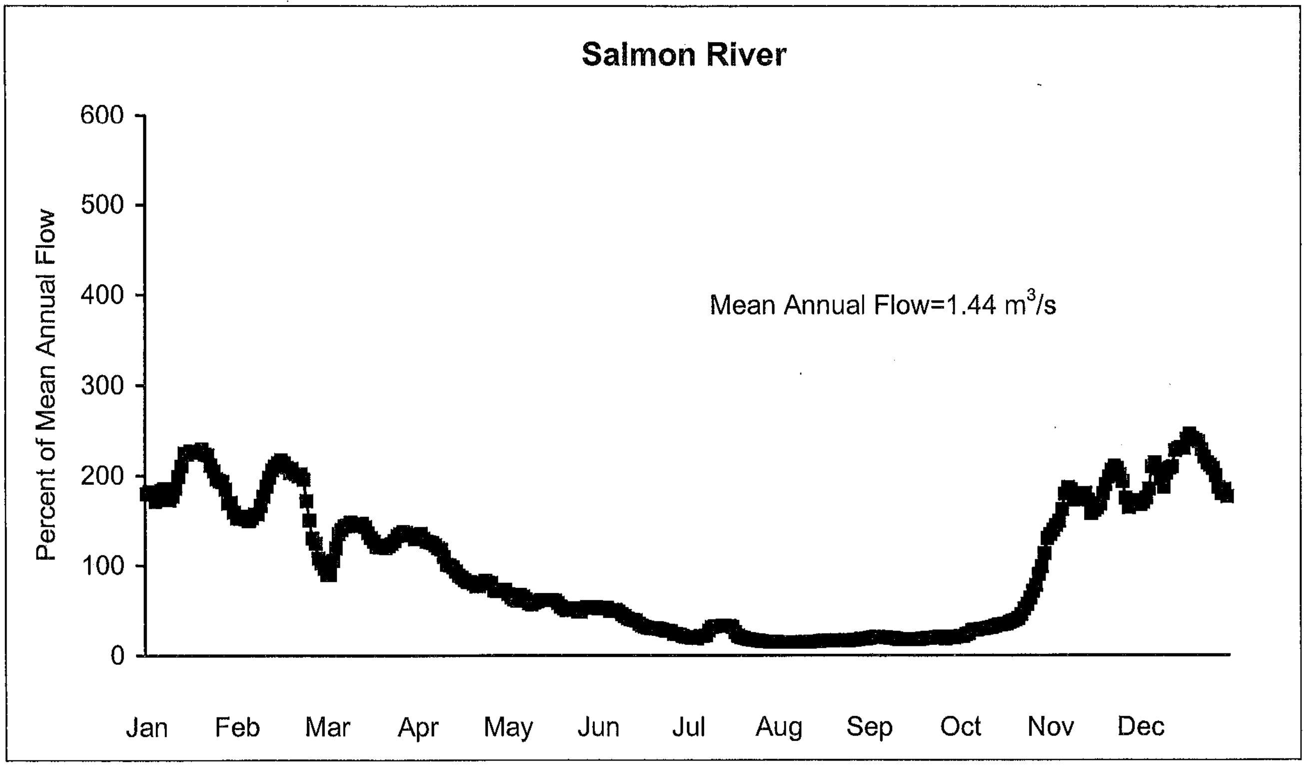
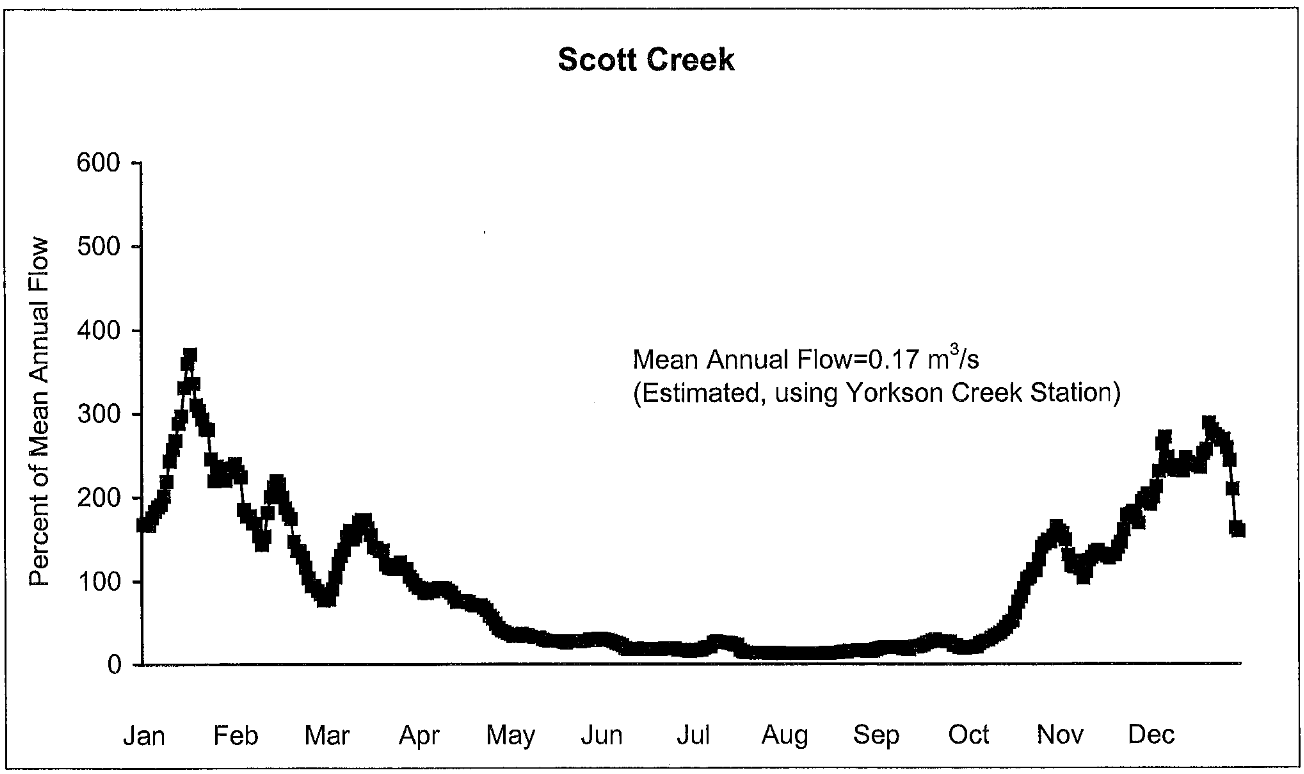
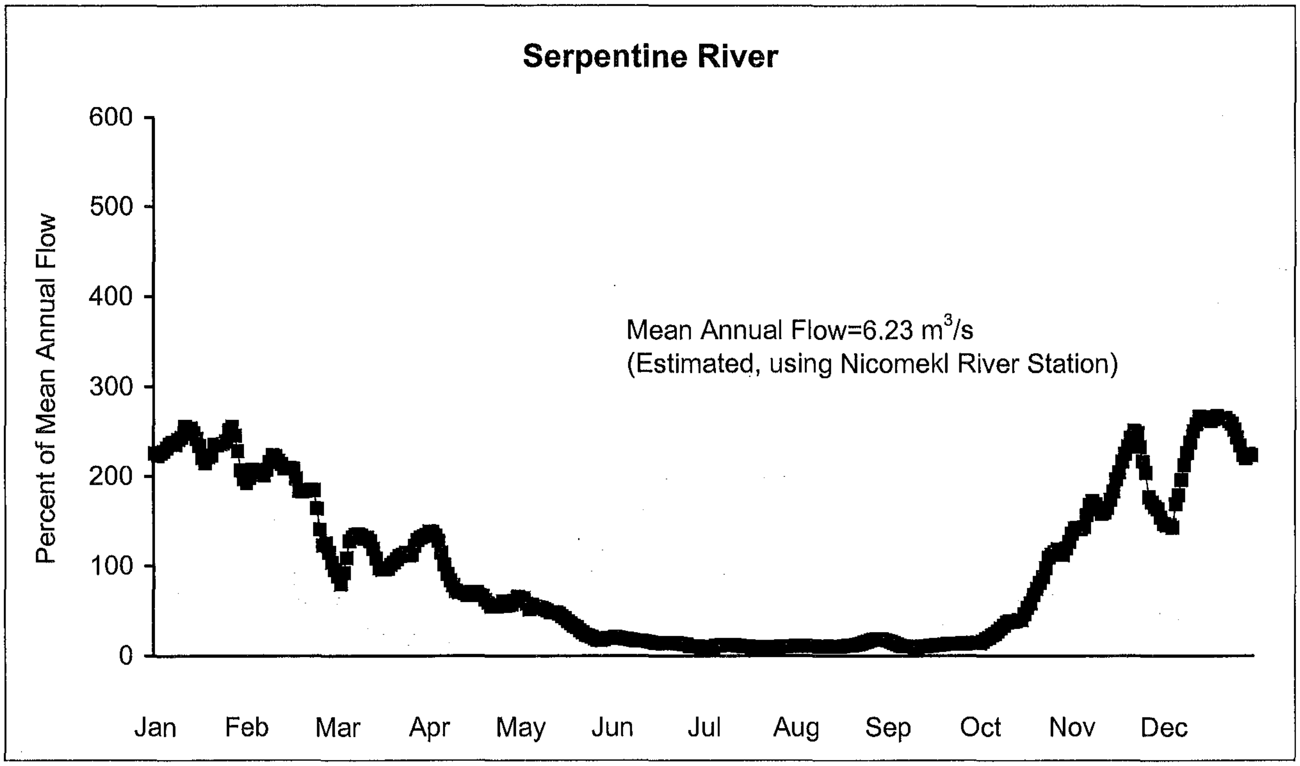
Jul
Aug
Sep
Oct
Nov
Dec


Pitt River
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=185 m³/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Ruby Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=4.06 m³/s
(Estimated, using Weaver Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Salmon River
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=1.44 m³/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Scott Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.17 m³/s
(Estimated, using Yorkson Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Serpentine River
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=6.23 m3/s
(Estimated, using Nicomekl River Station)
Jan
Feb
Mar
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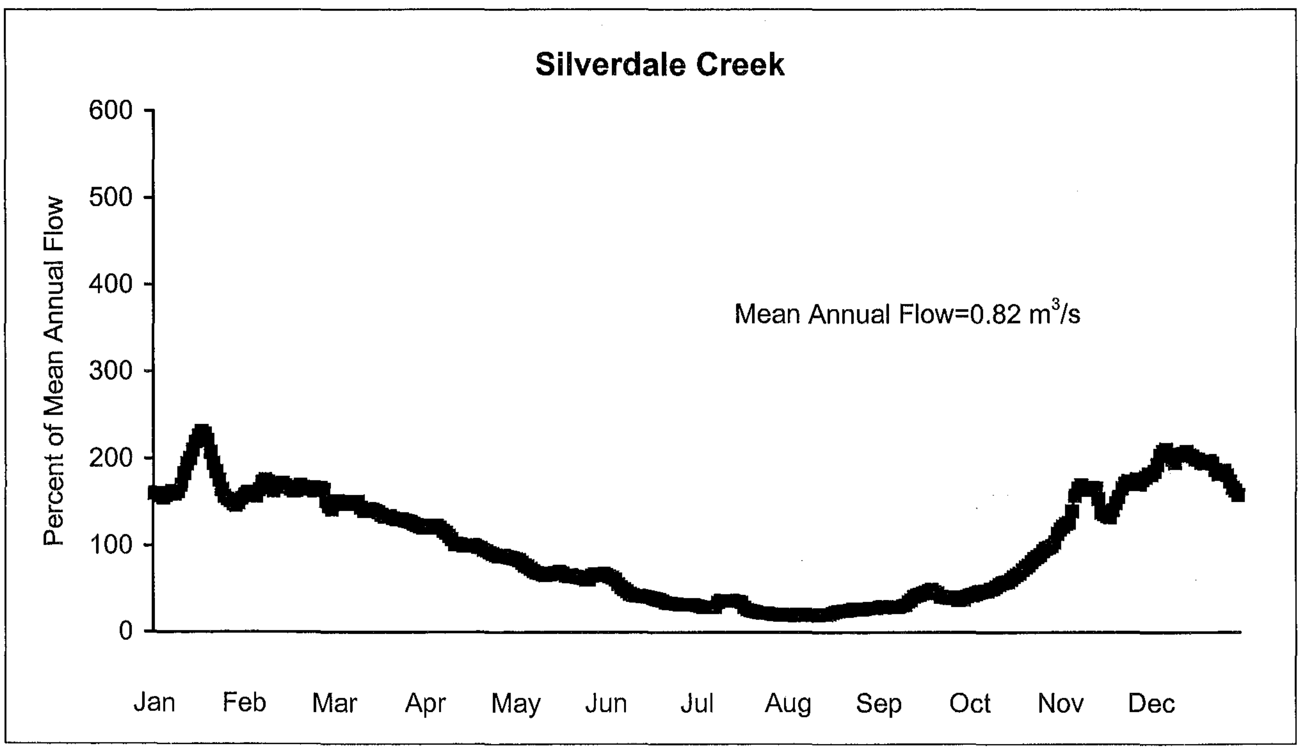
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Silverdale Creek
600
500
400
300
200
100
0
Percent of Mean Annual Flow
Mean Annual Flow=0.82 m3/s
Jan
Feb
Mar
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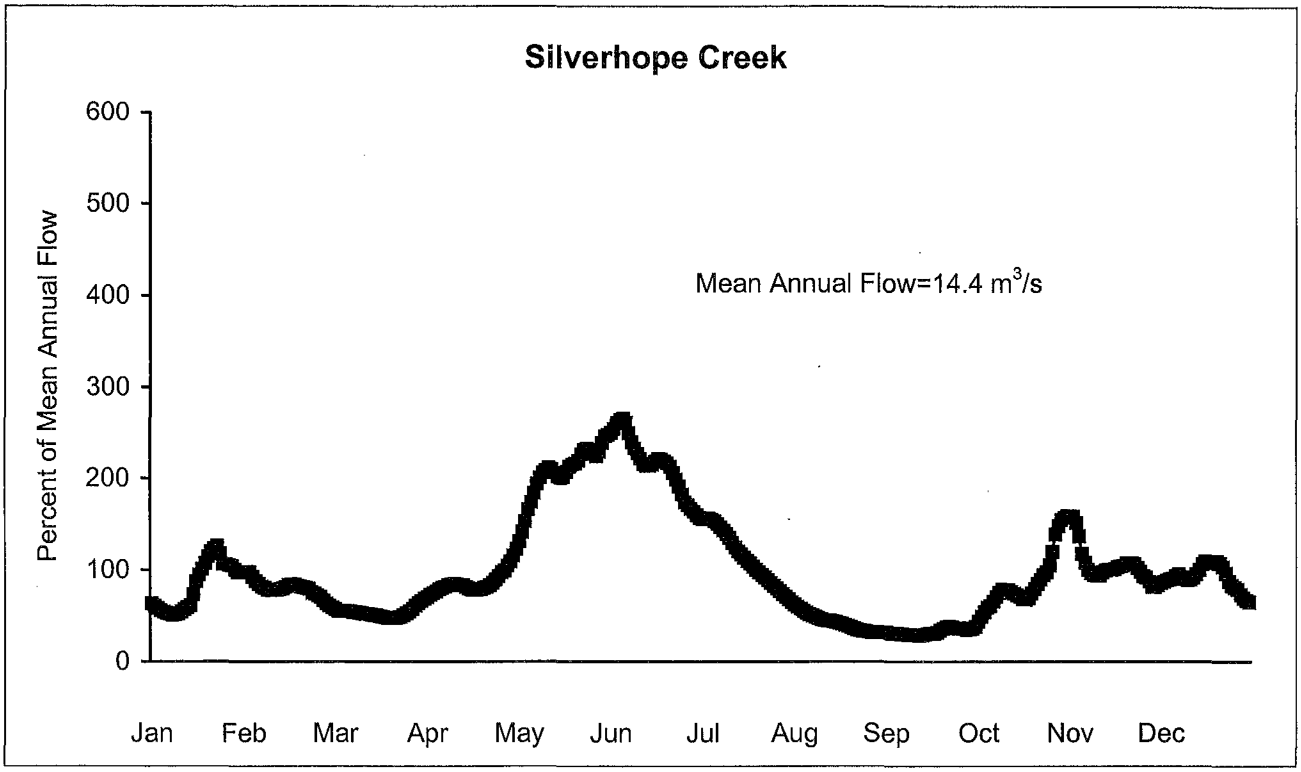
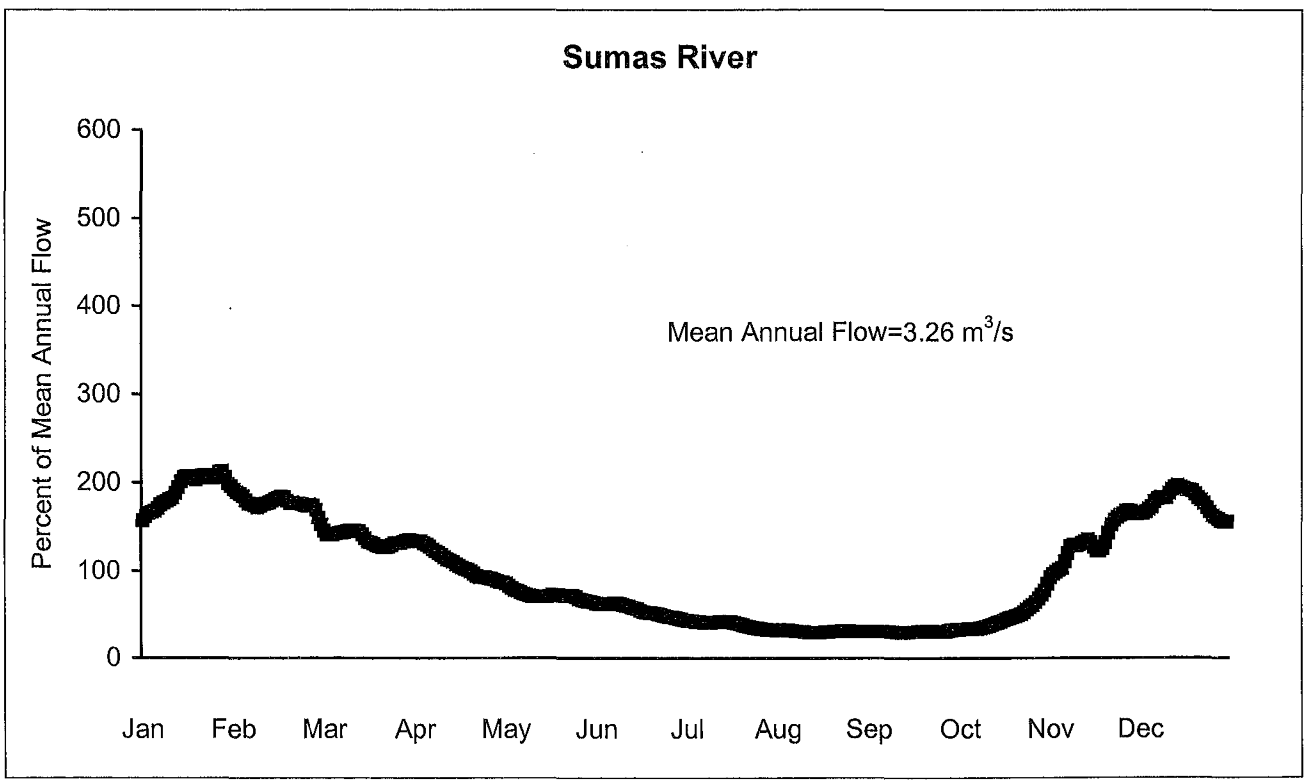
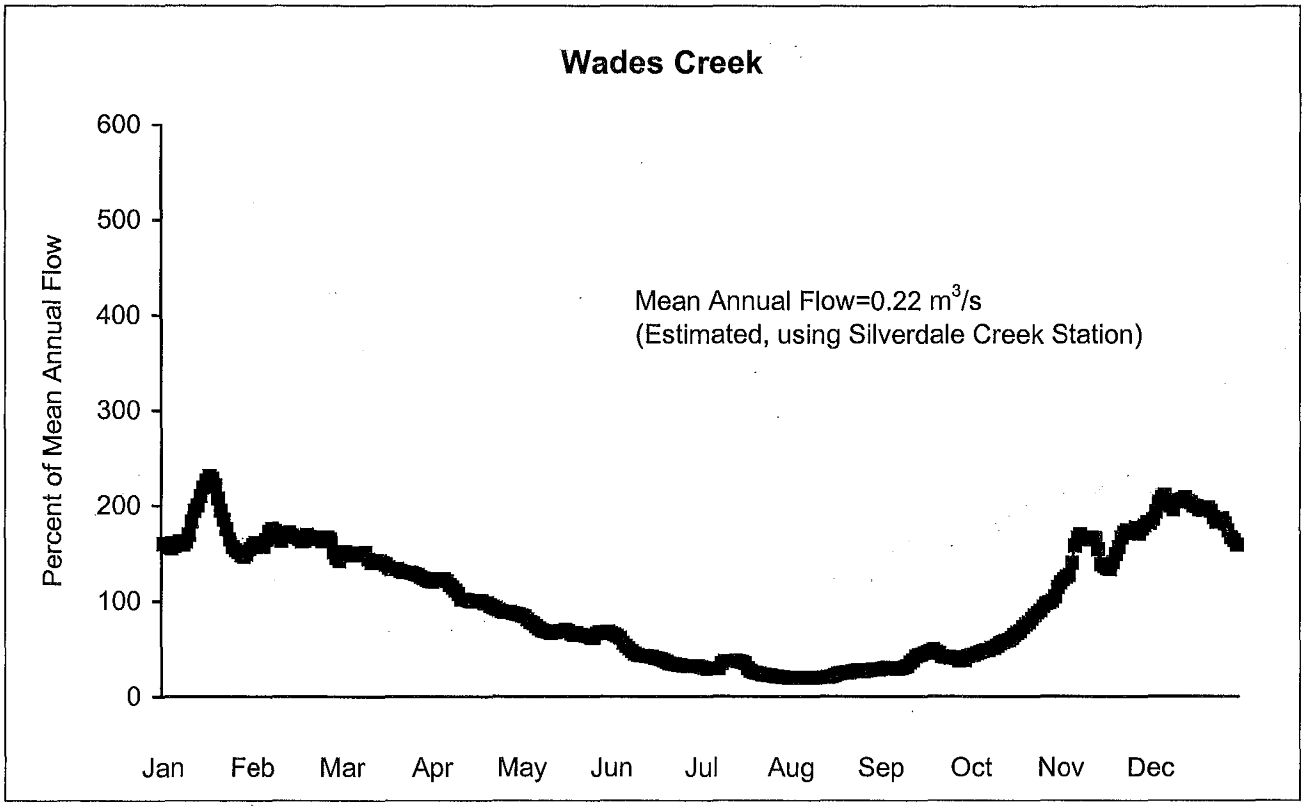
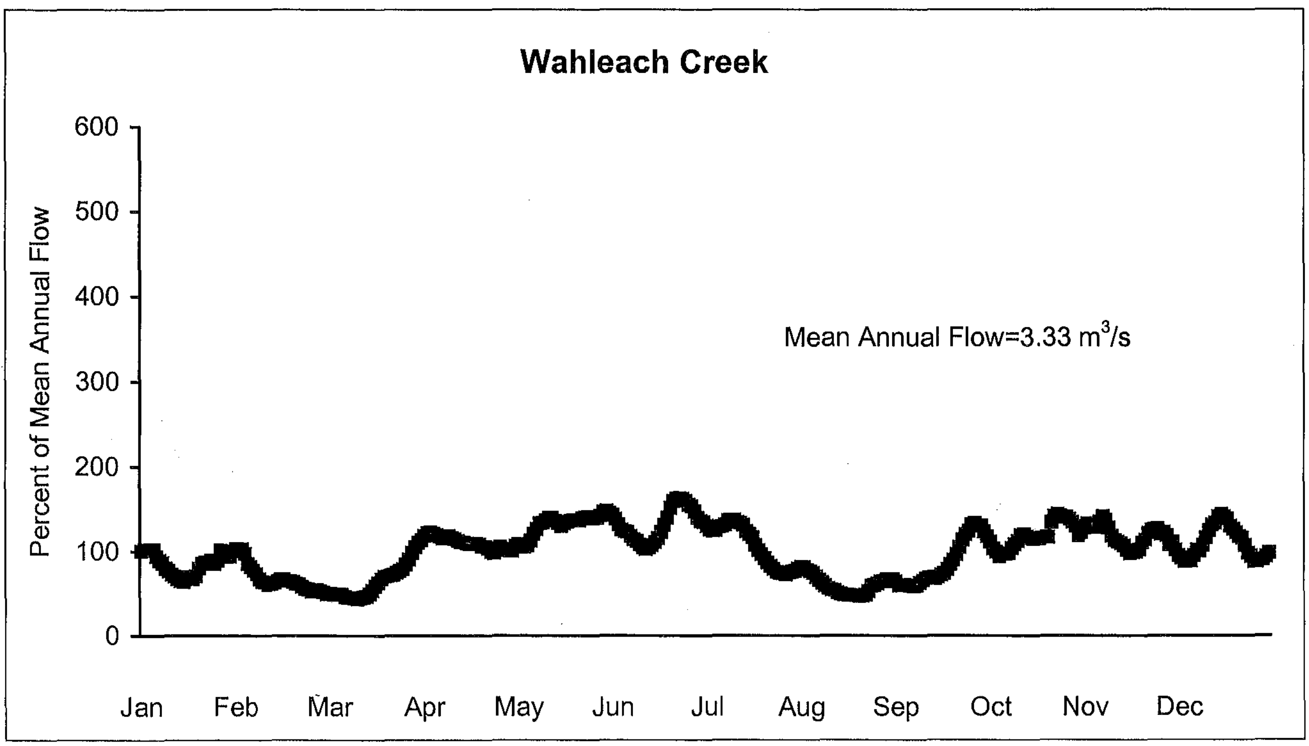
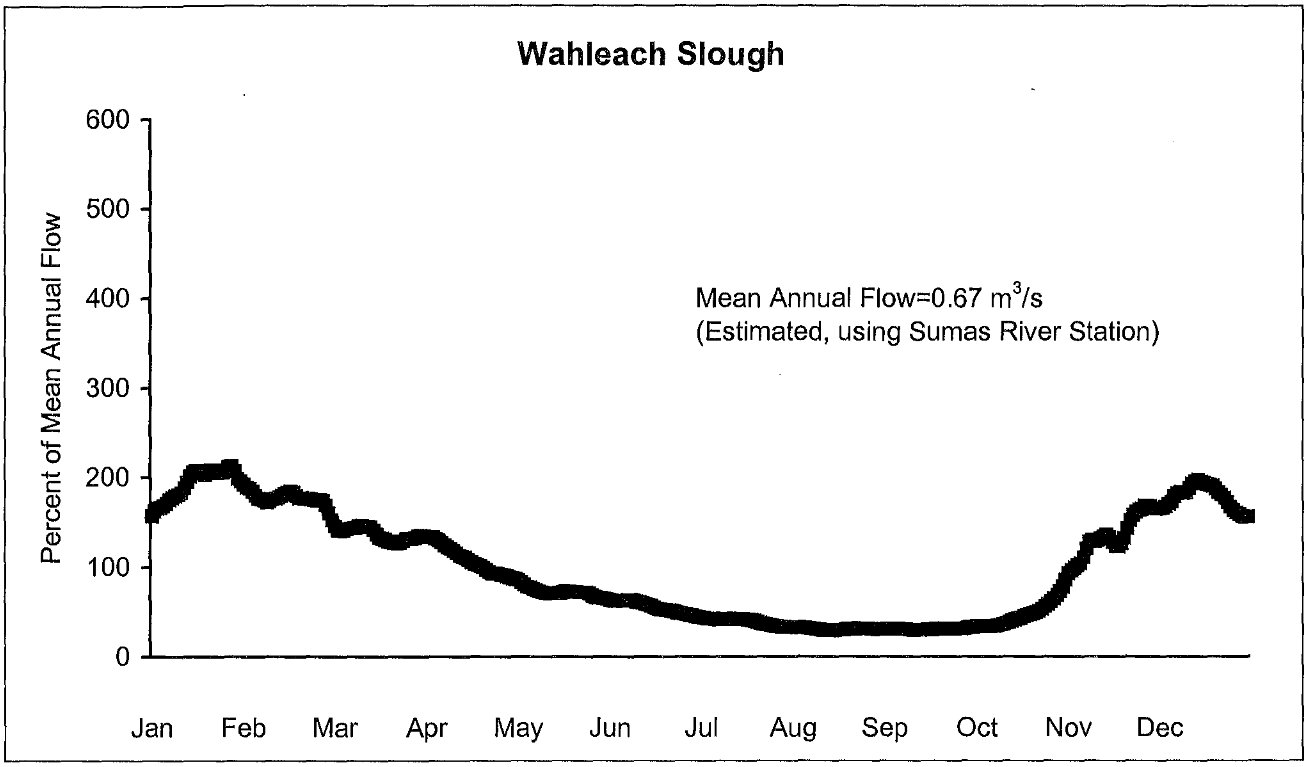
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

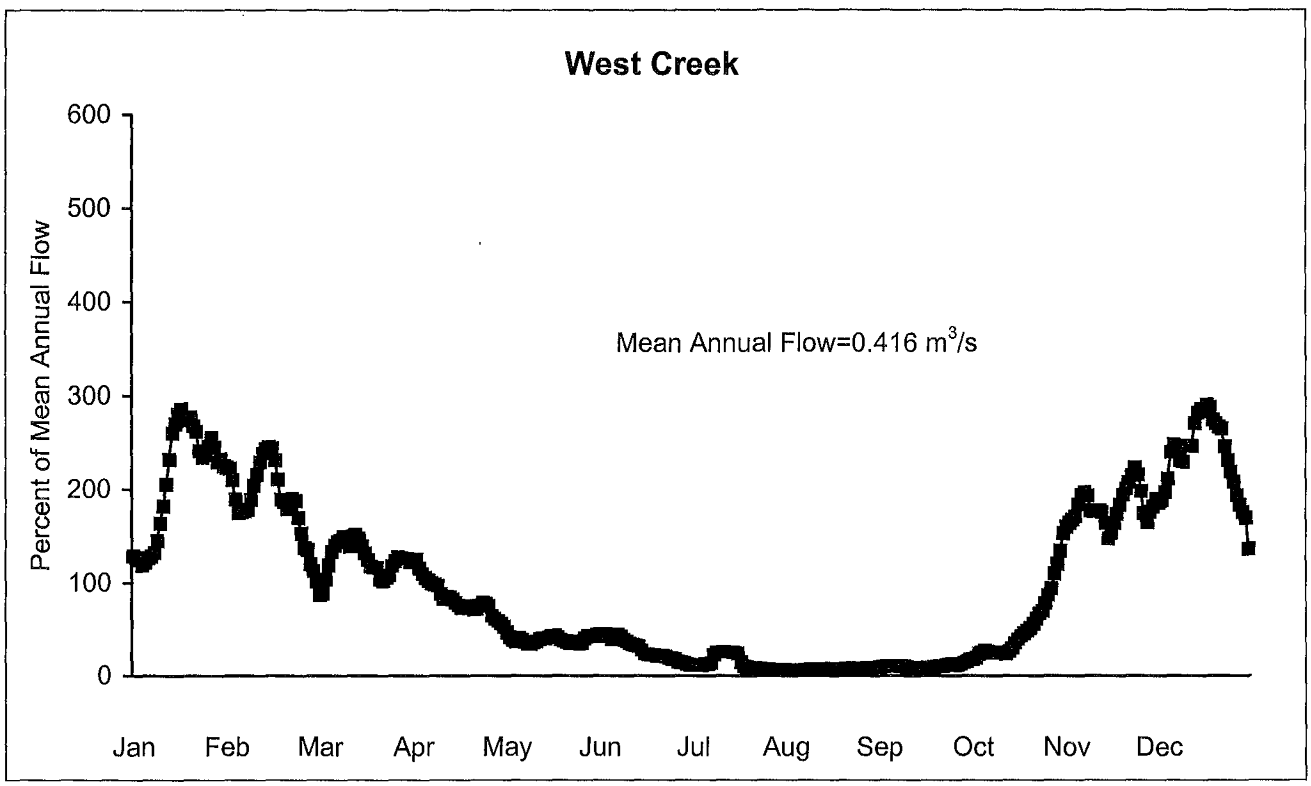

Silverhope Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=14.4 m^3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

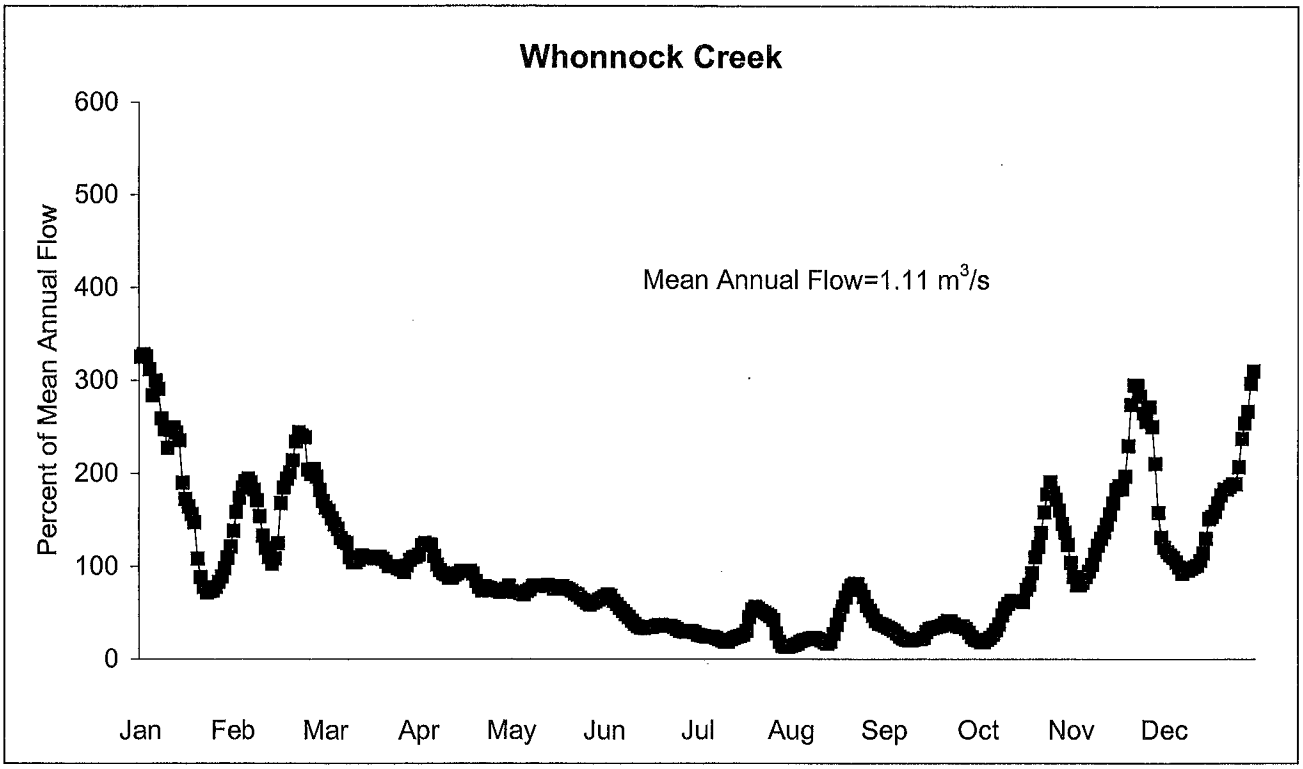

Sumas River
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=3.26 m^3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

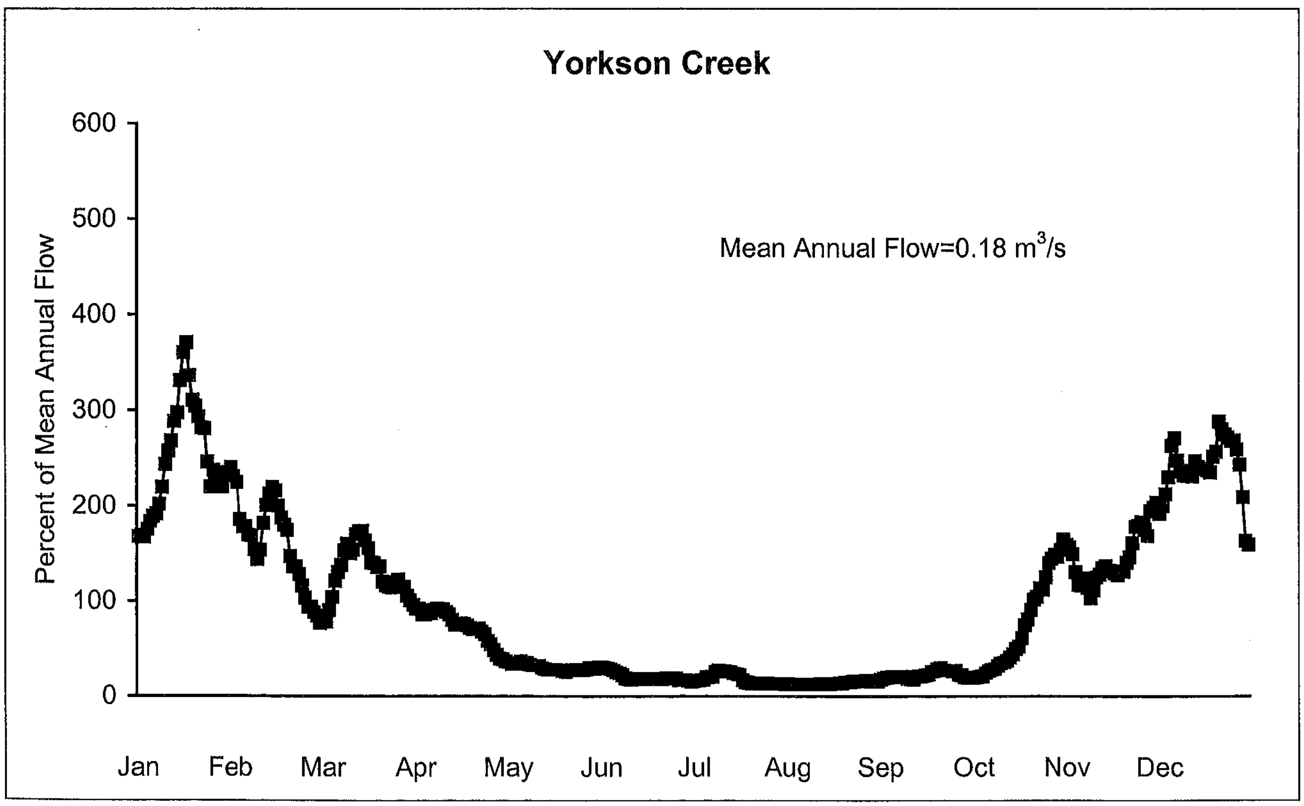

Wades Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.22 m³/s
(Estimated, using Silverdale Creek Station)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Wahleach Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=3.33 m³/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Wahleach Slough
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.67 m3/s
(Estimated, using Sumas River Station)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


West Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.416 m3/s
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec


Whonnock Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=1.11 m3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Yorkson Creek
Percent of Mean Annual Flow
600
500
400
300
200
100
0
Mean Annual Flow=0.18 m3/s
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

APPENDIX 3 – ESCAPEMENT

Escapement[1] data has been compiled from Fish Habitat Inventory and Information Program Stream Summary Catalogues and Pacific Biological Station DFO (Nanaimo) records (averaged over a 40 year period, 1953 - 1993).

Availability

Escapement data is available for a limited number of streams; many of these are enhanced systems (i.e. stocked with hatchery fish). In a number of streams, not all of the species present may be ennumerated (thus data for only one species is available for these streams).

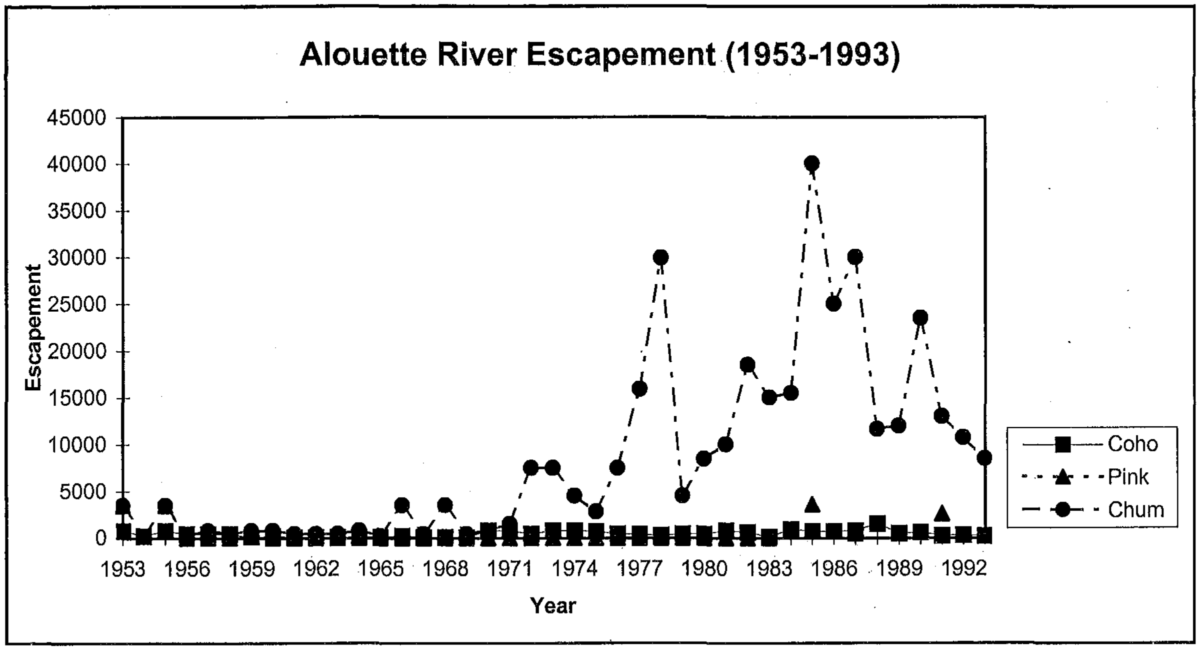
Reliability

There are many gaps in the data and counts have been done in a variety of ways. There are many factors that make this escapement data useful only as an indicator of salmon returns to the stream. This information alone should not be used for management decisions. It must be appreciated that the fish population of each stream may be exploited to varying degrees by legal and illegal fishing pressures. The stream escapement data only relates to the fish that survive that fishery and return to the stream to spawn.

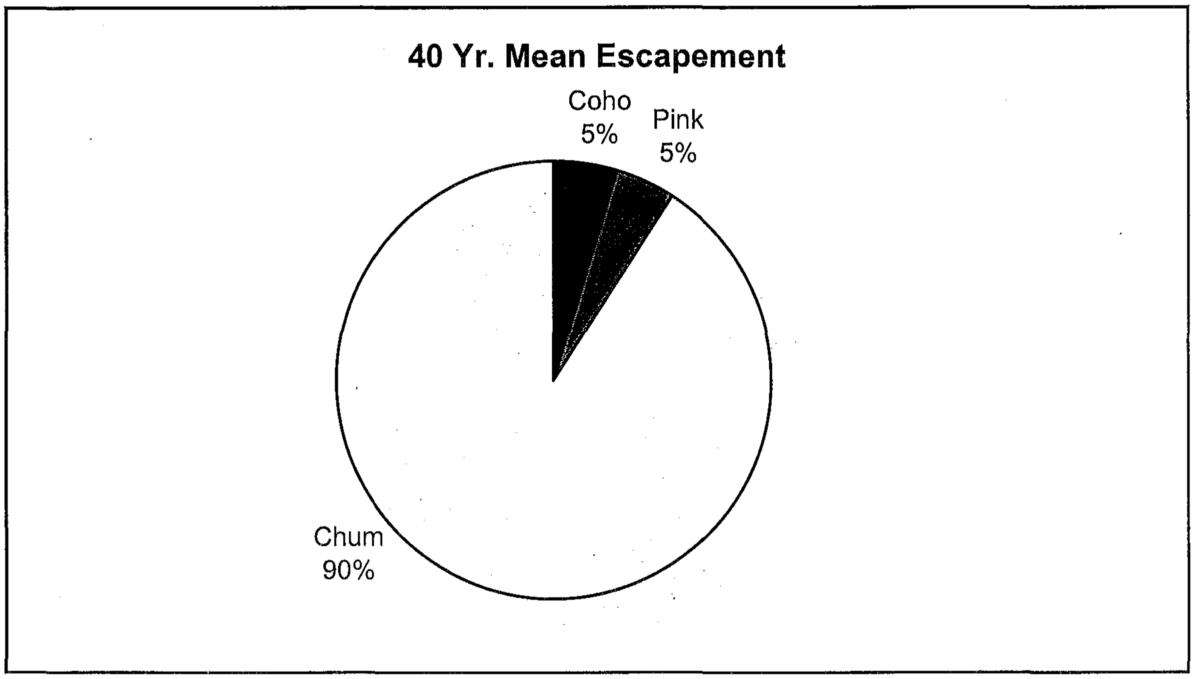
Close monitoring of individual systems by DFO has declined over the past years. Many areas have stopped doing fish counts on stream systems since the mid 1980s to the early 1990s due to decreased resources. The current approach is to use key indicator streams (counting fences have been constructed on some of these), which are used to indicate escapement trends for streams in the area with similar characteristics. Escapement data is available and has been included for the following streams:

Alouette River
Campbell River
Capilano River
Chehalis River
Chilliwack River (Lower)
Chilliwack River (Upper)
Coquihalla River
Coquitlam River
Harrison River
Hatzic Slough
Hope Slough
Hunter Creek
Kanaka Creek
Lorenzetta Creek
Lynn Creek
Mahood Creek
Maria Slough
Nathan Creek
Nicomekl River
Nicomen Slough
Pitt River
Ruby Creek
Salmon River
Serpentine River
Seymour River
Silverdale Creek
Silverhope Creek
Stave River
Sumas River
Wahleach Creek
West Creek
Whonnock Creek
Yorkson Creek

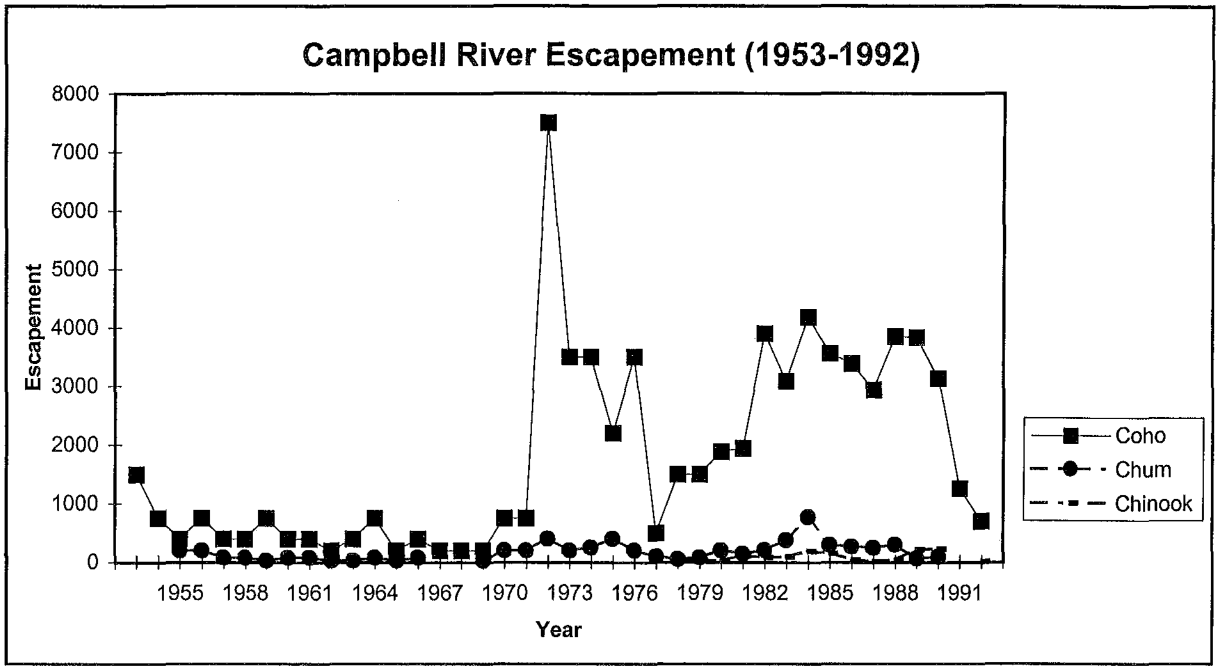
[1] Escapement refers to the number of fish returning to their natal stream (i.e. surviving in the ocean, escaping the fishery, etc.)

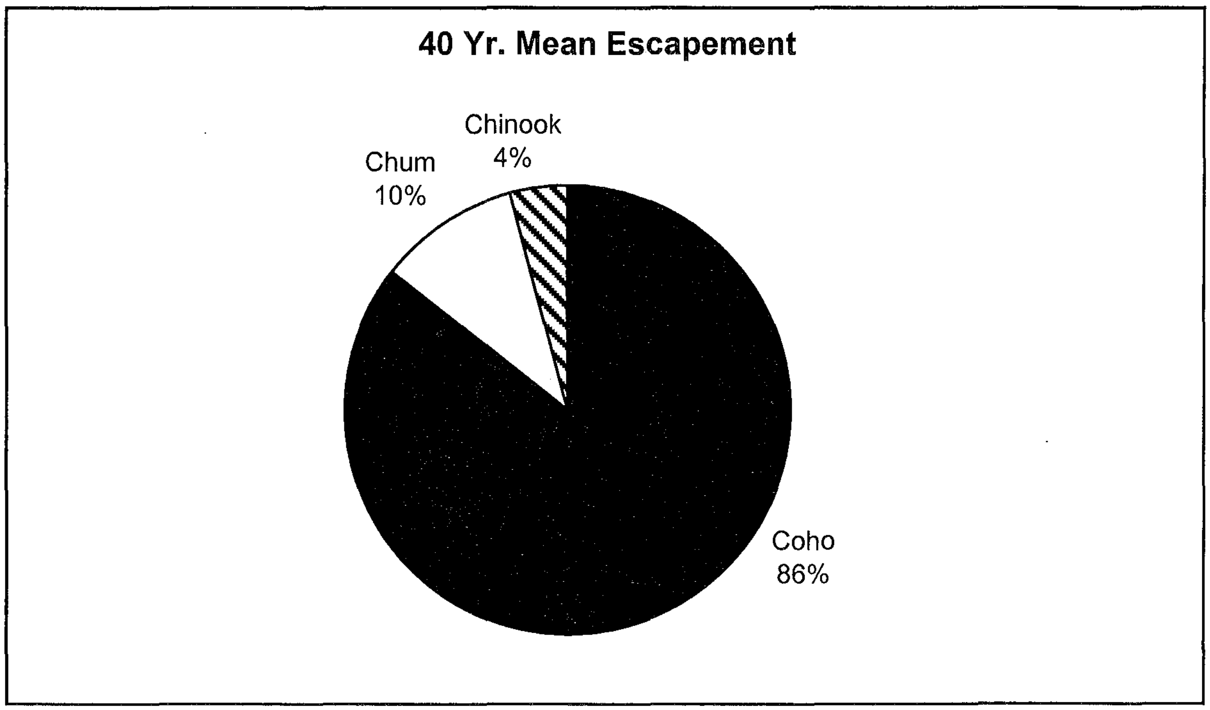


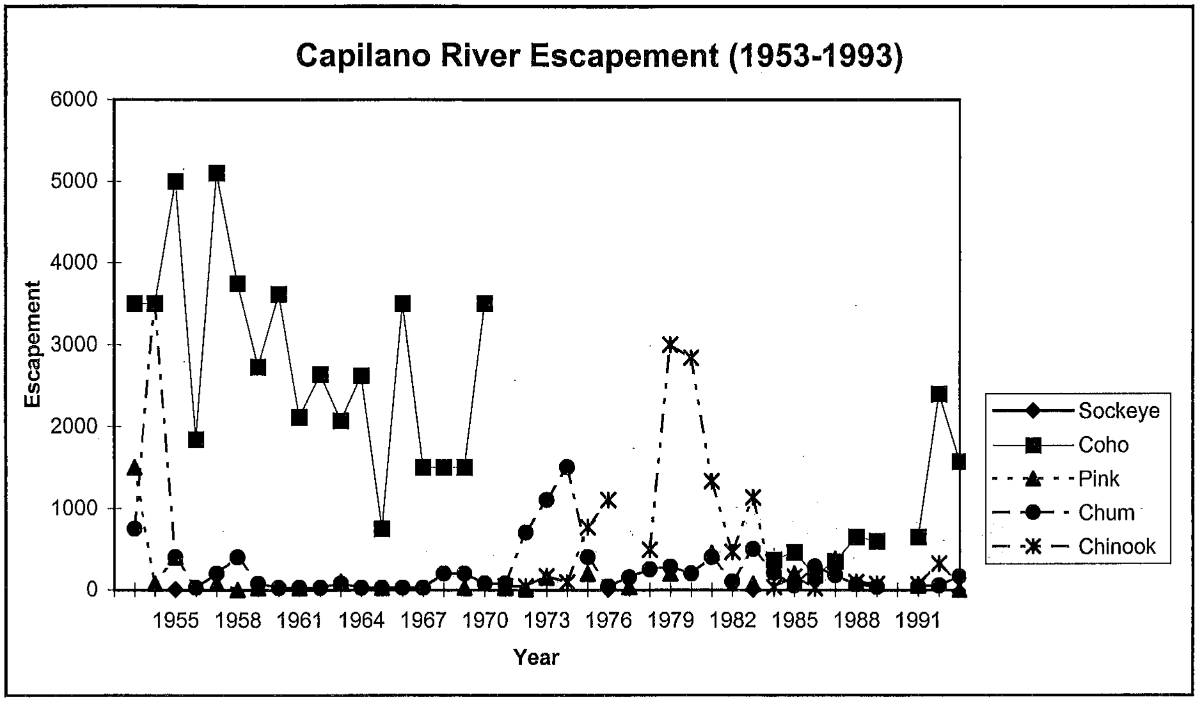
Alouette River Escapement (1953-1993)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Escapement
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
Year
Coho
Pink
Chum



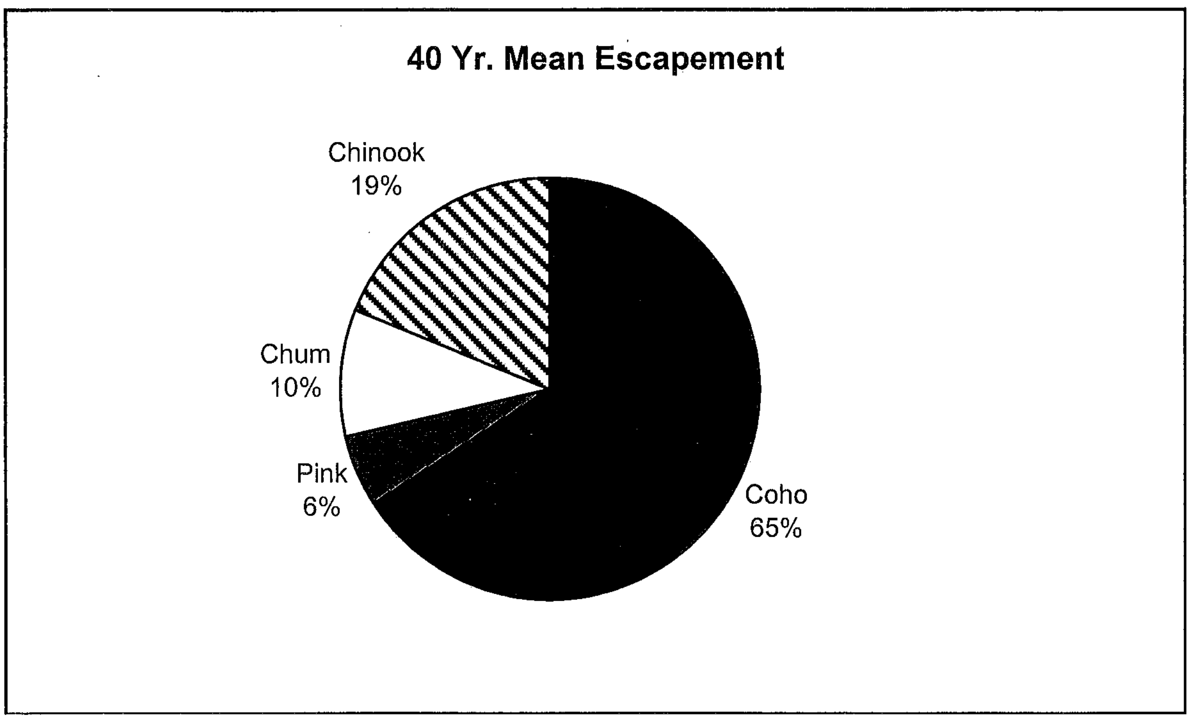
40 Yr. Mean Escapement
Coho 5%
Pink 5%
Chum 90%


Campbell River Escapement (1953-1992)
Escapement
8000
7000
6000
5000
4000
3000
2000
1000
0
1955 1958 1961 1964 1967 1970 1973 1976 1979 1982 1985 1988 1991
Year
Coho
Chum
Chinook

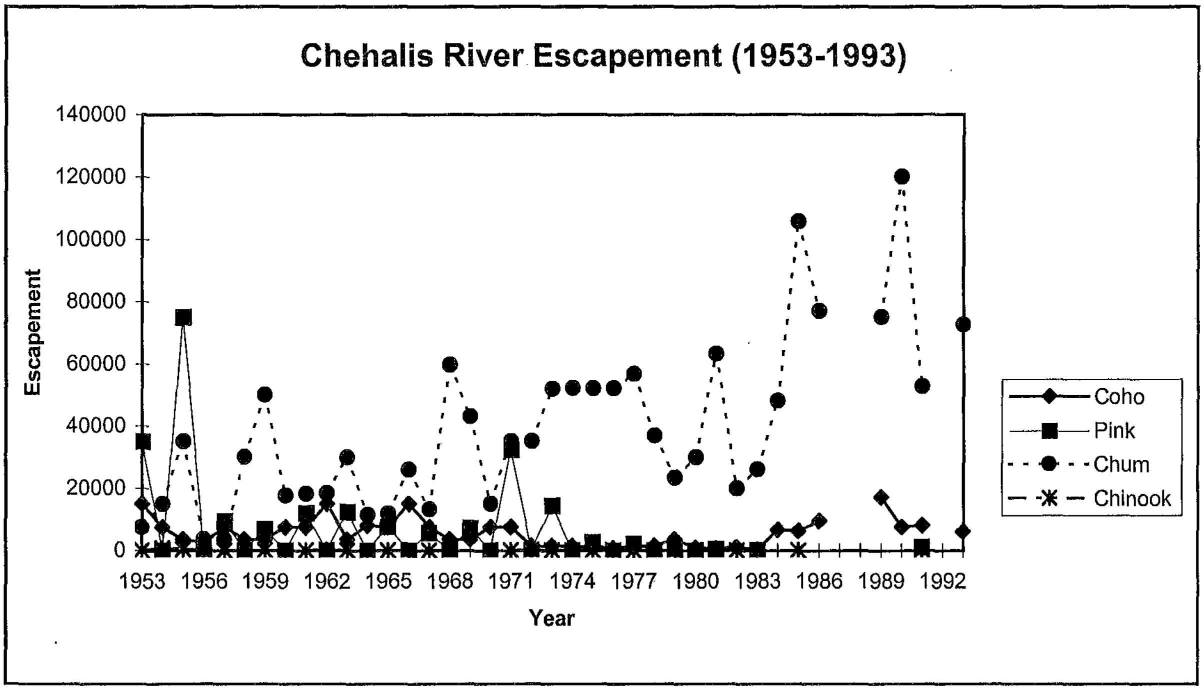

40 Yr. Mean Escapement
Chinook 4%
Chum 10%
Coho 86%

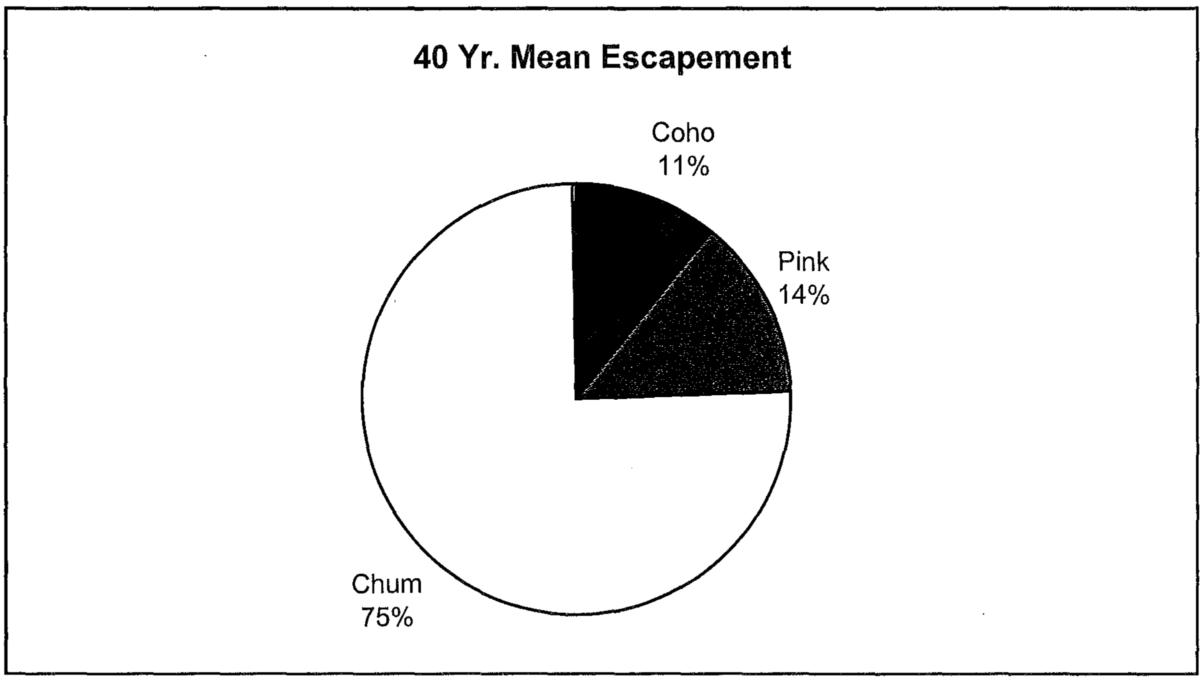


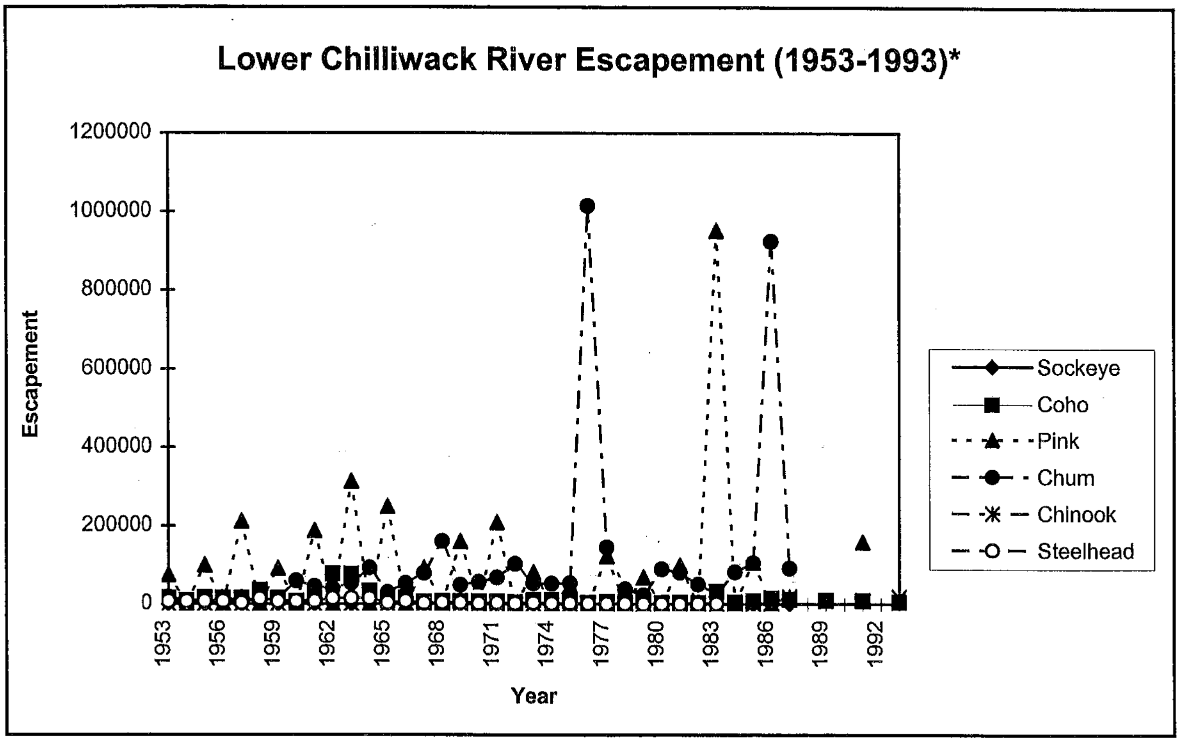
Capilano River Escapement (1953-1993)
6000
5000
4000
3000
2000
1000
0
Escapement
1955 1958 1961 1964 1967 1970 1973 1976 1979 1982 1985 1988 1991
Year
Sockeye
Coho
Pink
Chum
Chinook

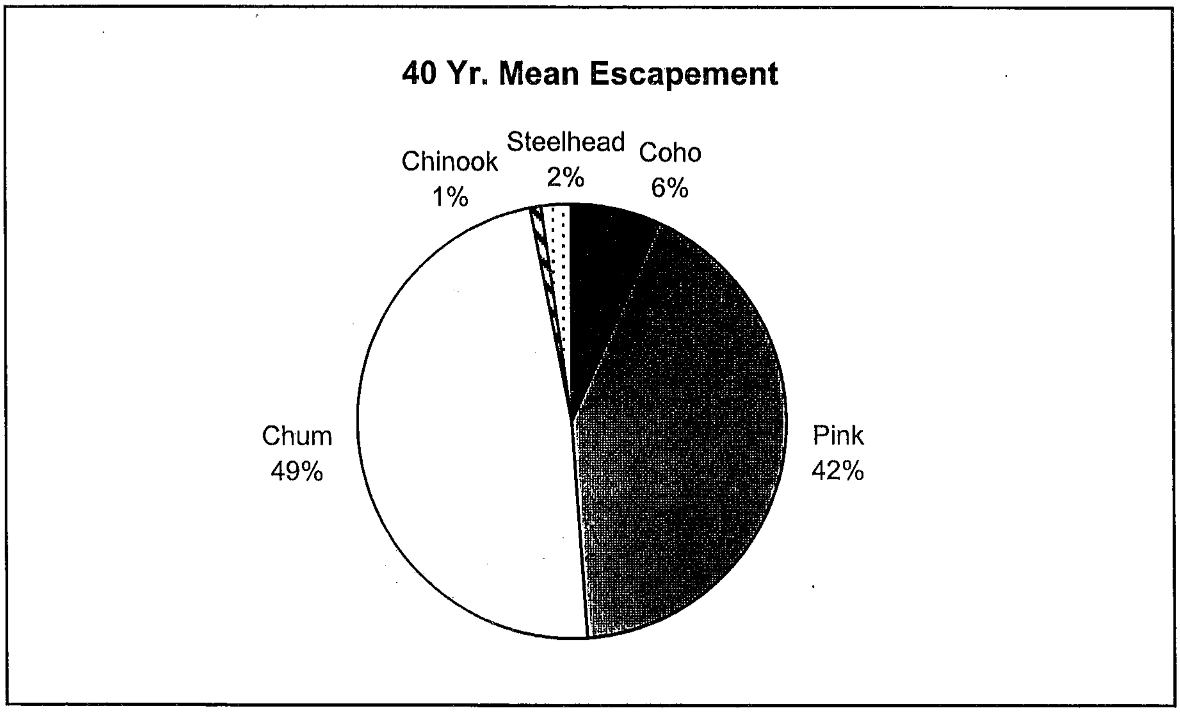


40 Yr. Mean Escapement
Chinook 19%
Chum 10%
Pink 6%
Coho 65%

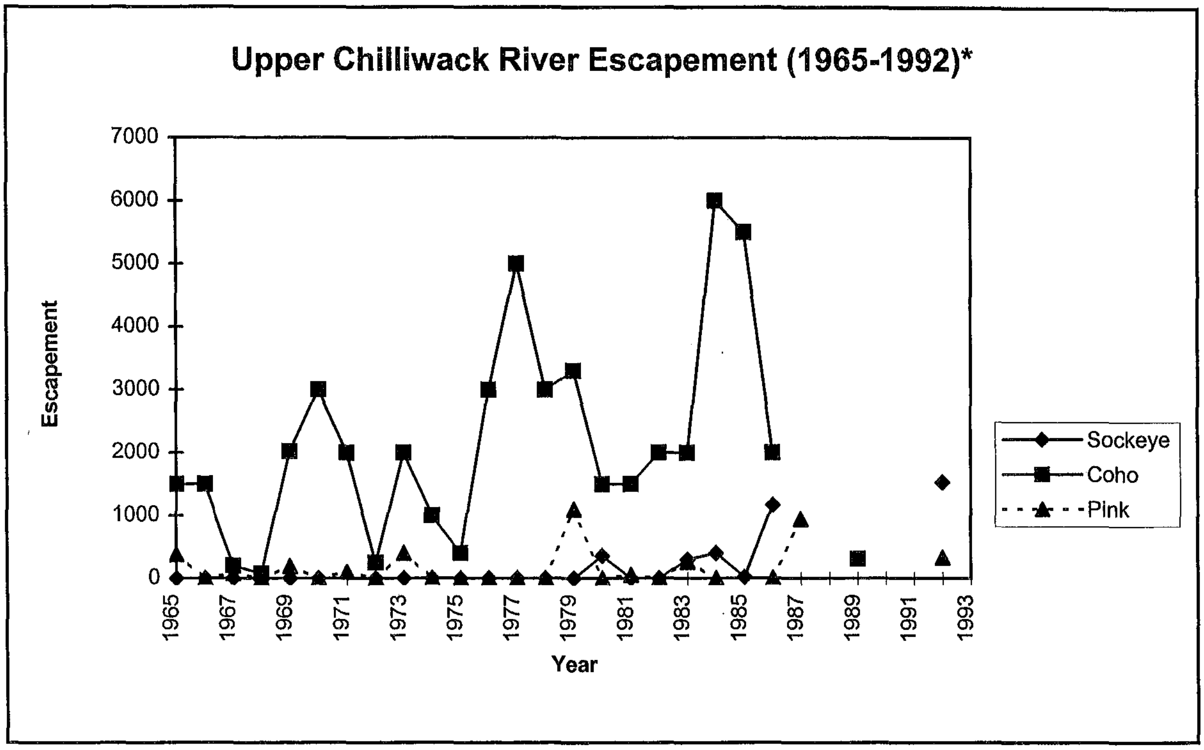

Chehalis River Escapement (1953-1993)
Escapement
140000
120000
100000
80000
60000
40000
20000
0
1953 1956 1959 1962 1965 1968 1971 1974 1977 1980 1983 1986 1989 1992
Year
Coho
Pink
Chum
Chinook

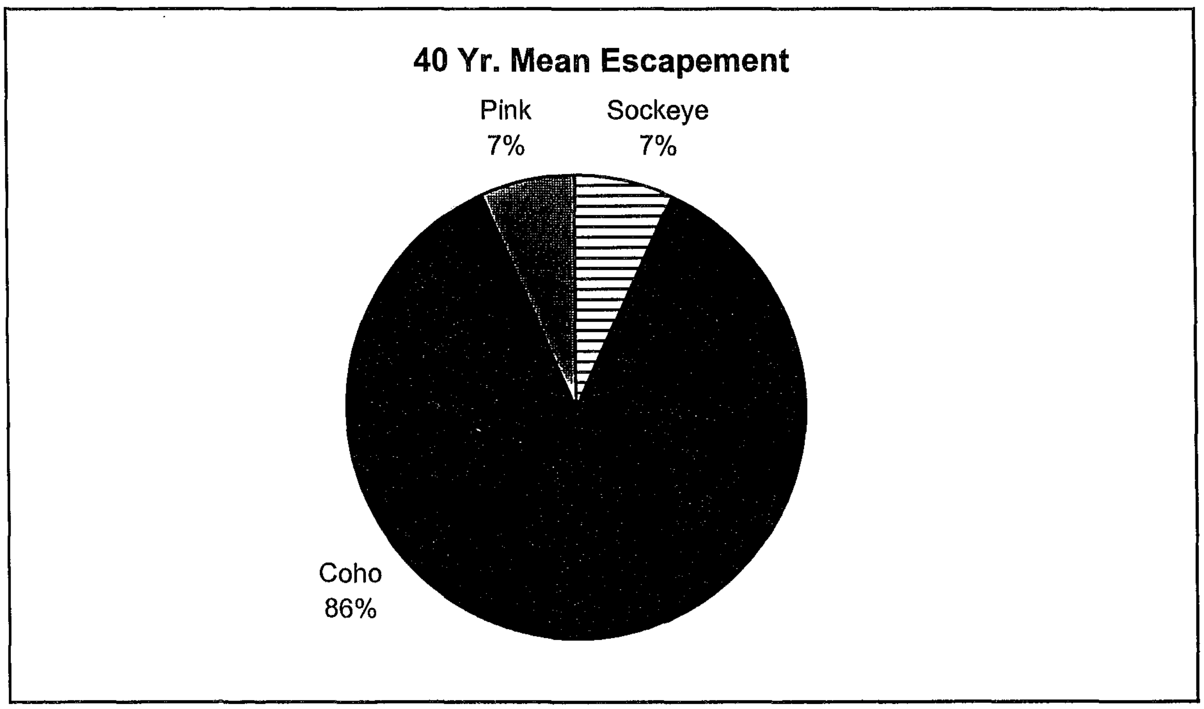

40 Yr. Mean Escapement
Coho 11%
Pink 14%
Chum 75%



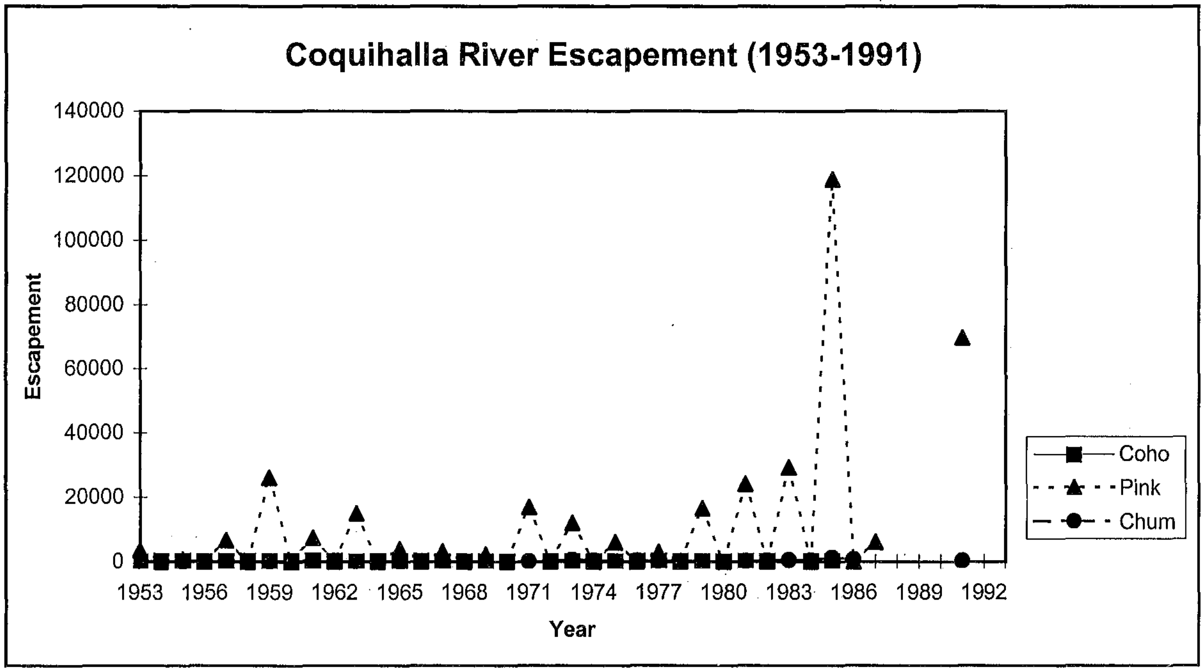


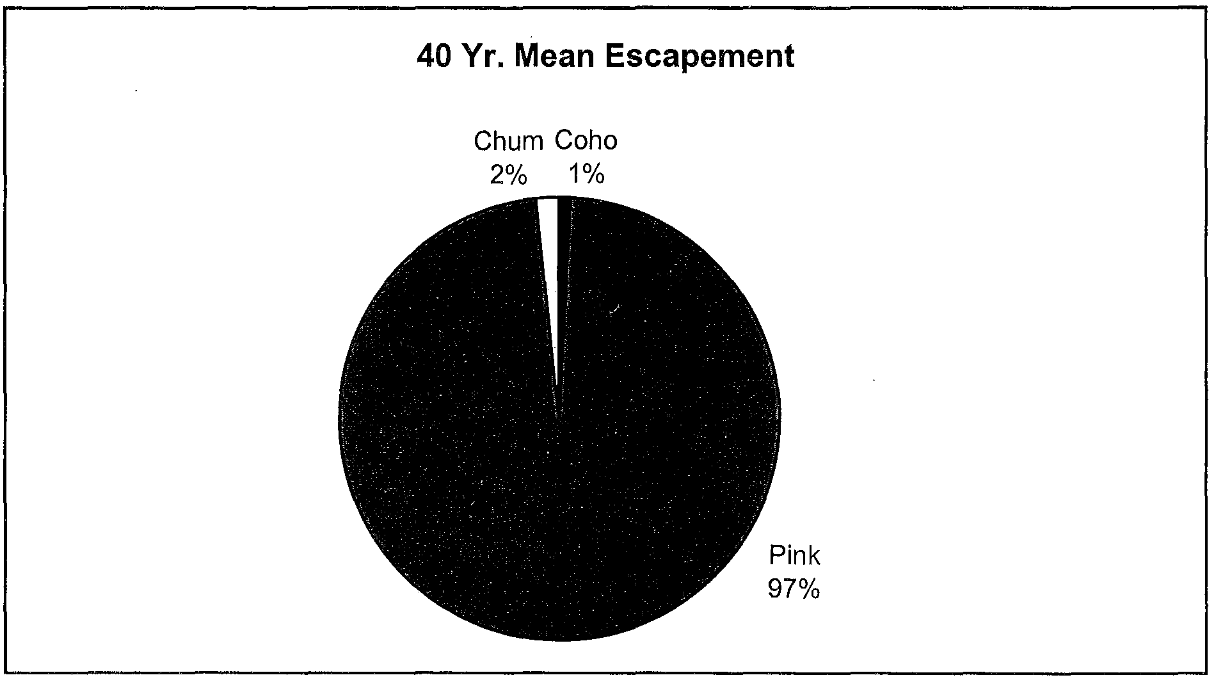
* Lower Chilliwack River, not including Chilliwack Lake.

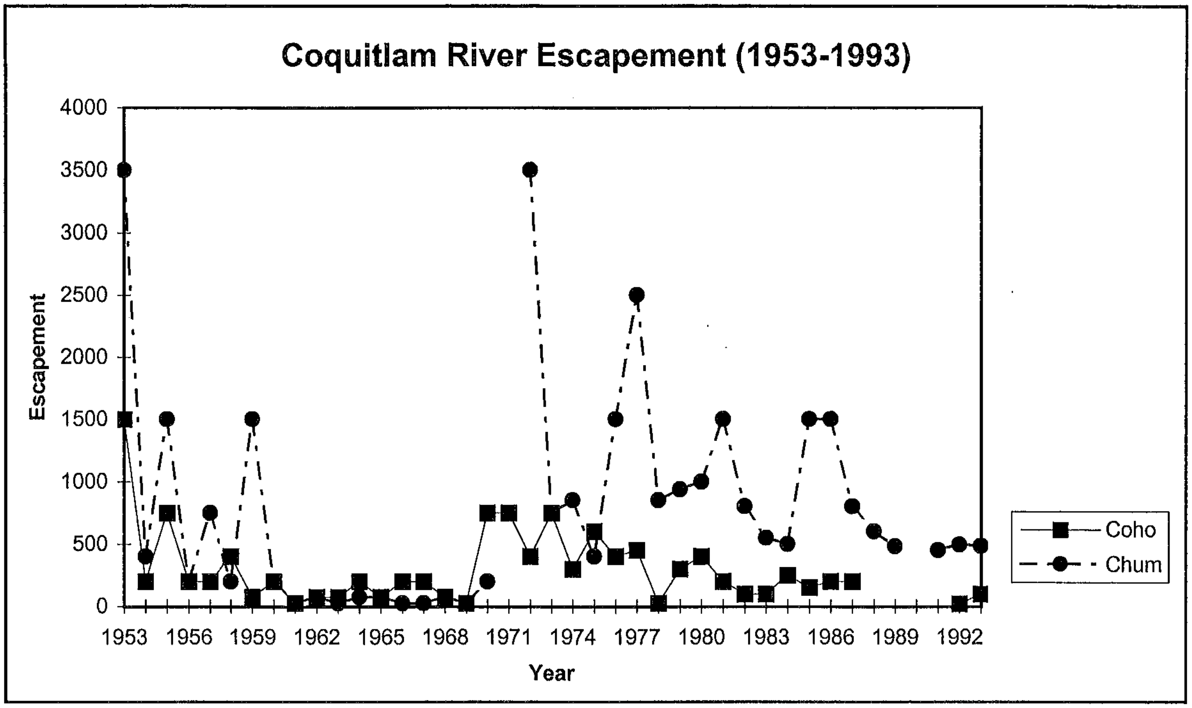


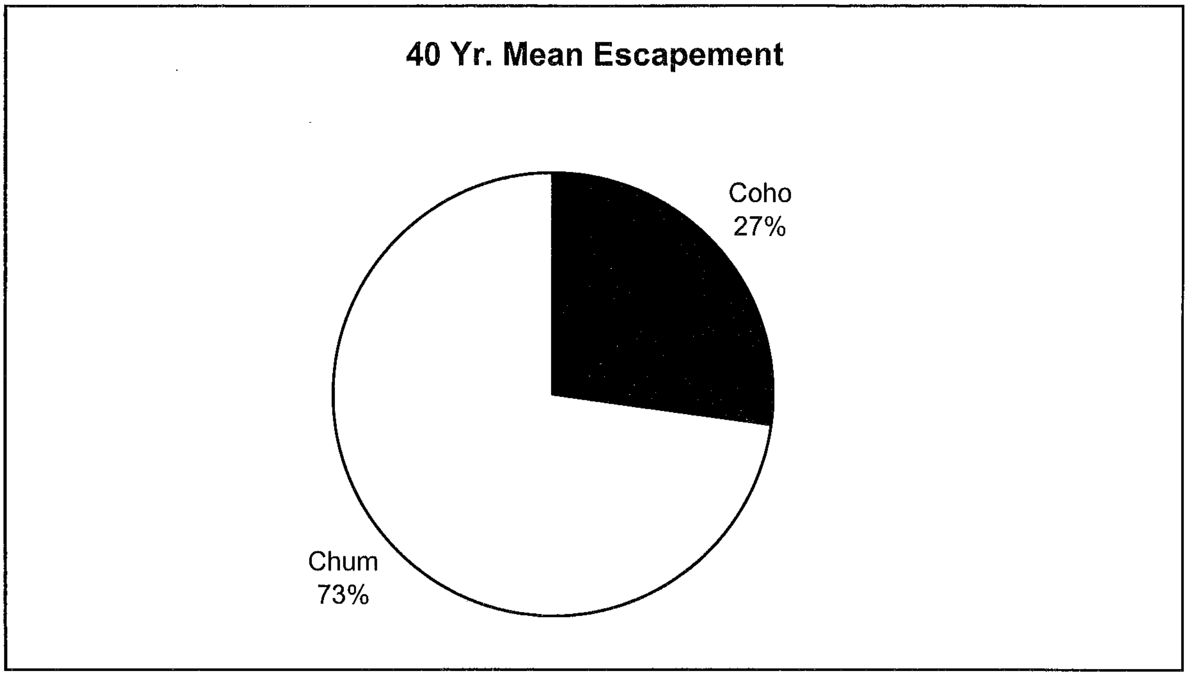


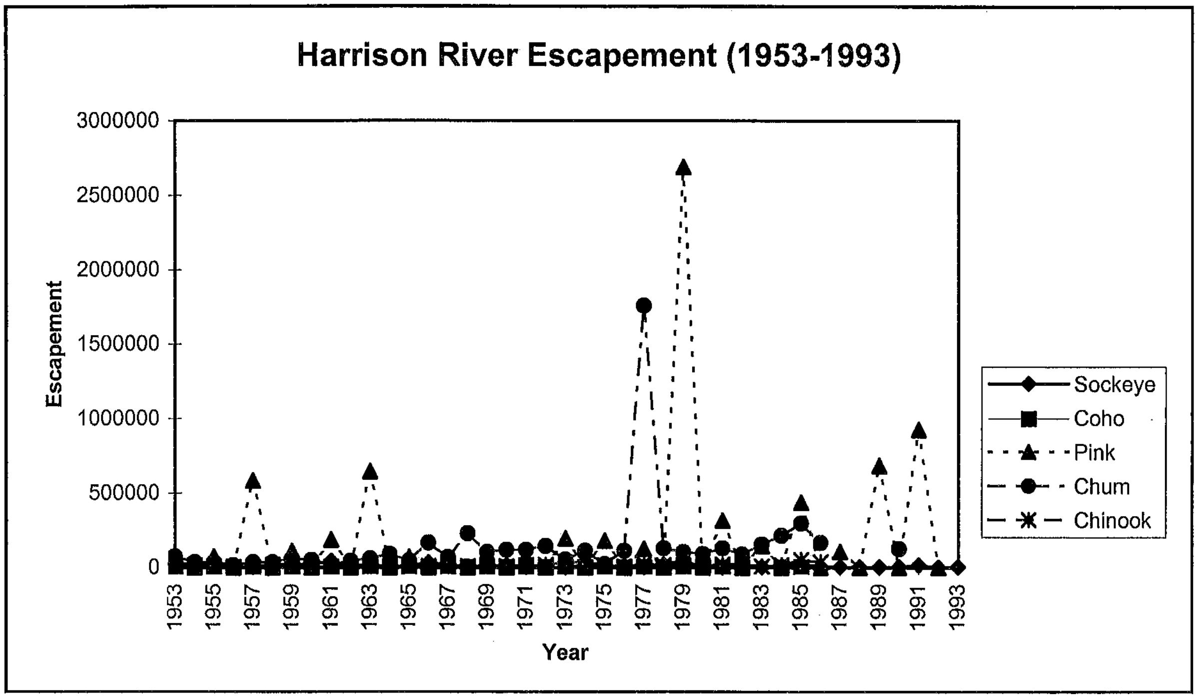
* Upper Chilliwack River including Chilliwack Lake.

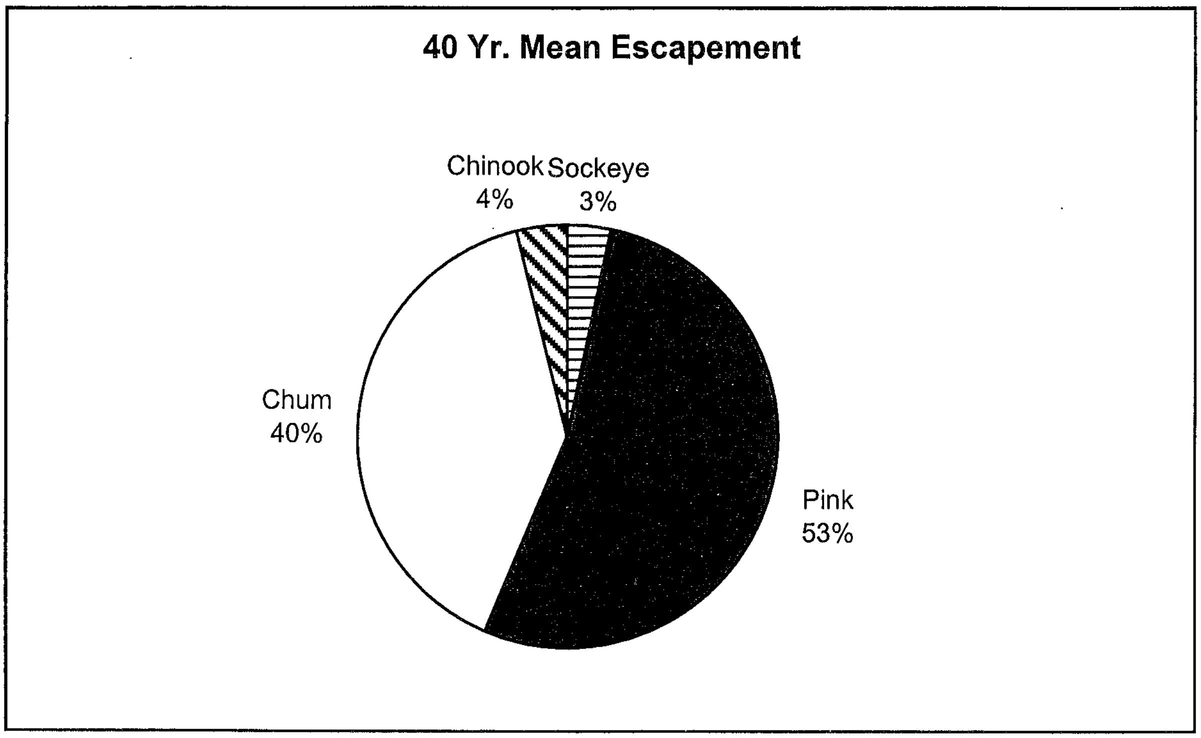

Coquihalla River Escapement (1953-1991)
Escapement
140000
120000
100000
80000
60000
40000
20000
0
1953 1956 1959 1962 1965 1968 1971 1974 1977 1980 1983 1986 1989 1992
Year
Coho
Pink
Chum

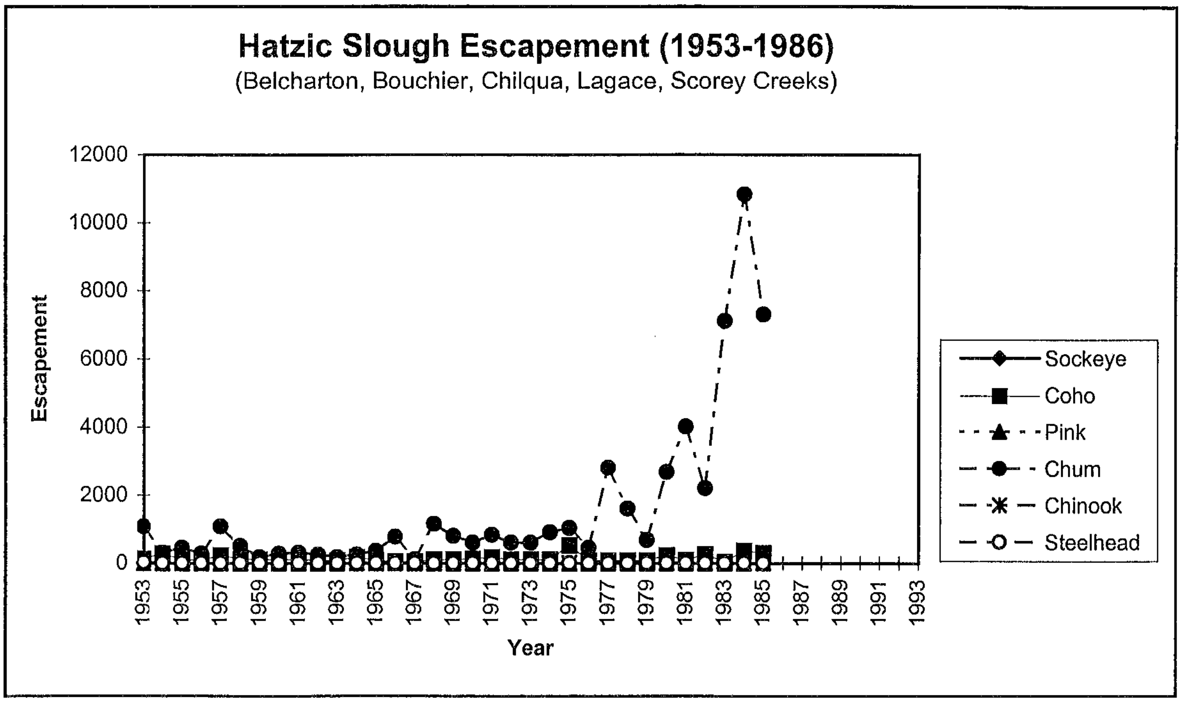

40 Yr. Mean Escapement
Chum 2%
Coho 1%
Pink 97%


Coquitlam River Escapement (1953-1993)
Escapement
4000
3500
3000
2500
2000
1500
1000
500
0
1953 1956 1959 1962 1965 1968 1971 1974 1977 1980 1983 1986 1989 1992
Year
Coho
Chum

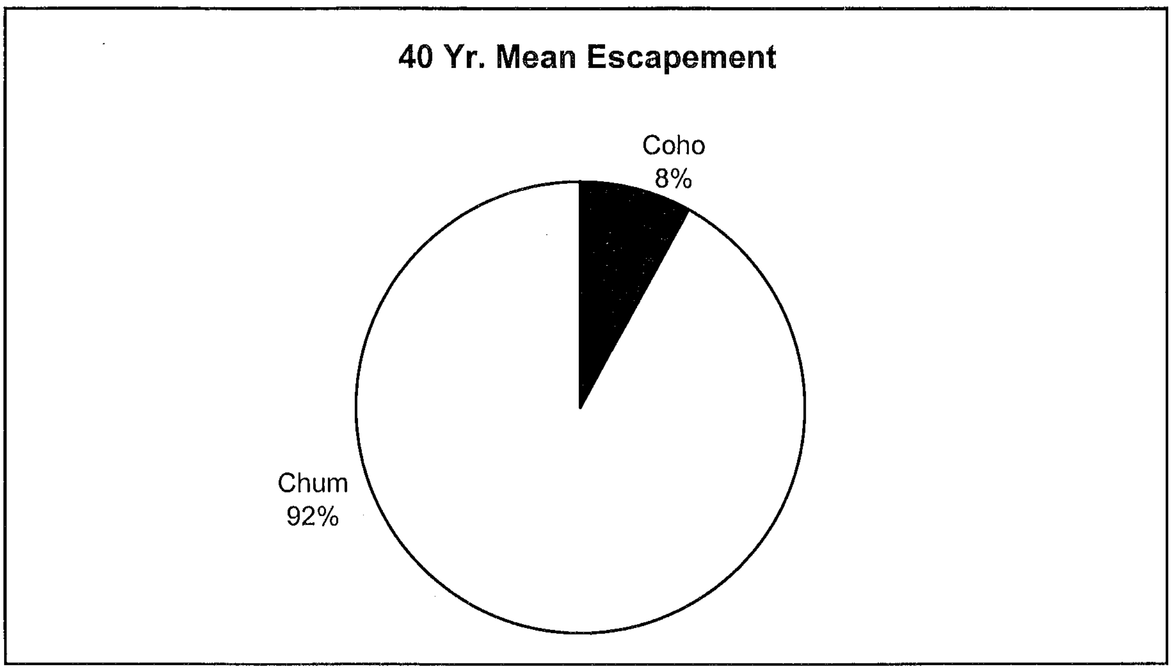

40 Yr. Mean Escapement
Coho
27%
Chum
73%


Harrison River Escapement (1953-1993)
Escapement
3000000
2500000
2000000
1500000
1000000
500000
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Sockeye
Coho
Pink
Chum
Chinook

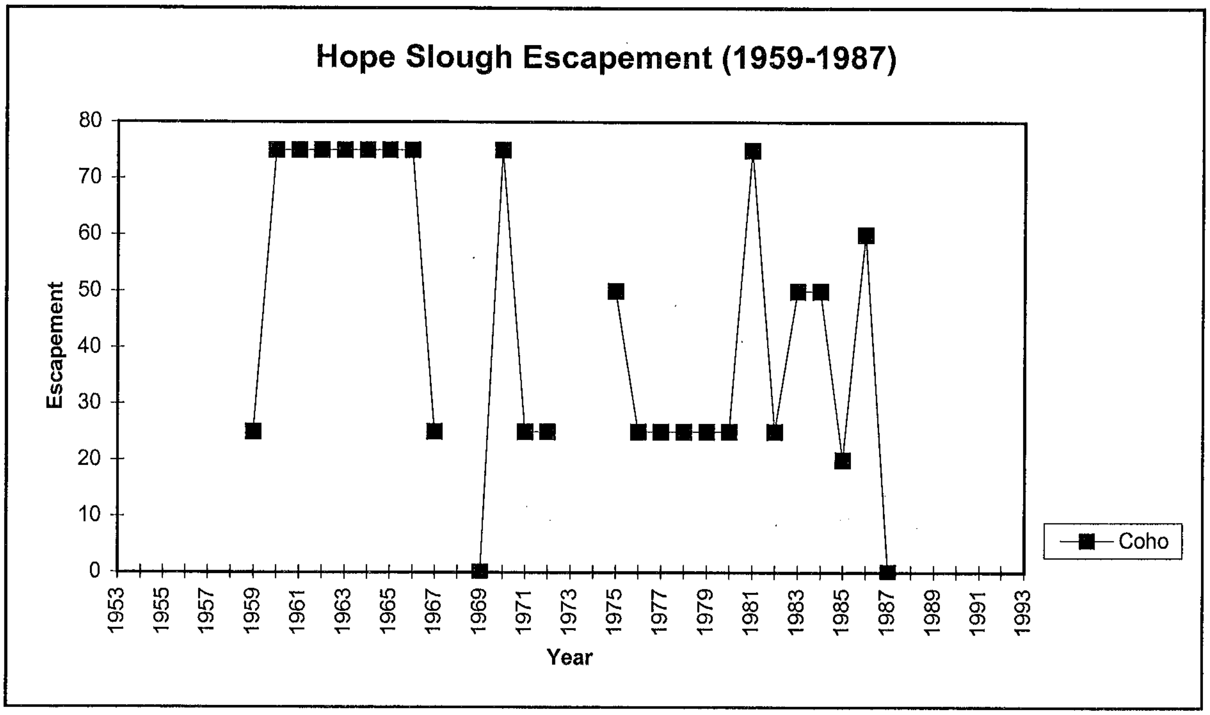

40 Yr. Mean Escapement
Chinook 4%
Sockeye 3%
Chum 40%
Pink 53%

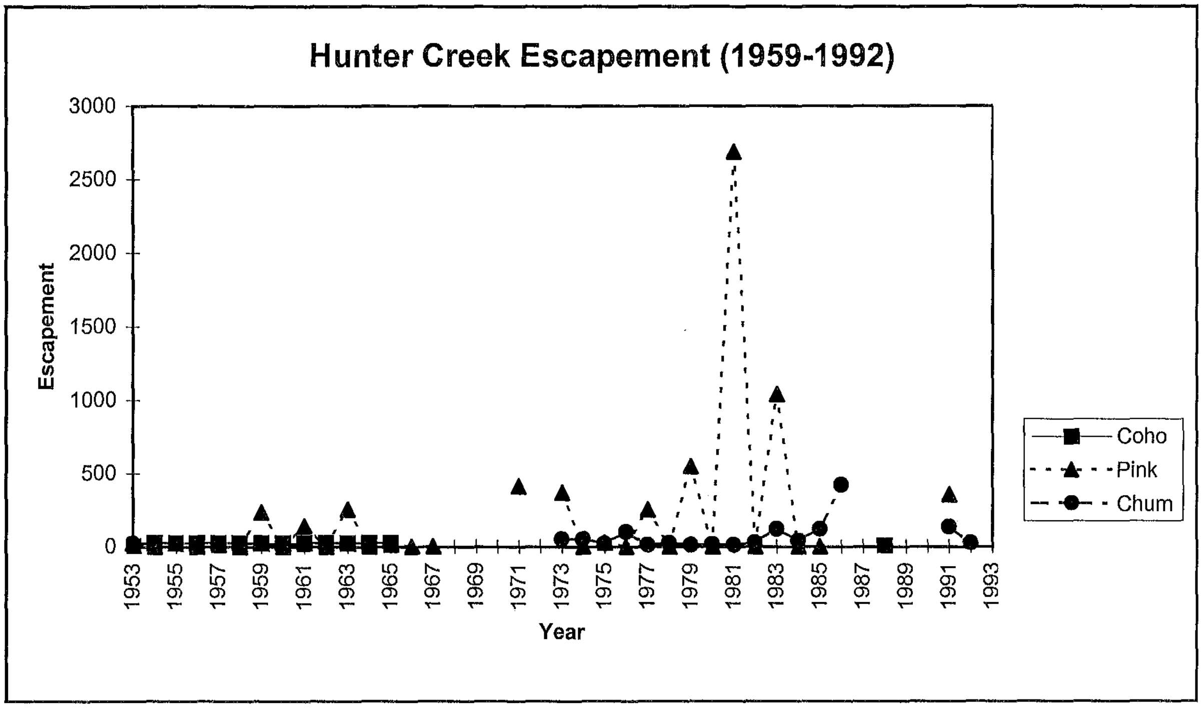


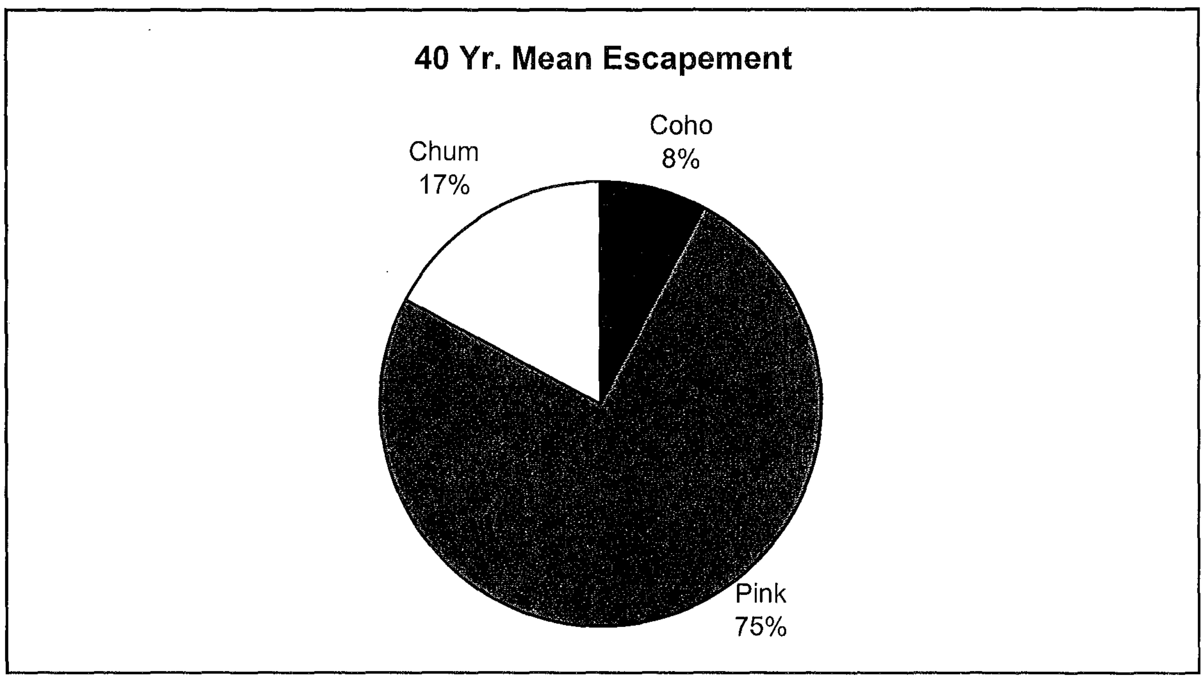
Hatzic Slough Escapement (1953-1986)
(Belcharton, Bouchier, Chilqua, Lagace, Scorey Creeks)
12000
10000
8000
6000
4000
2000
0
Escapement
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Sockeye
Coho
Pink
Chum
Chinook
Steelhead

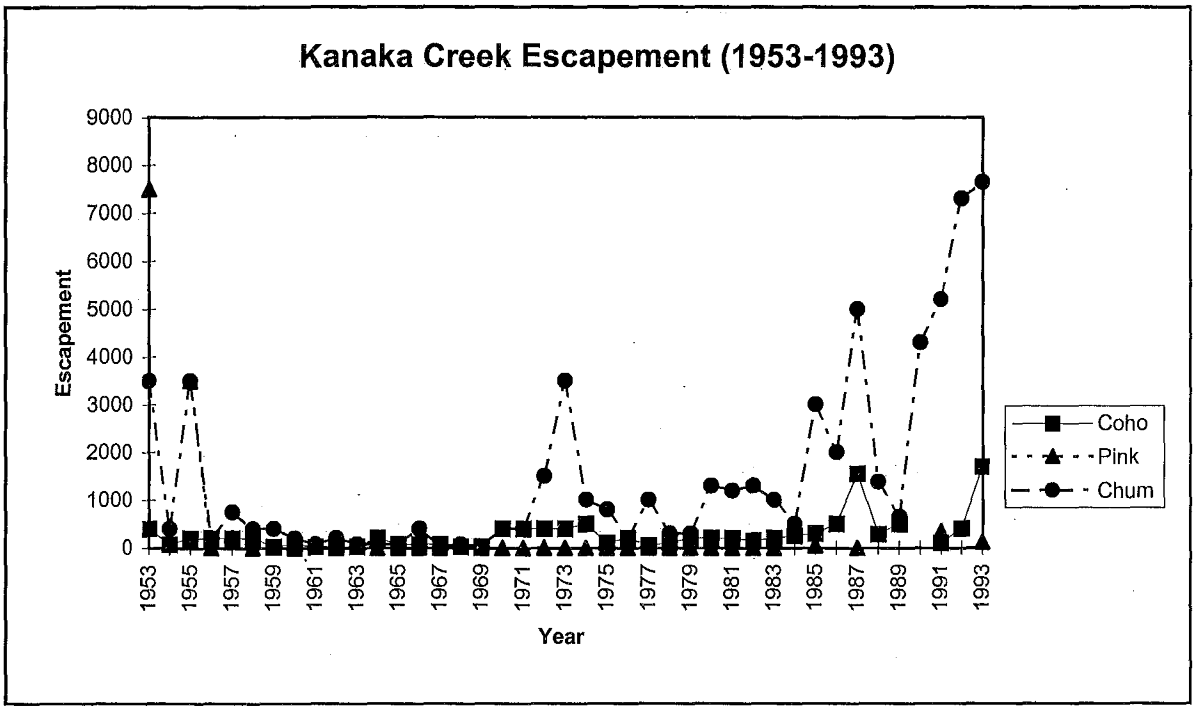


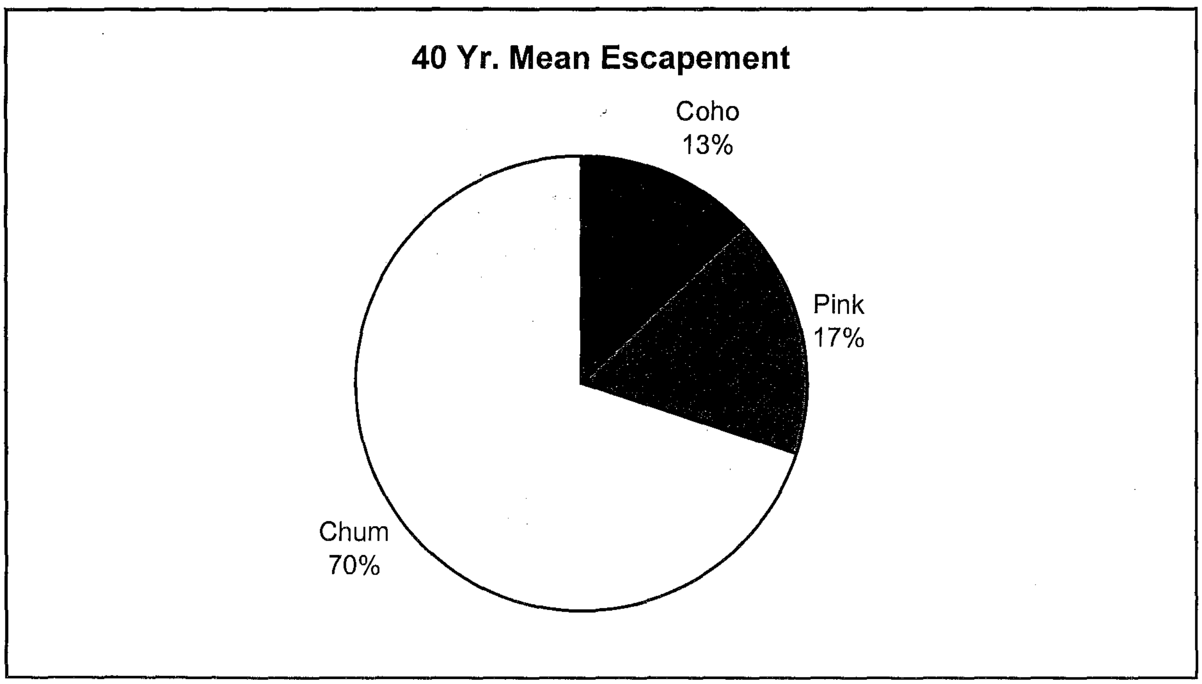
40 Yr. Mean Escapement
Coho
8%
Chum
92%

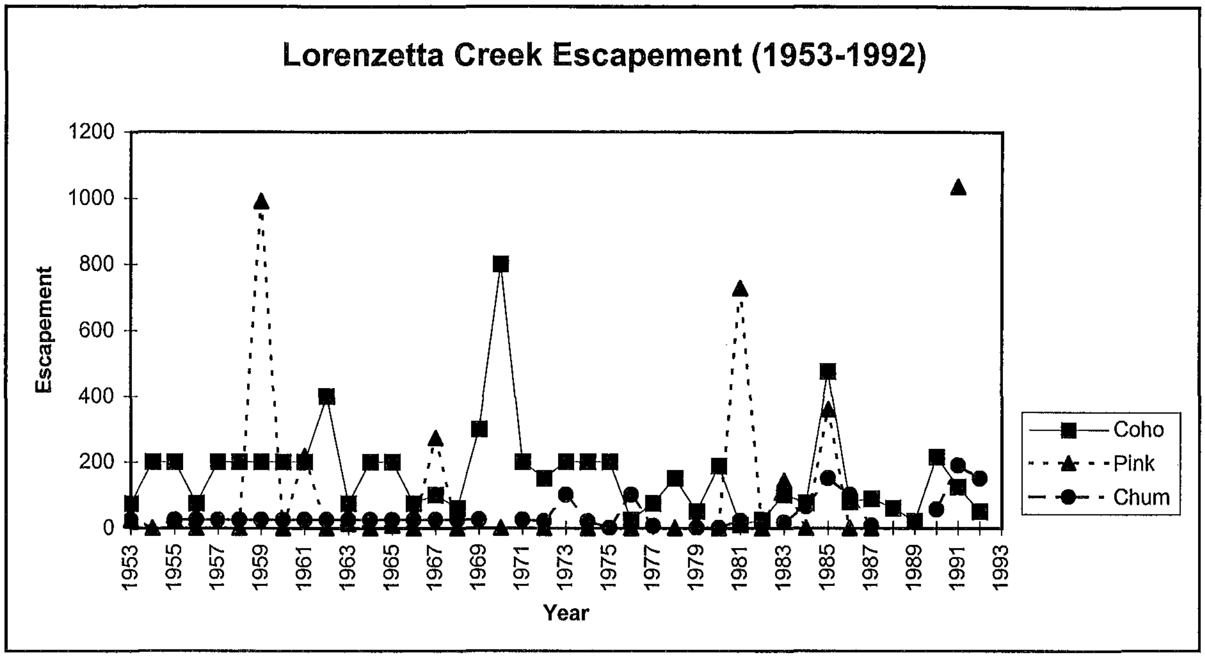

Hope Slough Escapement (1959-1987)
Escapement
80
70
60
50
40
30
20
10
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho

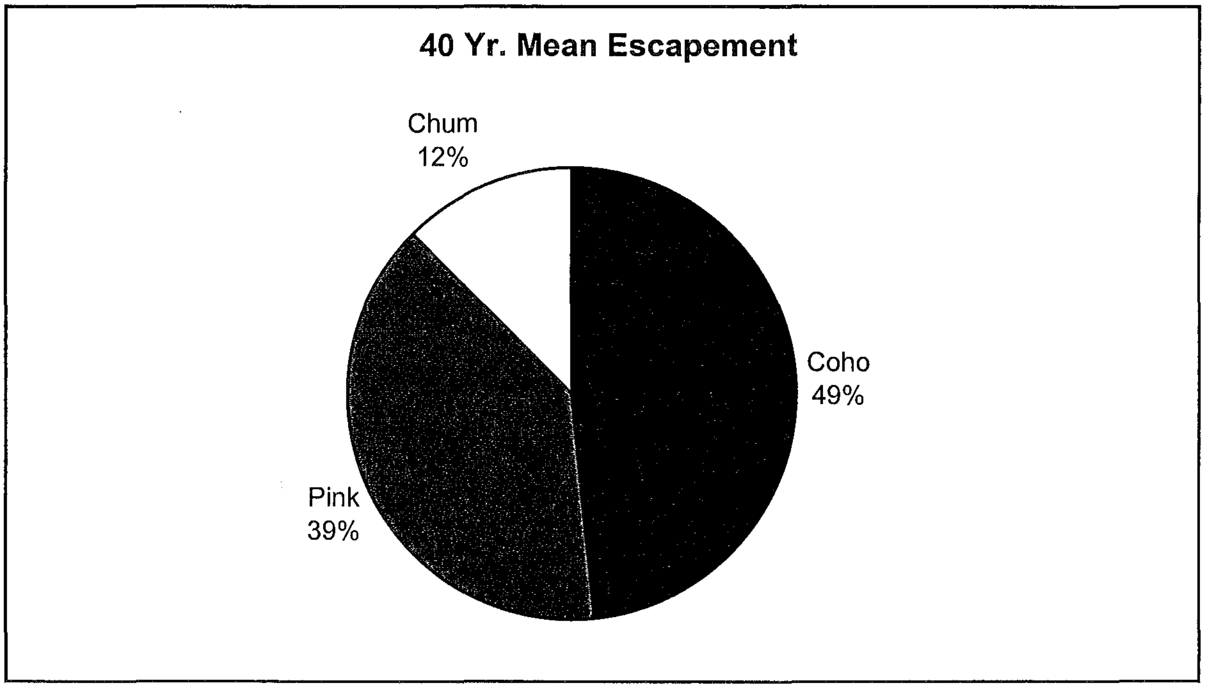

Hunter Creek Escapement (1959-1992)
Escapement
3000
2500
2000
1500
1000
500
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho
Pink
Chum

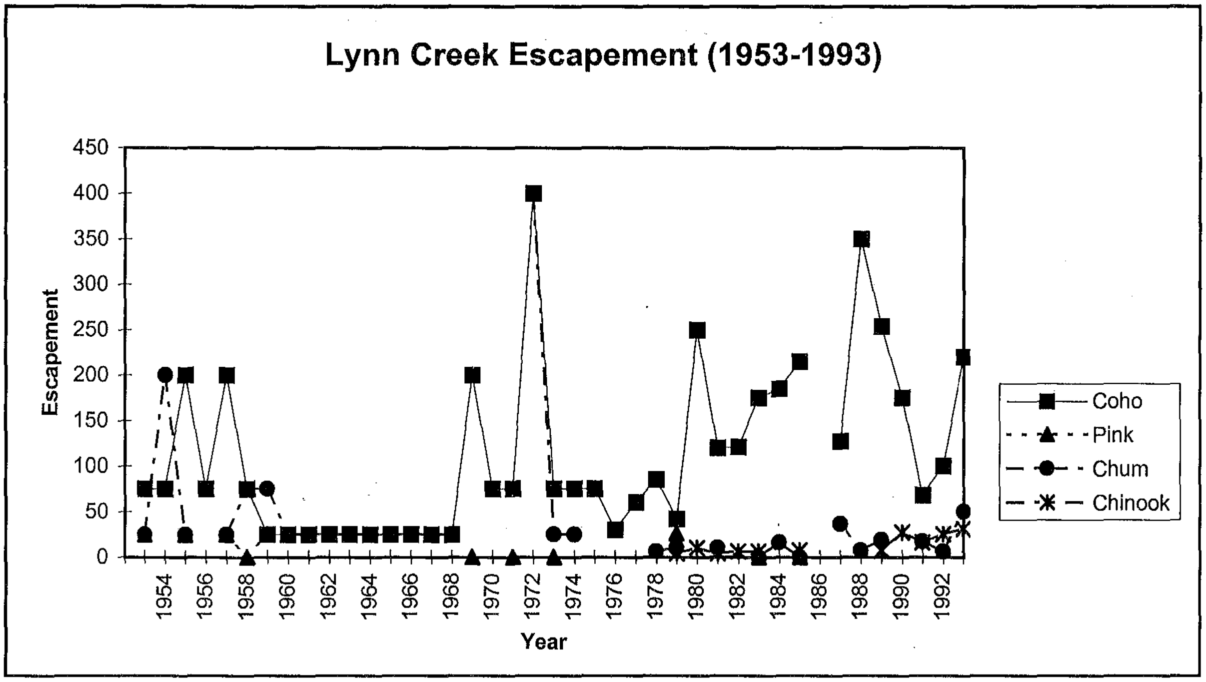

40 Yr. Mean Escapement
Chum
17%
Coho
8%
Pink
75%

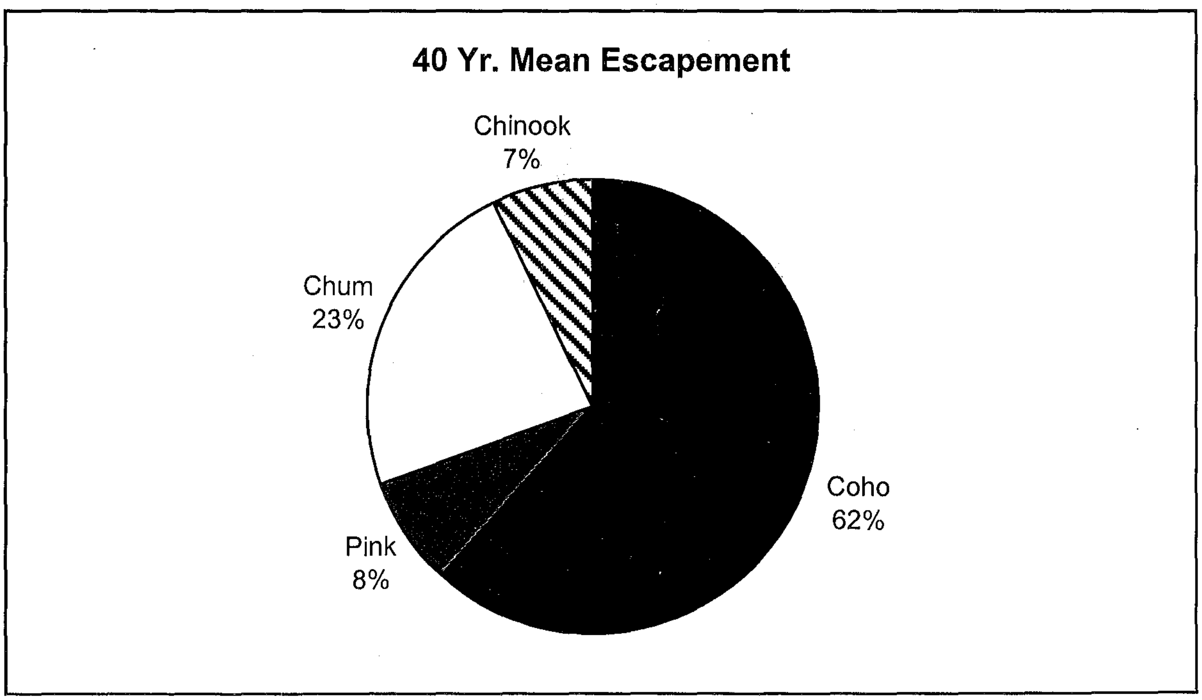

Kanaka Creek Escapement (1953-1993)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Escapement
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho
Pink
Chum

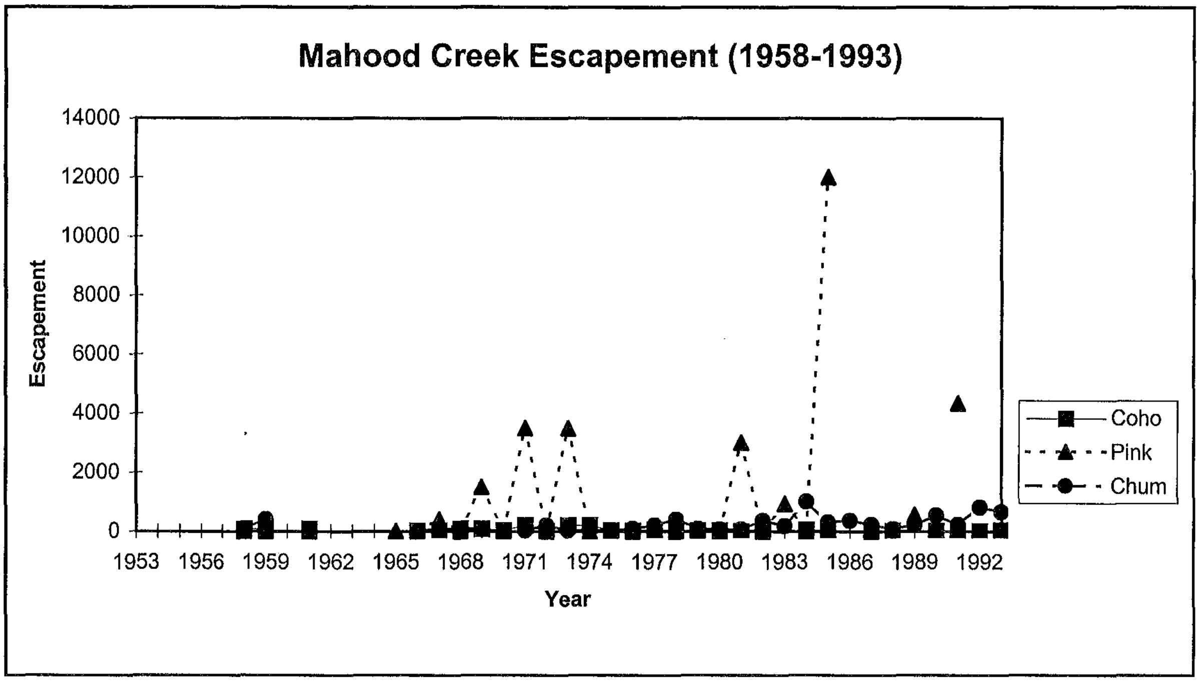

40 Yr. Mean Escapement
Coho 13%
Pink 17%
Chum 70%

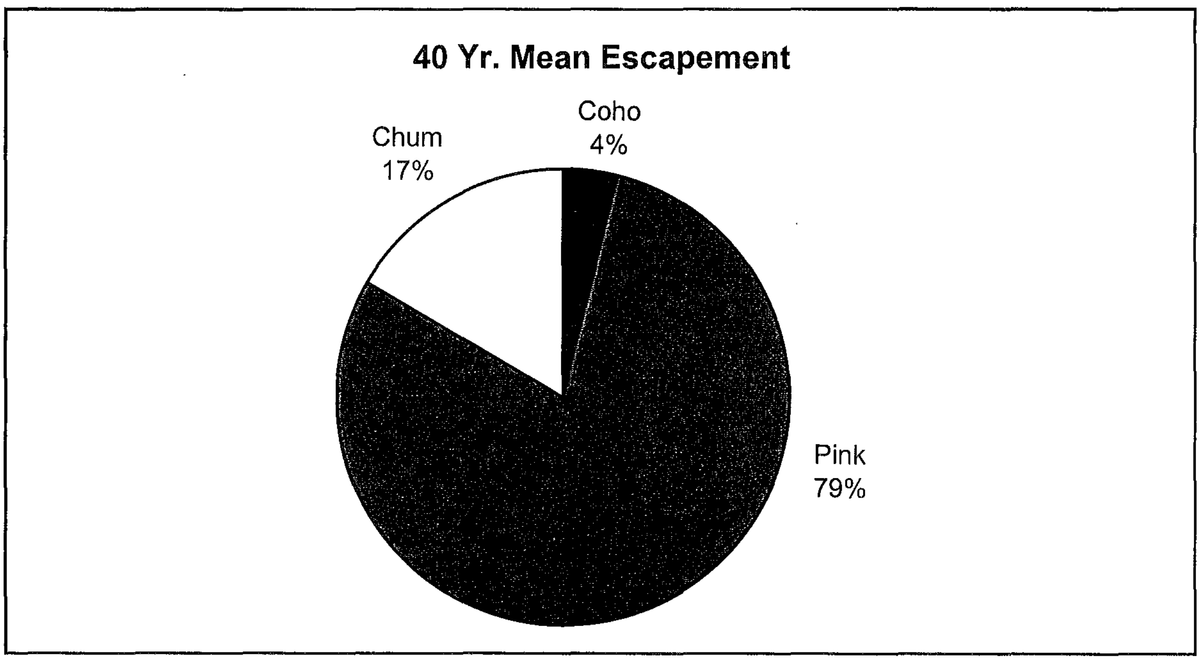

Lorenzetta Creek Escapement (1953-1992)
Escapement
1200
1000
800
600
400
200
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho
Pink
Chum

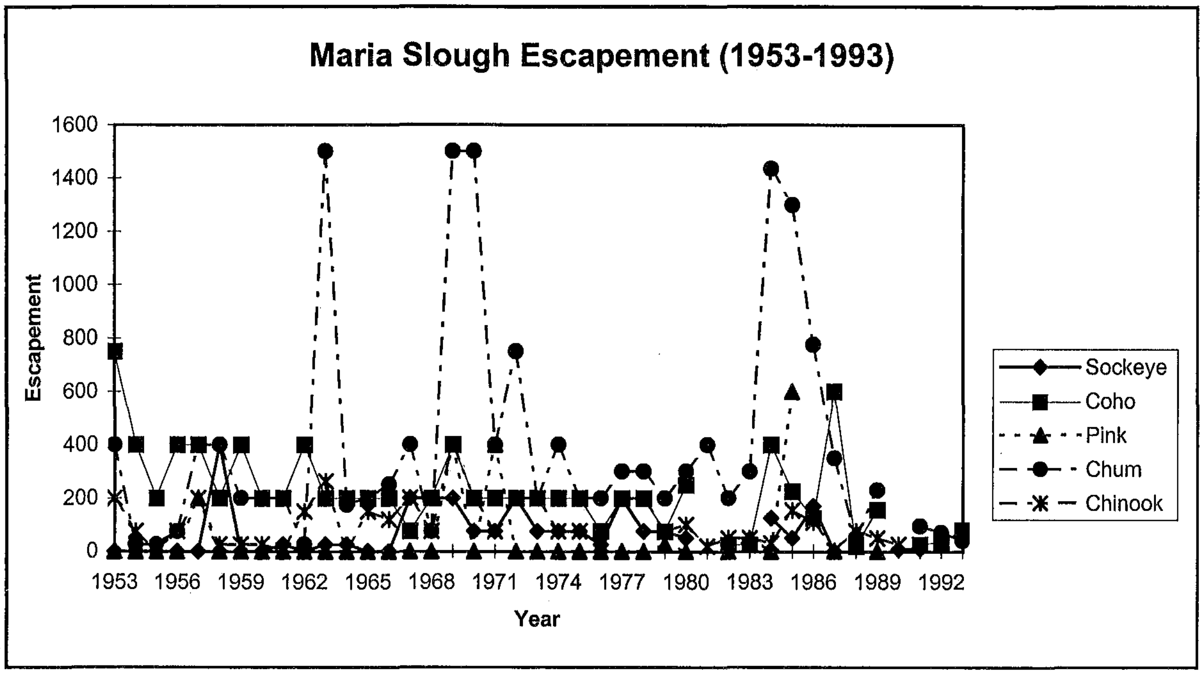

40 Yr. Mean Escapement
Chum
12%
Coho
49%
Pink
39%

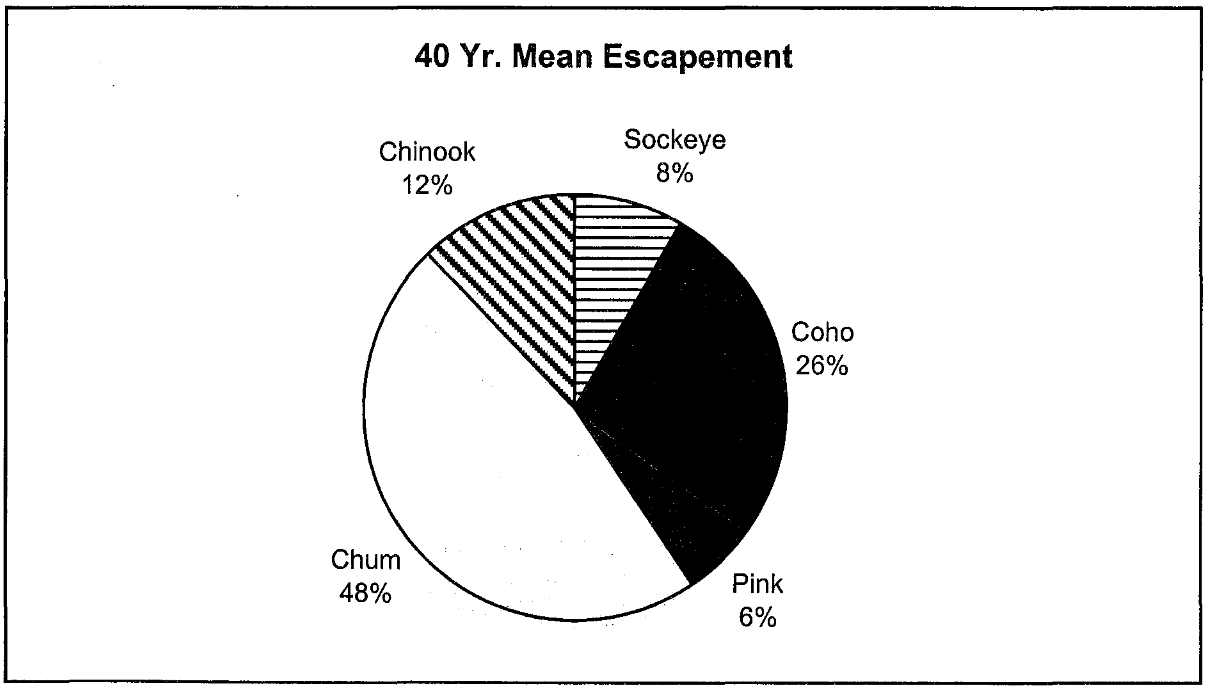

Lynn Creek Escapement (1953-1993)
Escapement
450
400
350
300
250
200
150
100
50
0
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
Year
Coho
Pink
Chum
Chinook

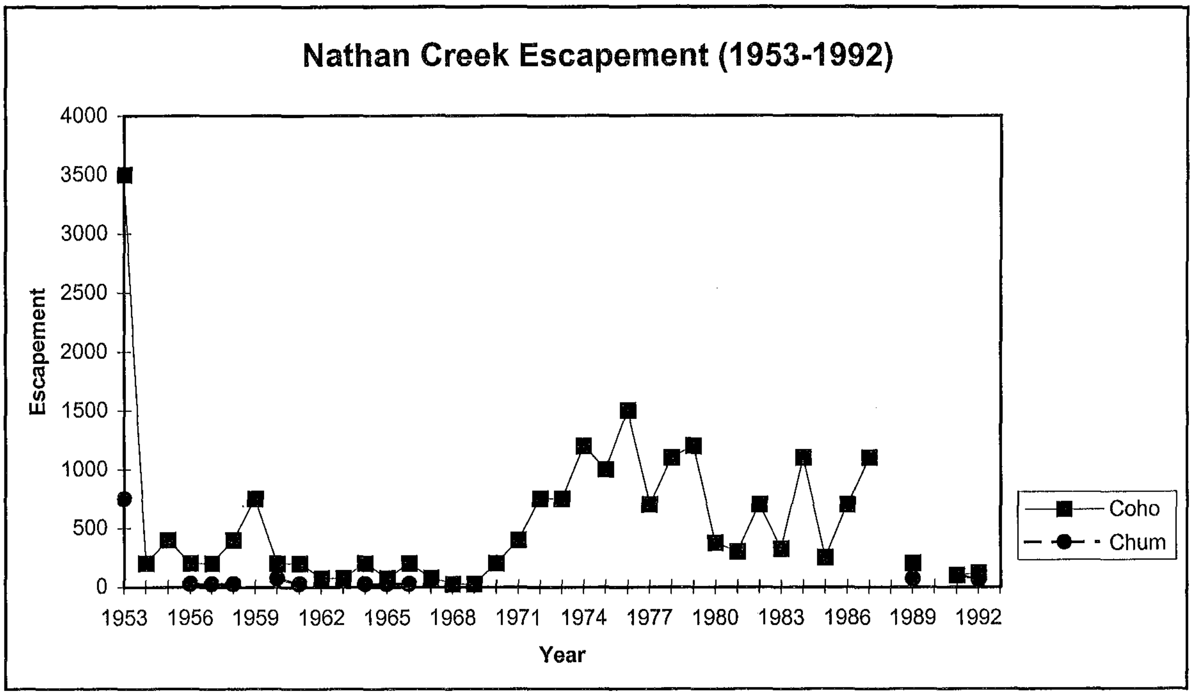

40 Yr. Mean Escapement
Chinook 7%
Chum 23%
Pink 8%
Coho 62%

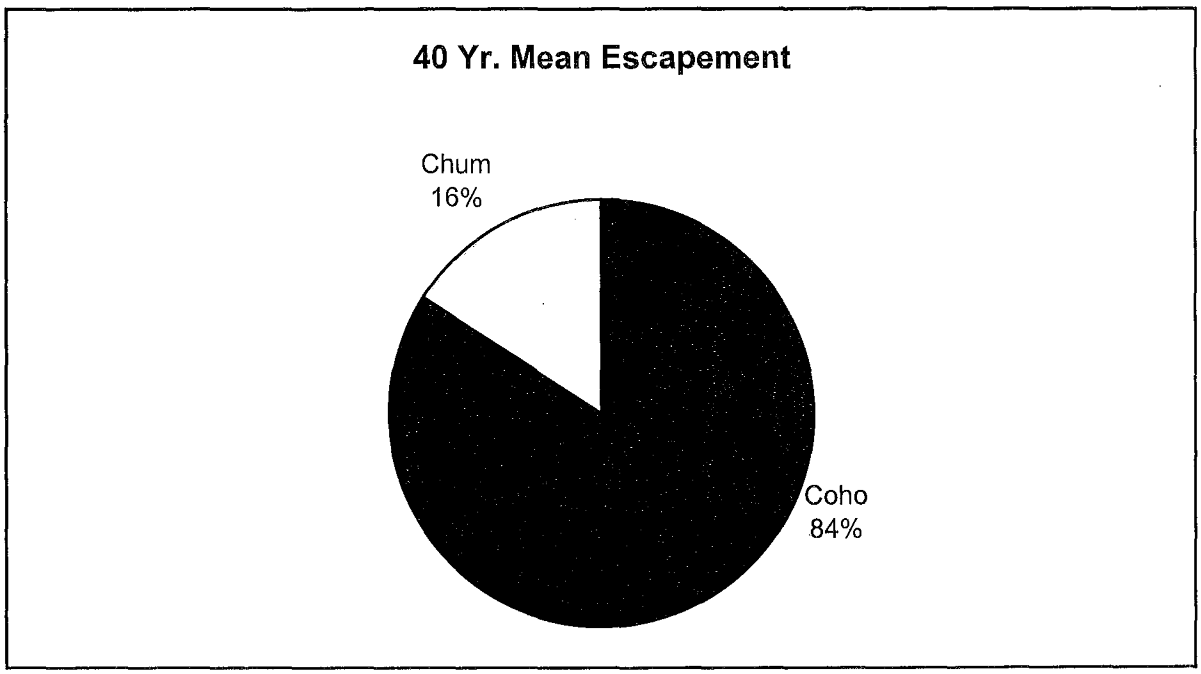

Mahood Creek Escapement (1958-1993)
Escapement
14000
12000
10000
8000
6000
4000
2000
0
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
Year
Coho
Pink
Chum

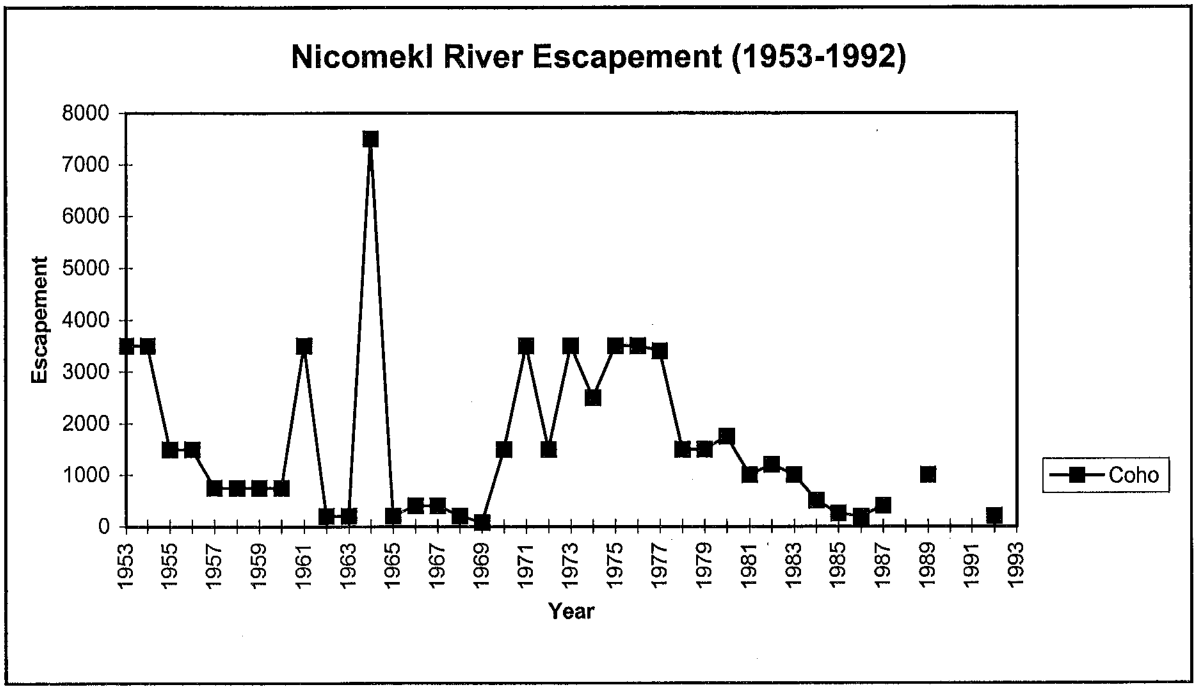

40 Yr. Mean Escapement
Coho 4%
Chum 17%
Pink 79%

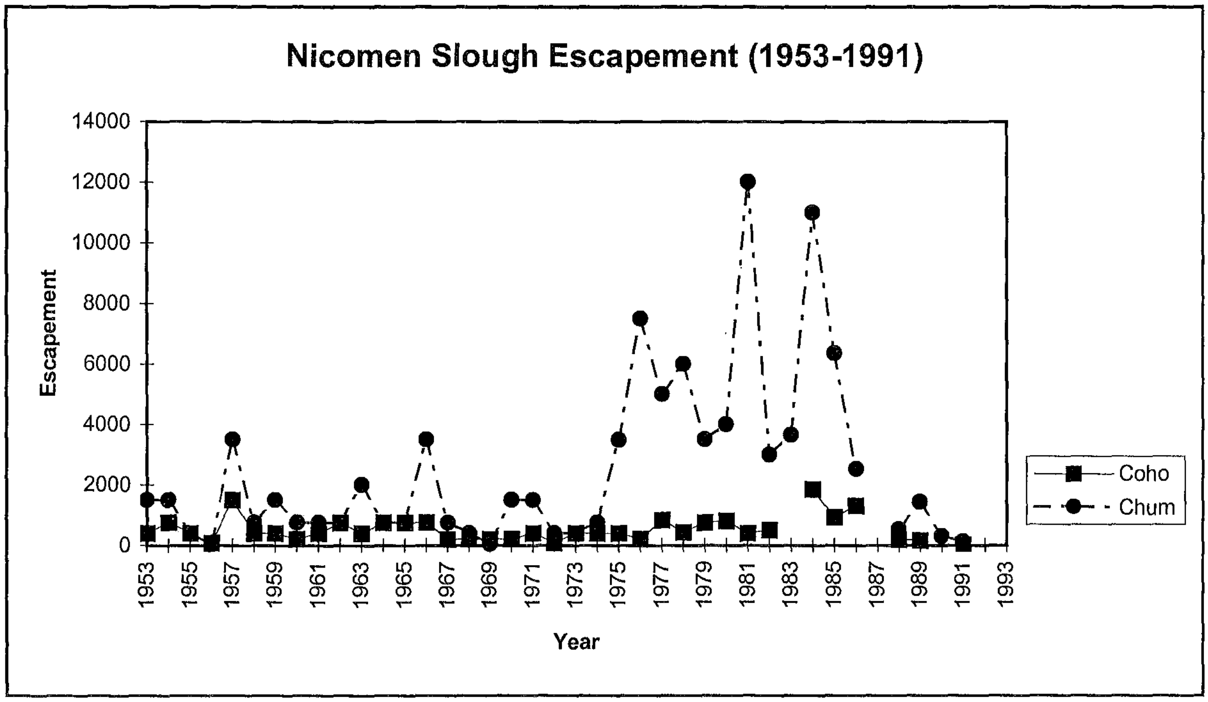

Maria Slough Escapement (1953-1993)
Escapement
1600
1400
1200
1000
800
600
400
200
0
1953 1956 1959 1962 1965 1968 1971 1974 1977 1980 1983 1986 1989 1992
Year
Sockeye
Coho
Pink
Chum
Chinook

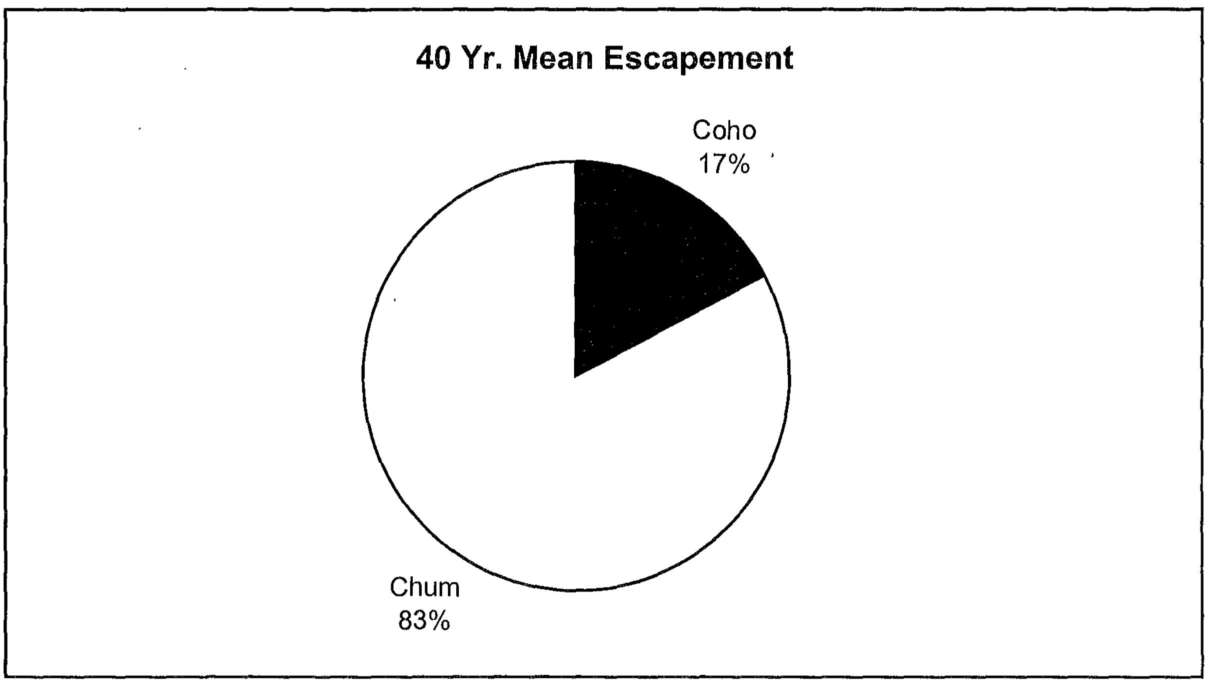

40 Yr. Mean Escapement
Chinook 12%
Sockeye 8%
Coho 26%
Pink 6%
Chum 48%

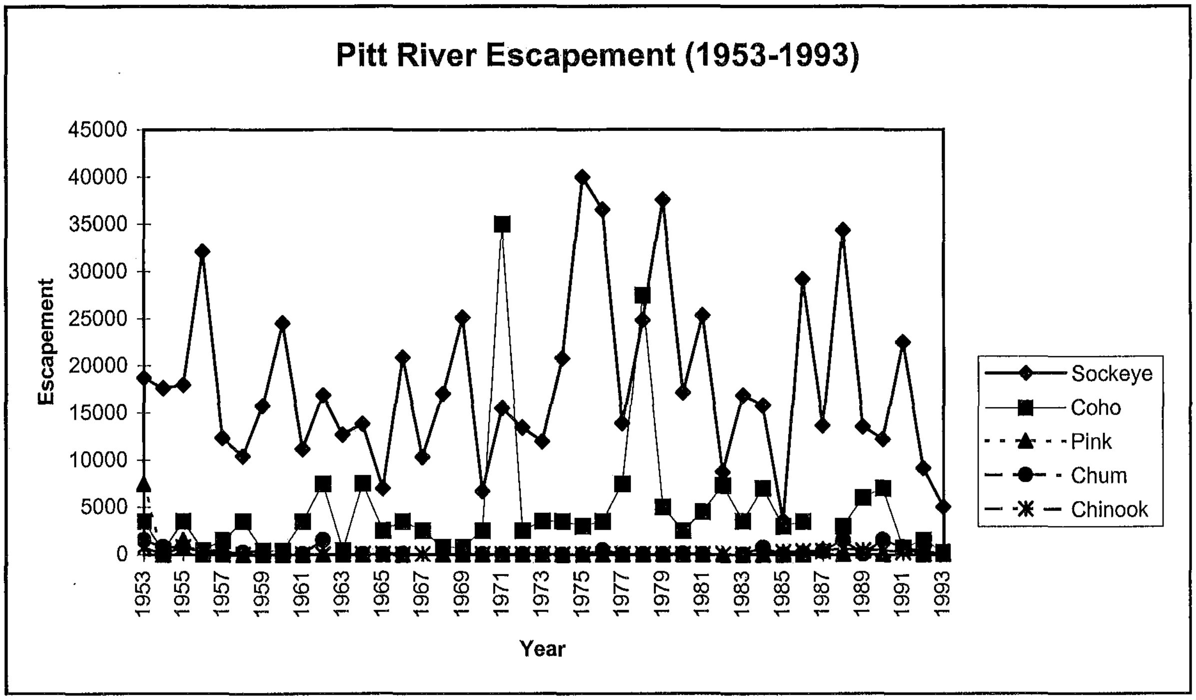

Nathan Creek Escapement (1953-1992)
4000
3500
3000
2500
2000
1500
1000
500
0
Escapement
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
Year
Coho
Chum

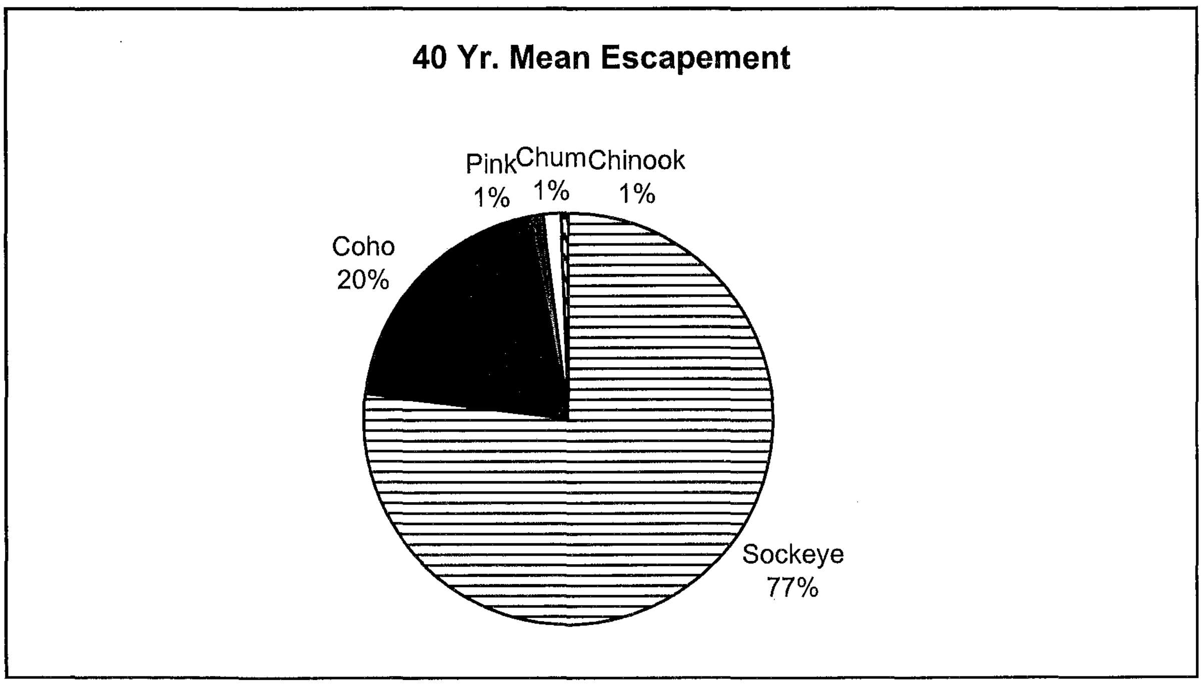

40 Yr. Mean Escapement
Chum
16%
Coho
84%

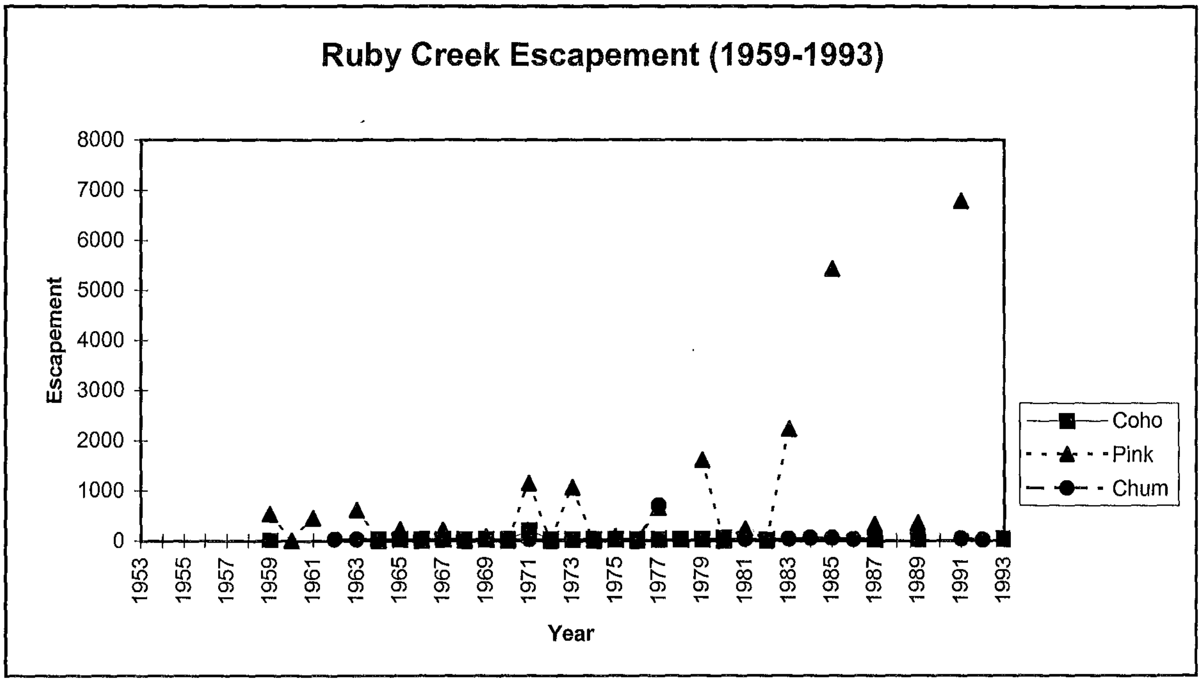

Nicomekl River Escapement (1953-1992)
8000
7000
6000
5000
4000
3000
2000
1000
0
Escapement
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho

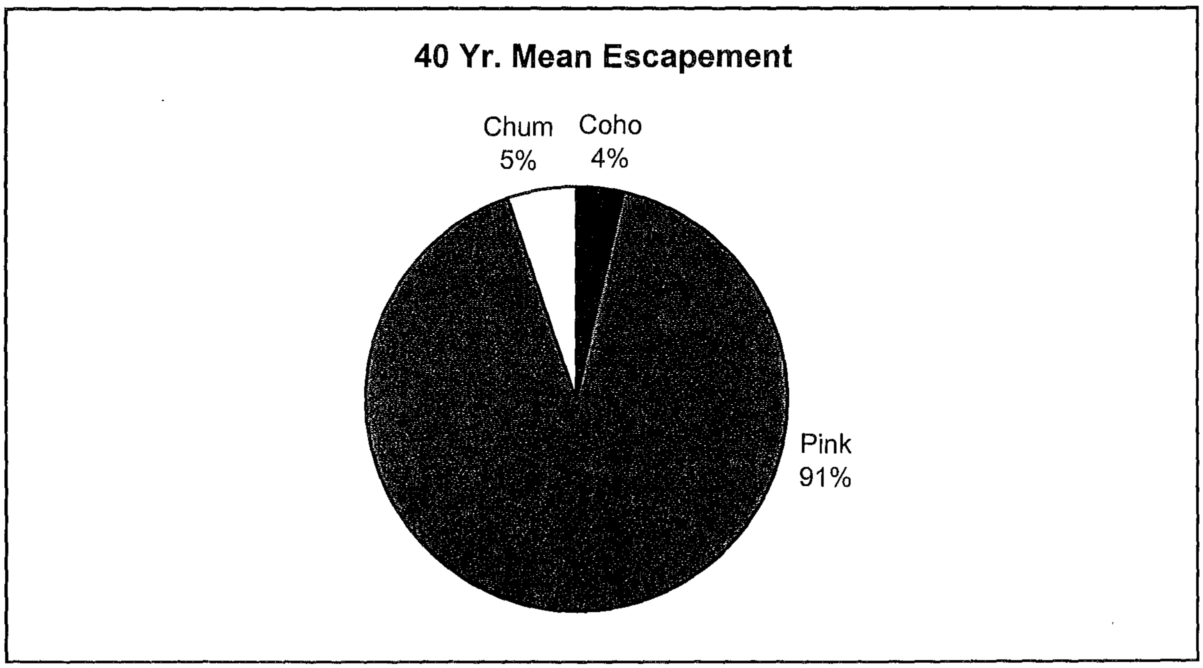

Nicomen Slough Escapement (1953-1991)
Escapement
14000
12000
10000
8000
6000
4000
2000
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho
Chum

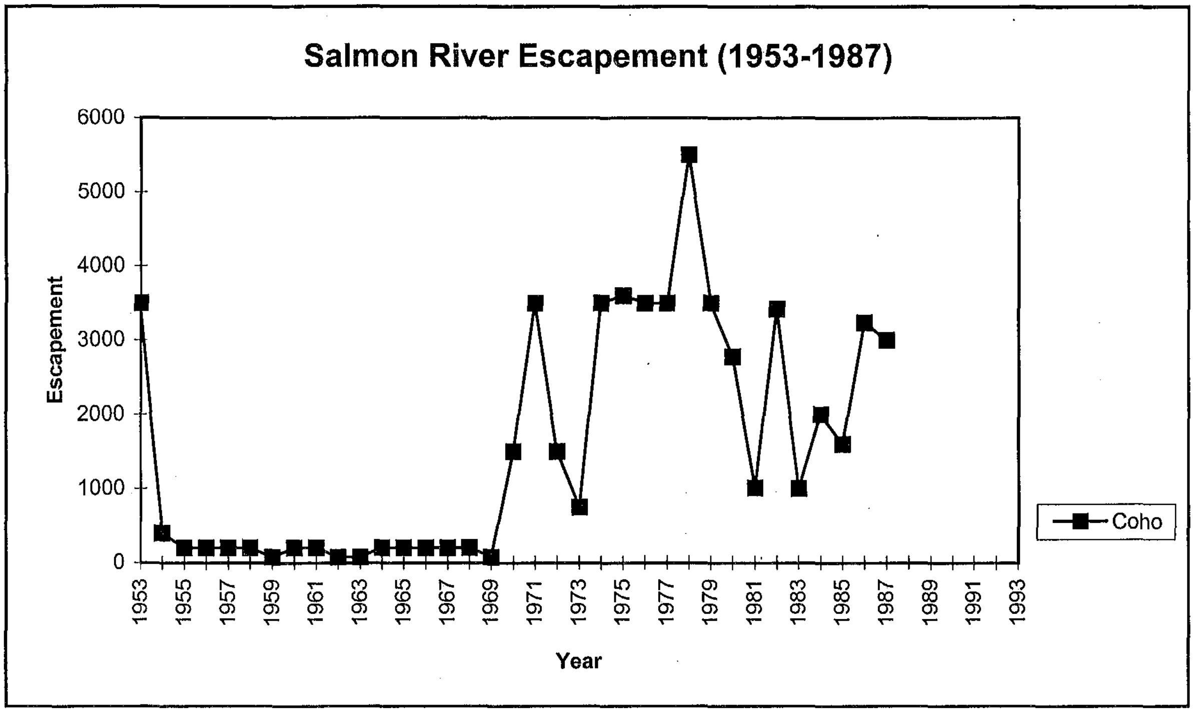

40 Yr. Mean Escapement
Coho
17%
Chum
83%

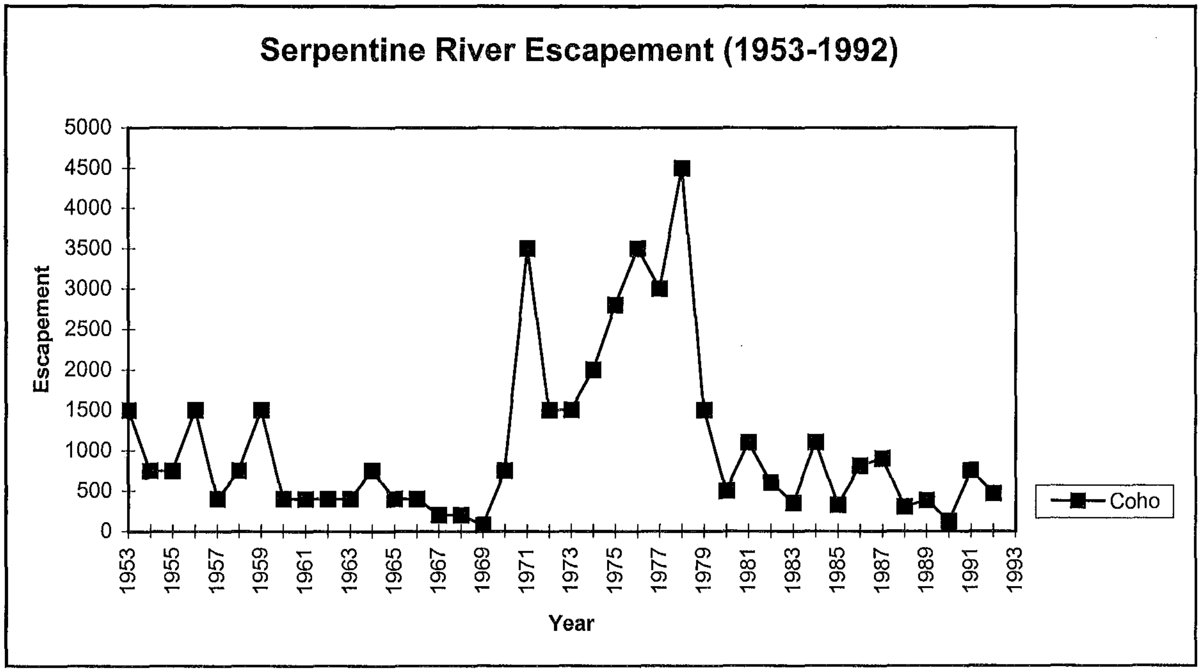

Pitt River Escapement (1953-1993)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Escapement
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Sockeye
Coho
Pink
Chum
Chinook

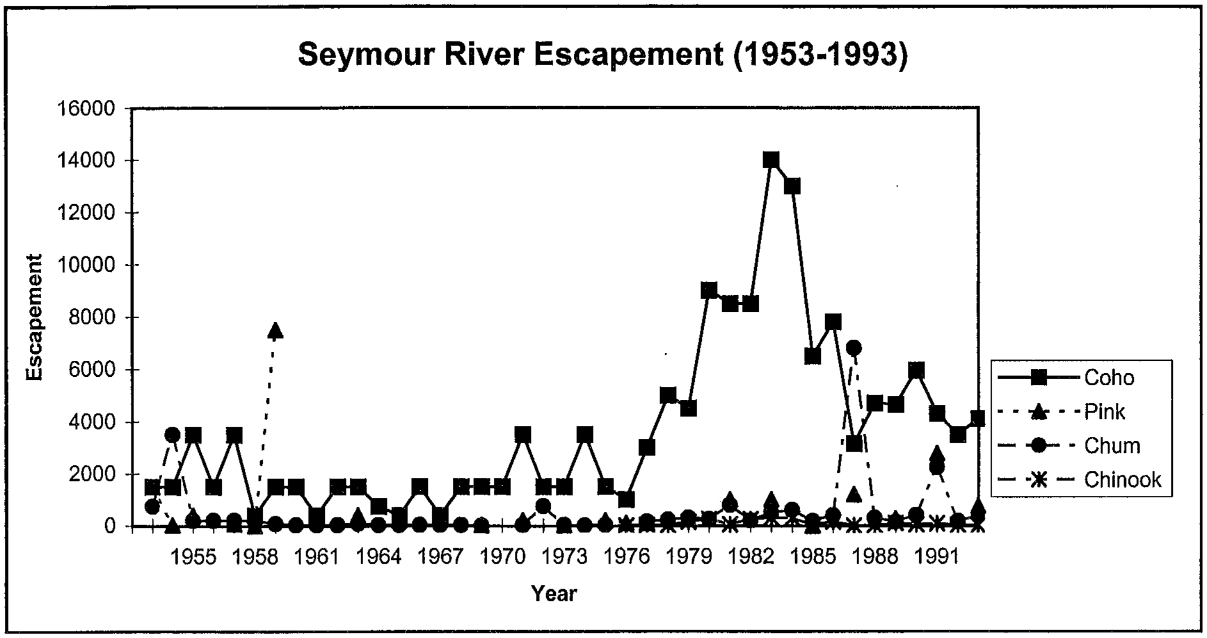

40 Yr. Mean Escapement
Pink 1%
Chum 1%
Chinook 1%
Coho 20%
Sockeye 77%

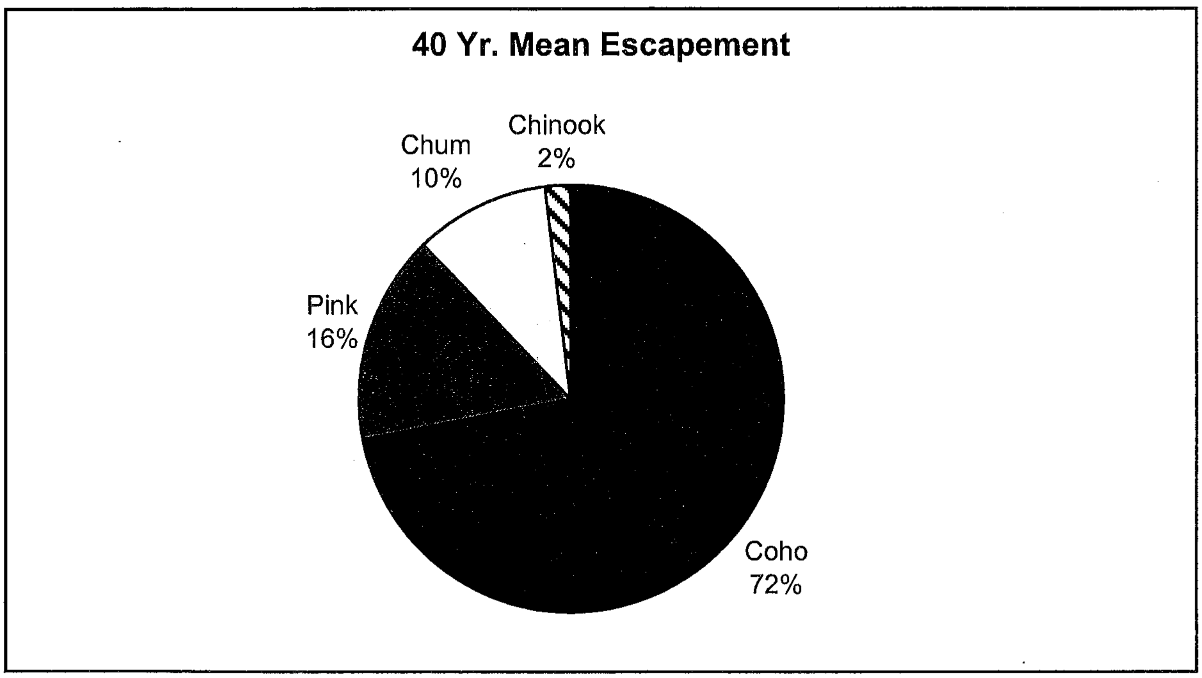

Ruby Creek Escapement (1959-1993)
Escapement
8000
7000
6000
5000
4000
3000
2000
1000
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho
Pink
Chum

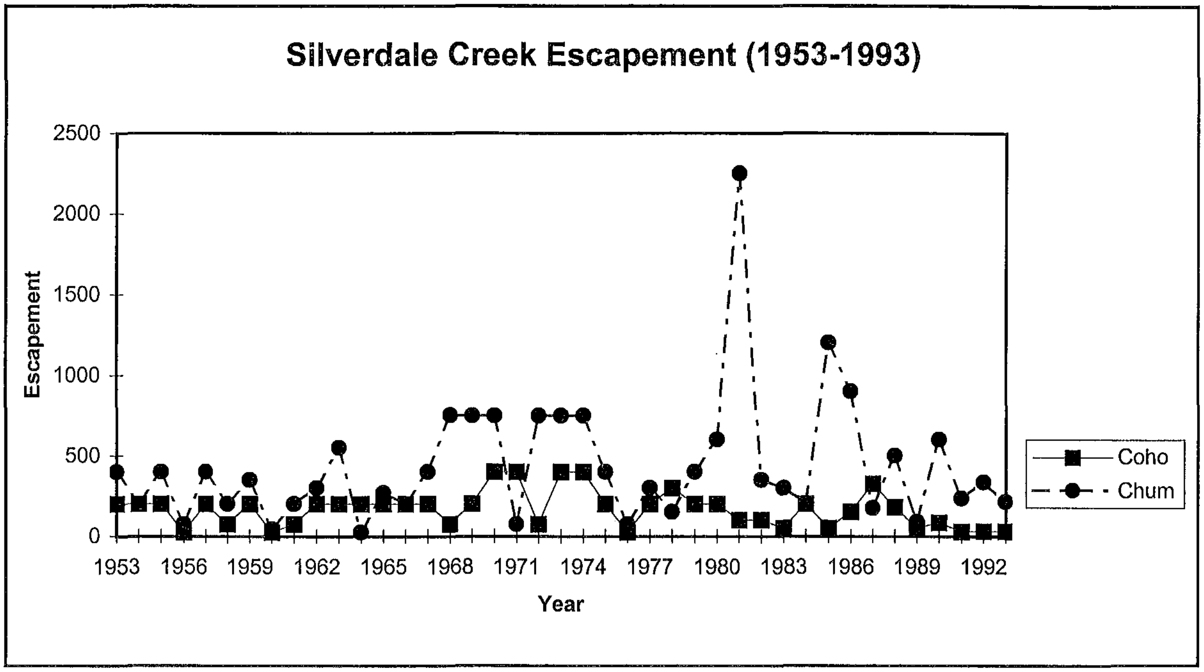

40 Yr. Mean Escapement
Chum 5%
Coho 4%
Pink 91%

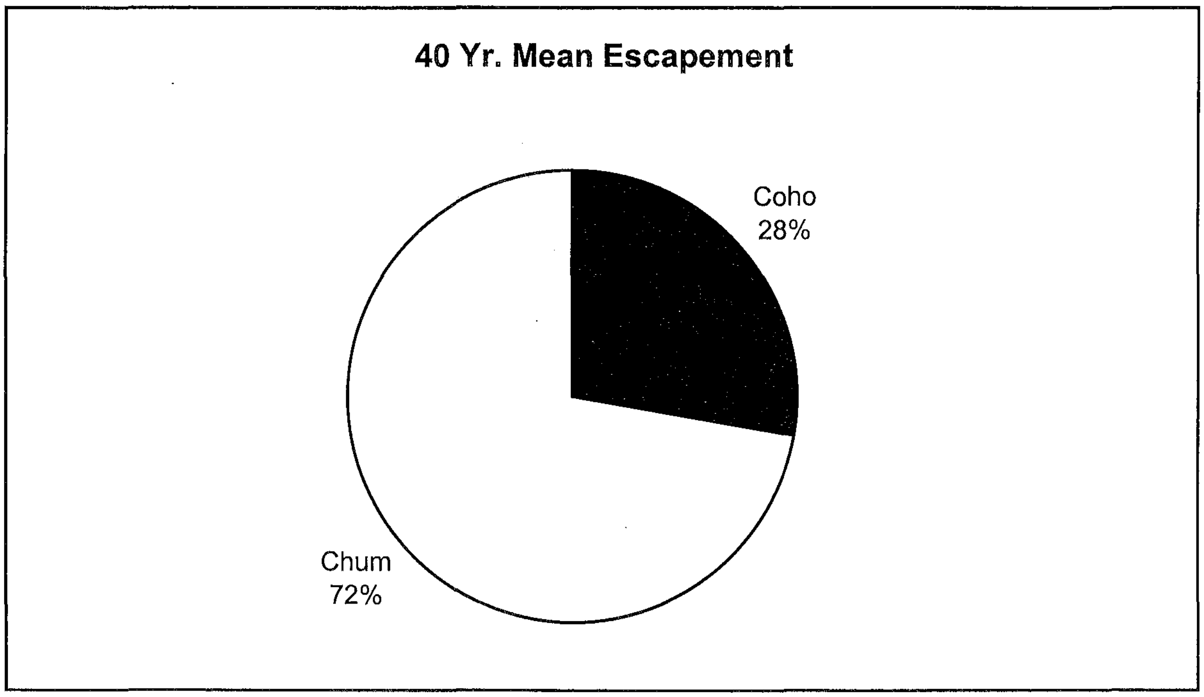

Salmon River Escapement (1953-1987)
6000
5000
4000
3000
2000
1000
0
Escapement
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho

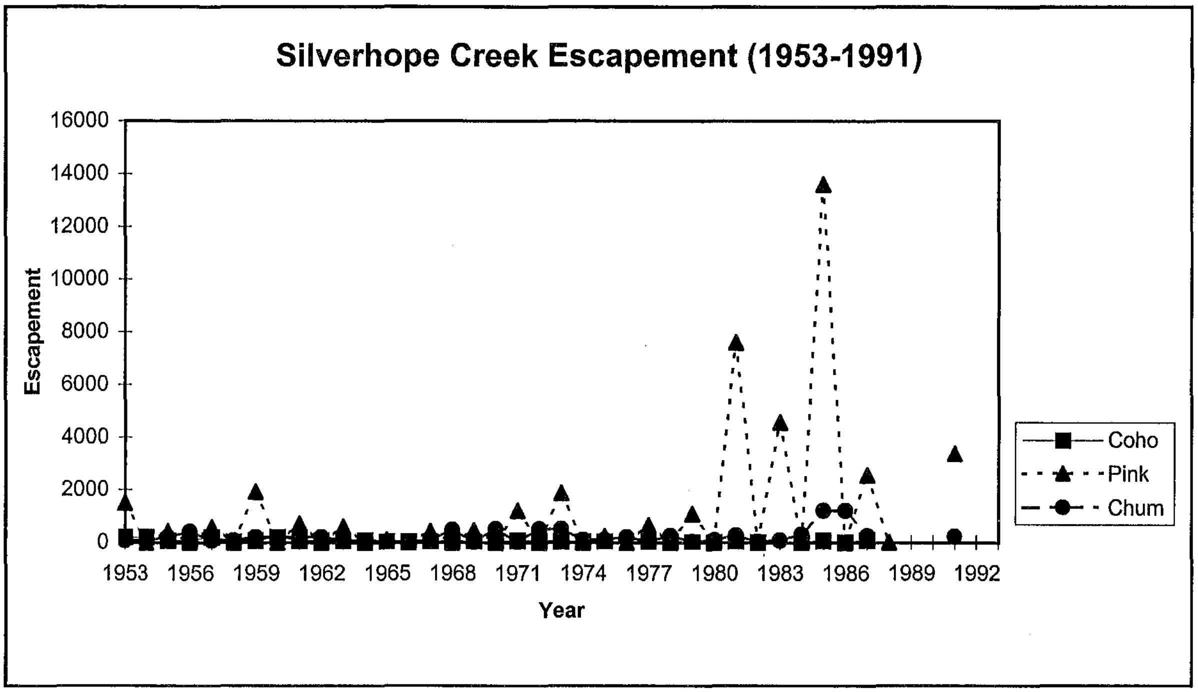

Serpentine River Escapement (1953-1992)
Escapement
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho

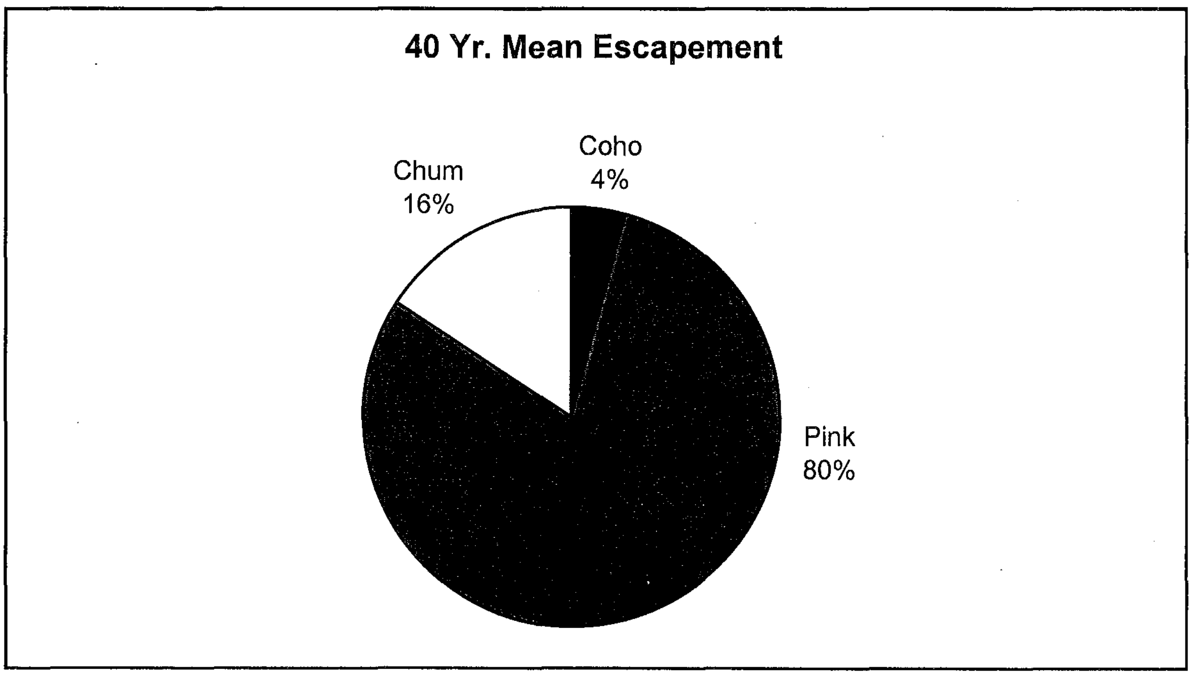

Seymour River Escapement (1953-1993)
Escapement
16000
14000
12000
10000
8000
6000
4000
2000
0
1955 1958 1961 1964 1967 1970 1973 1976 1979 1982 1985 1988 1991
Year
Coho
Pink
Chum
Chinook

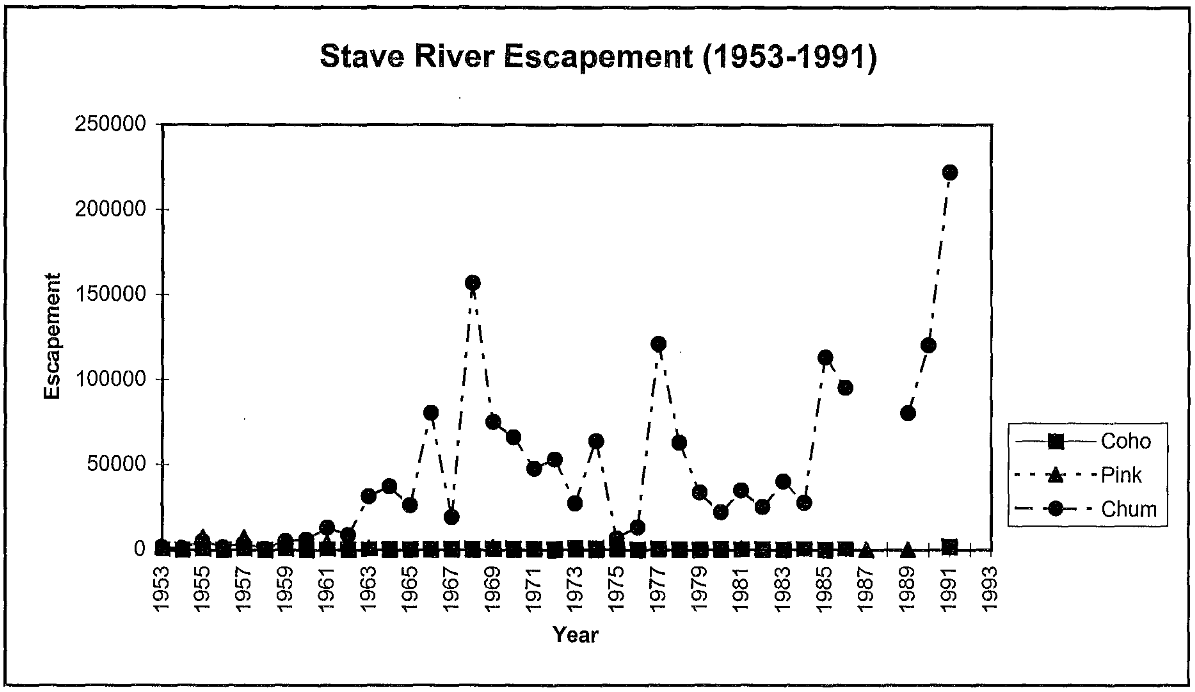

40 Yr. Mean Escapement
Chinook 2%
Chum 10%
Pink 16%
Coho 72%

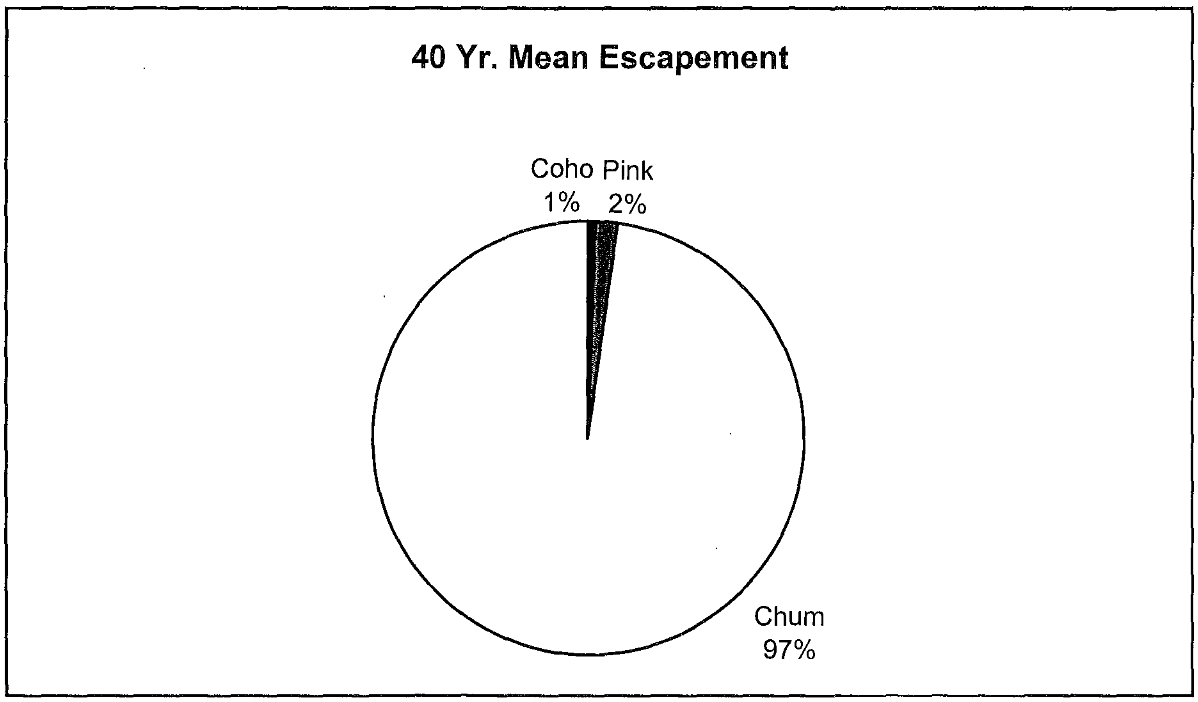

Silverdale Creek Escapement (1953-1993)
2500
2000
1500
1000
500
0
Escapement
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
Year
Coho
Chum

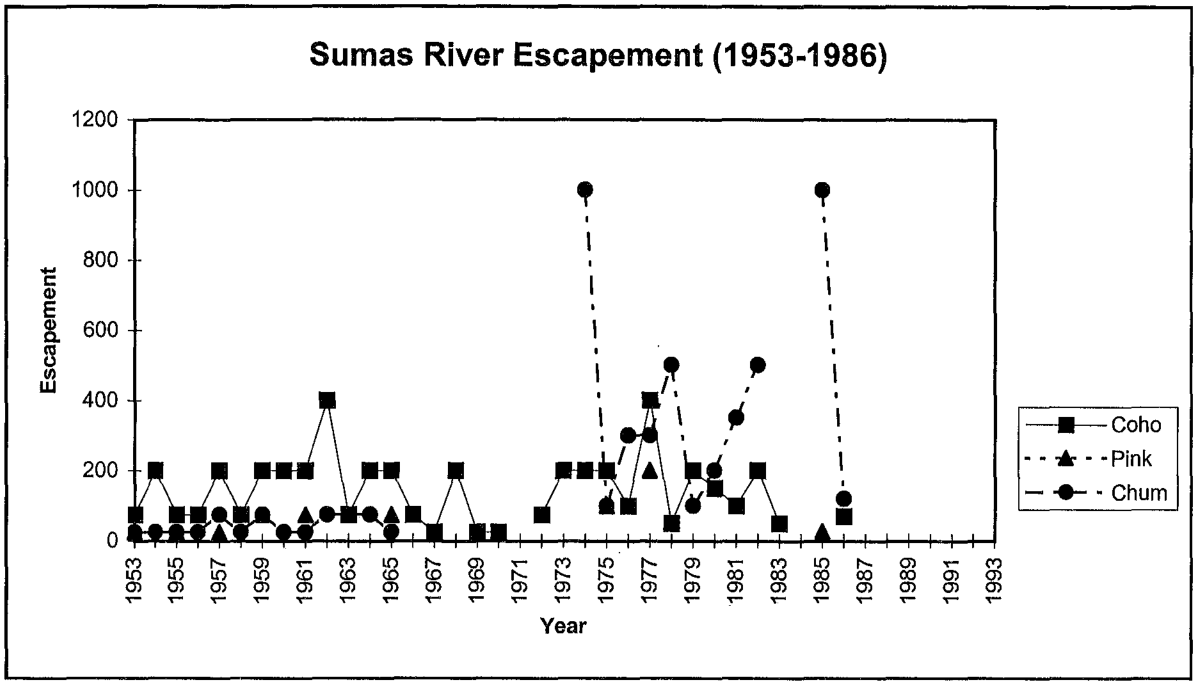

40 Yr. Mean Escapement
Coho
28%
Chum
72%

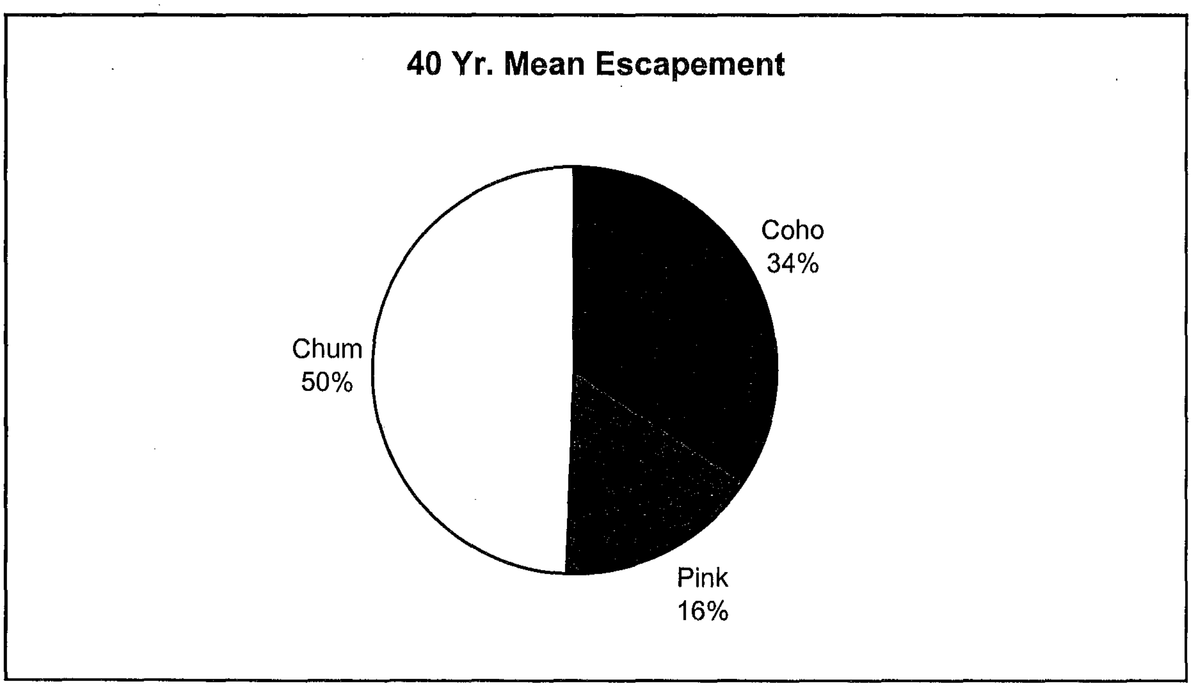

Silverhope Creek Escapement (1953-1991)
16000
14000
12000
10000
8000
6000
4000
2000
0
Escapement
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
Year
Coho
Pink
Chum

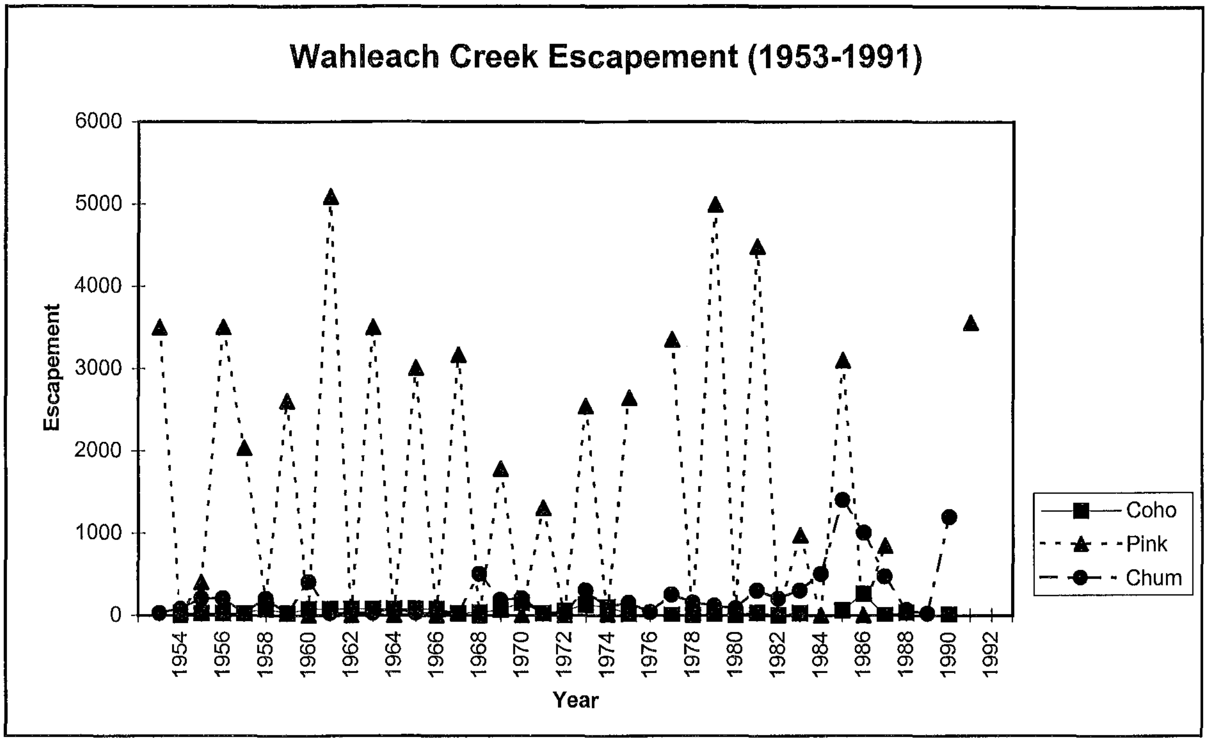

40 Yr. Mean Escapement
Chum 16%
Coho 4%
Pink 80%

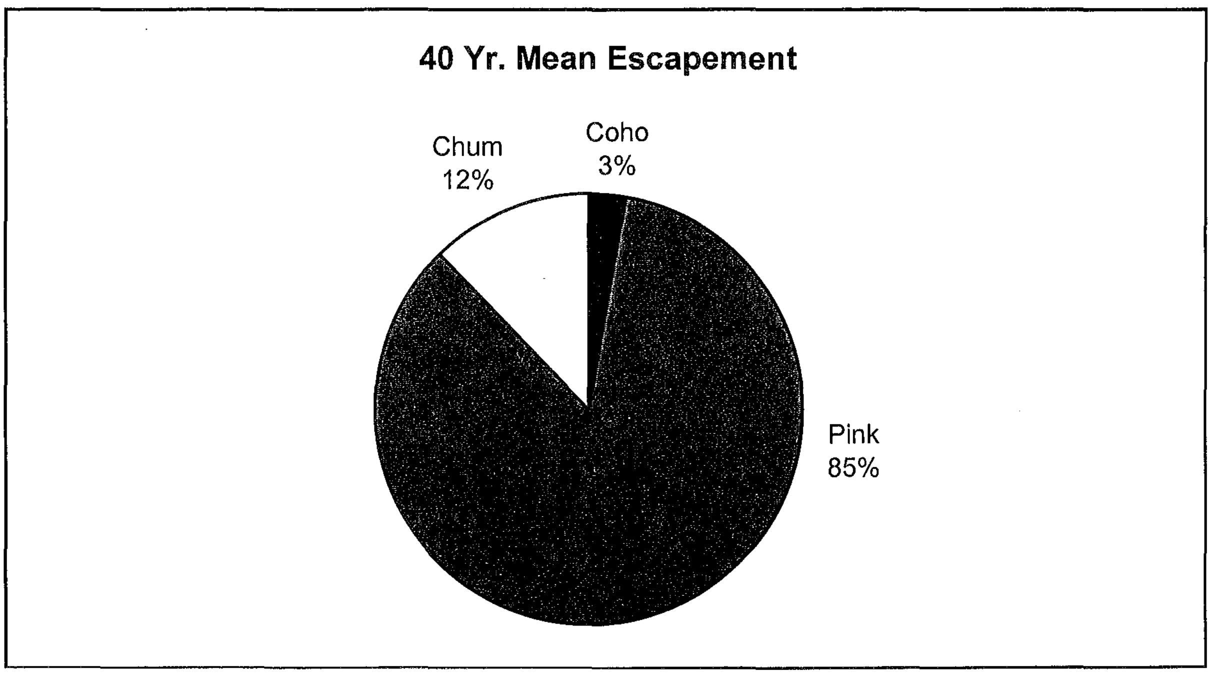

Stave River Escapement (1953-1991)
250000
200000
150000
100000
50000
0
Escapement
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho
Pink
Chum

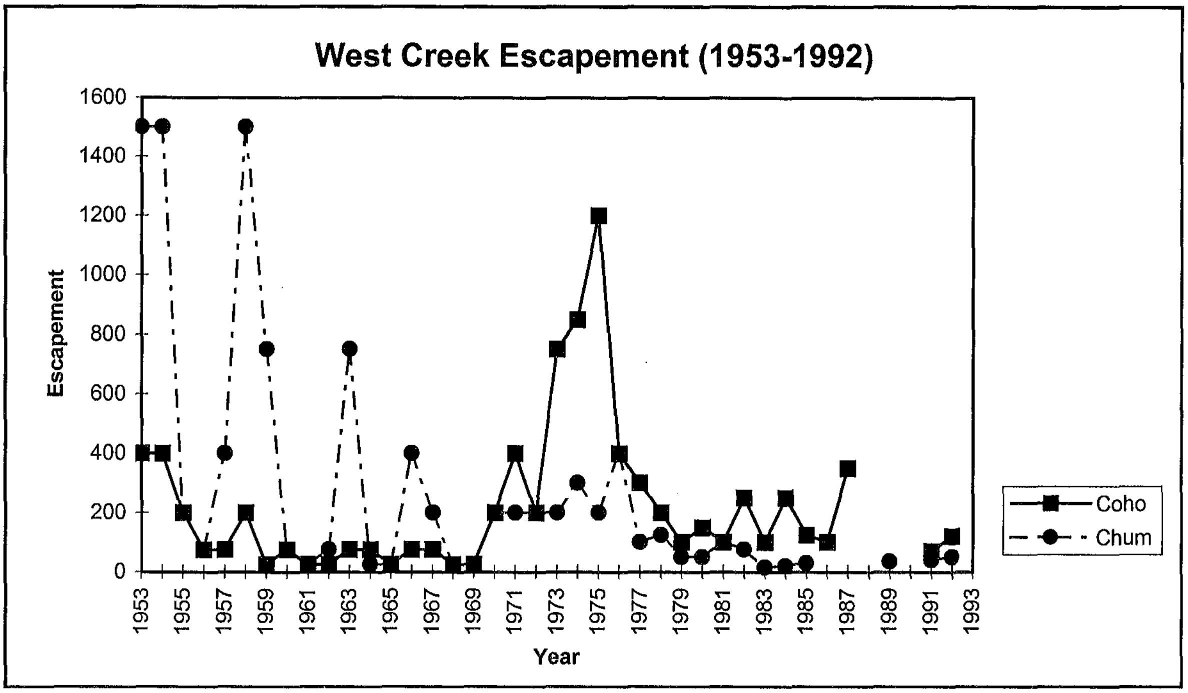

40 Yr. Mean Escapement
Coho
1%
Pink
2%
Chum
97%

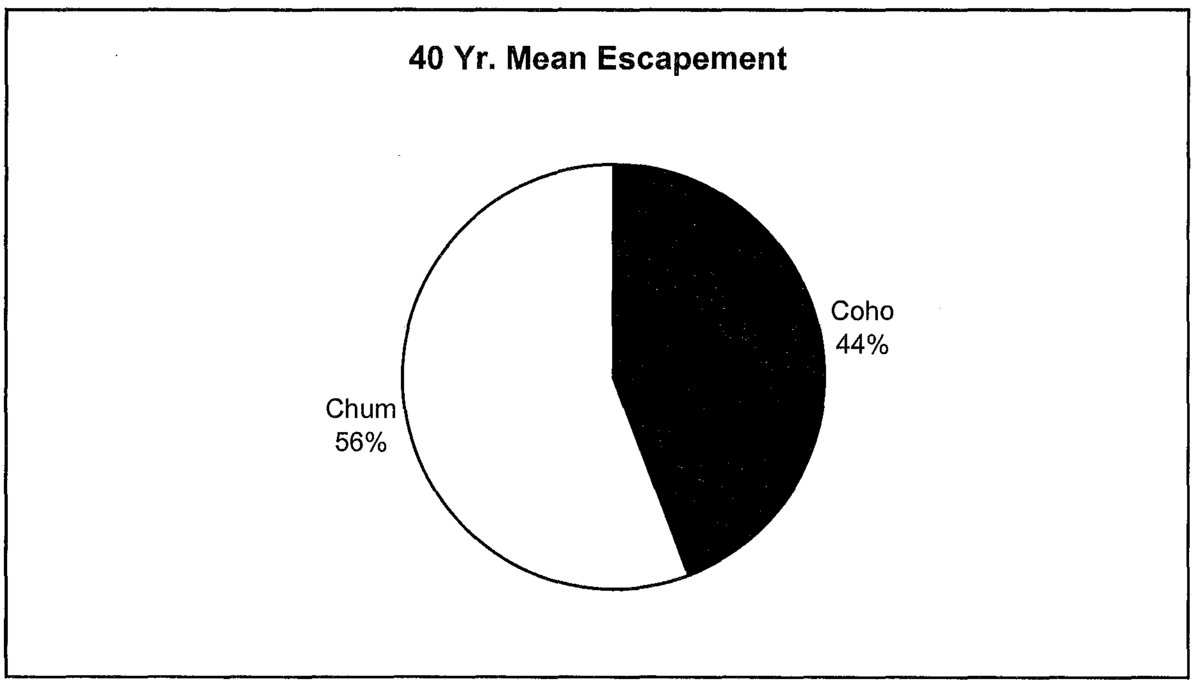

Sumas River Escapement (1953-1986)
Escapement
1200
1000
800
600
400
200
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho
Pink
Chum

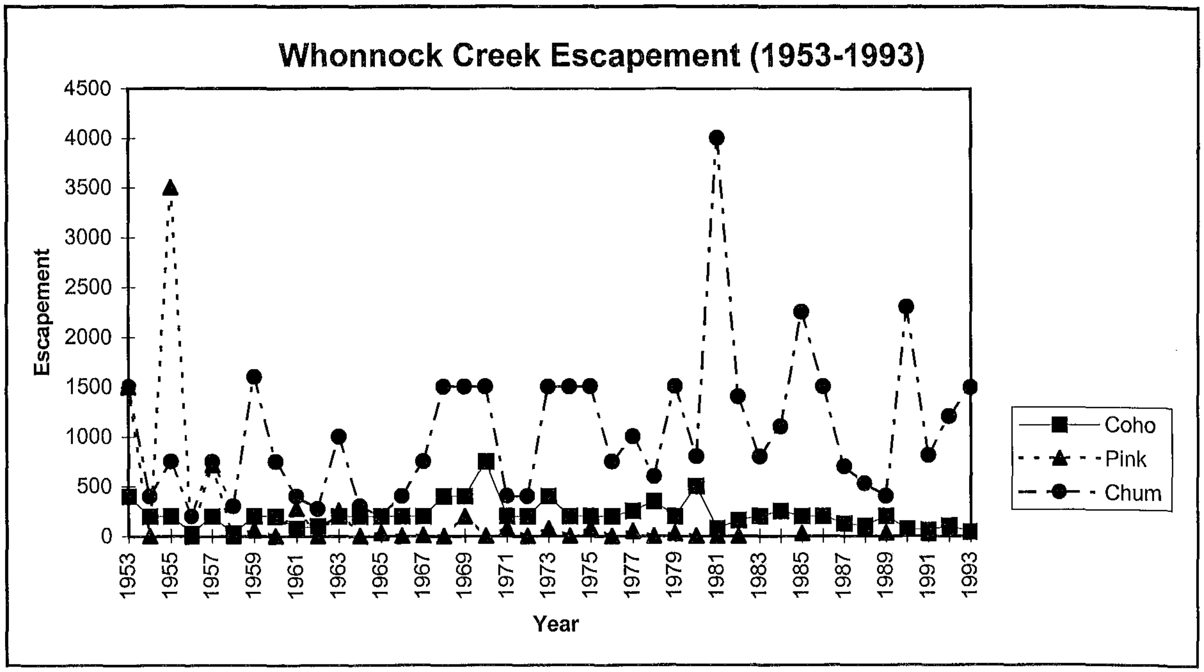

40 Yr. Mean Escapement
Coho 34%
Chum 50%
Pink 16%

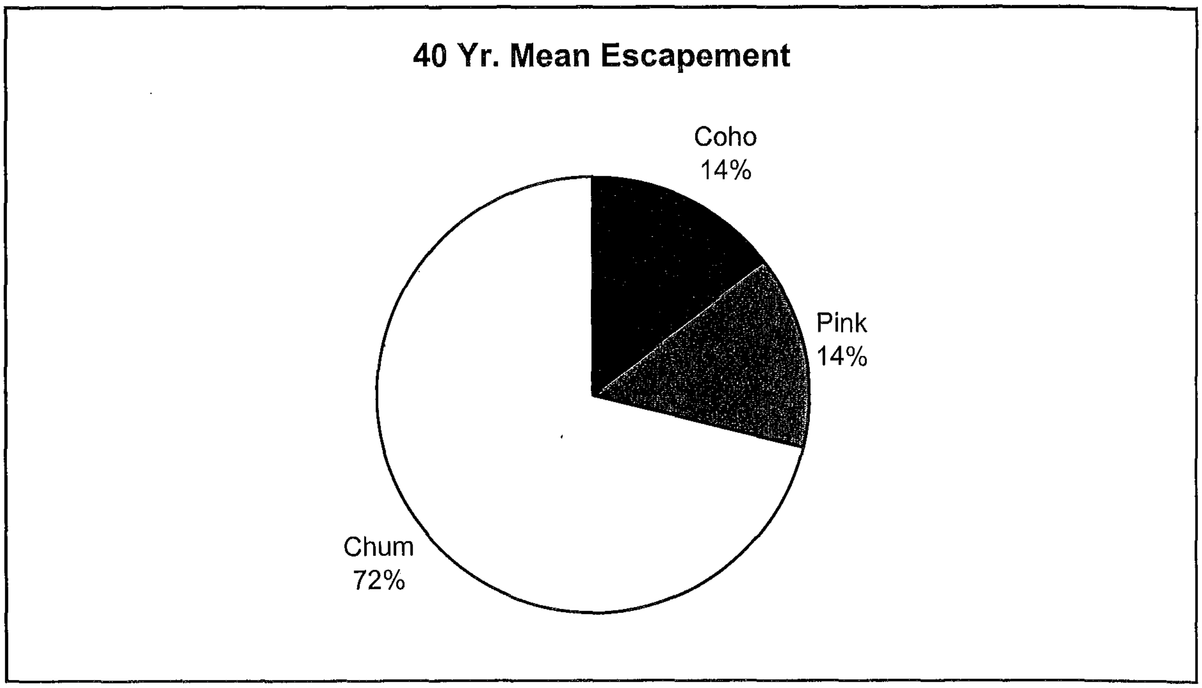

Wahleach Creek Escapement (1953-1991)
Escapement
6000
5000
4000
3000
2000
1000
0
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
Year
Coho
Pink
Chum

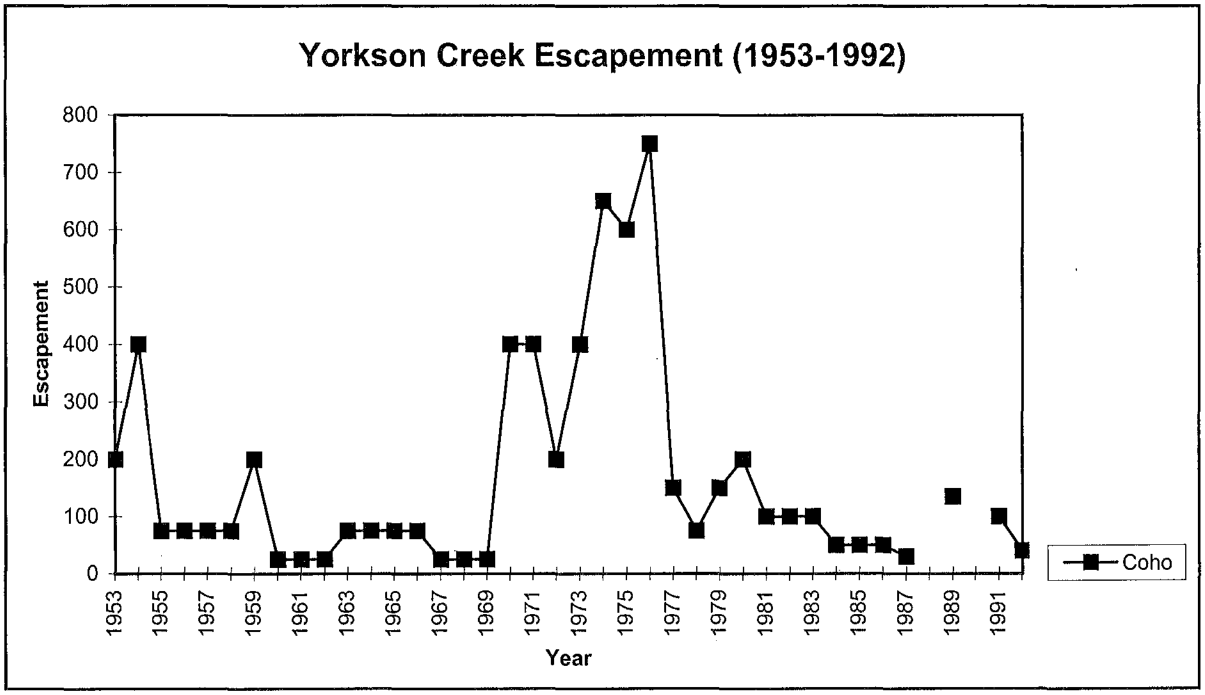

40 Yr. Mean Escapement
Chum 12%
Coho 3%
Pink 85%


West Creek Escapement (1953-1992)
Escapement
Year
Coho
Chum
1600
1400
1200
1000
800
600
400
200
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993


40 Yr. Mean Escapement
Coho
44%
Chum
56%


Whonnock Creek Escapement (1953-1993)
Escapement
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year
Coho
Pink
Chum


40 Yr. Mean Escapement
Coho
14%
Pink
14%
Chum
72%


Yorkson Creek Escapement (1953-1992)
Escapement
800
700
600
500
400
300
200
100
0
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
Year
Coho