



## DRAFT Issues & Alternatives Document

### RIVER HAZARDS

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Flooding of Chilliwack Lake Road, November 2006.

## Acknowledgements

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# Chilliwack River Watershed Strategy Issues & Alternatives:

## **RIVER HAZARDS**

### **1.0 General Description of the Issue**

The modern Chilliwack River developed as glaciers melted and receded (Hay and Company 1992b: 28). This glacial history combined with past and present day climate, vegetation, and land use practices, are major factors that drive natural physical processes in the watershed, such as flooding, erosion, sedimentation, landslides, debris flows and floods, etc. Although these processes are natural and important for maintaining ecosystems that have developed in the watershed since the last glaciation (10,000 years ago), they become ‘hazards’ when they pose threats to human settlements, infrastructure, and other values.

The Chilliwack River Valley has a long history of human settlement. Archaeological evidence suggests that human settlement in the Chilliwack Valley extends back at least 5,000 thousand years (CRWS Background Document). Some common types of archaeological sites documented in the valley include settlement sites (e.g., house pits), burial sites (e.g., burial mounds), and resource extraction and processing sites (e.g., culturally modified trees, lithic scatters, roasting pits). Oral history and ethnographic evidence document the locations of travel routes and traditional and spiritual use areas located throughout the watershed.

The present day Chilliwack River Watershed, upstream of Vedder Crossing, is home to nearly 2,000 residents of the Fraser Valley Regional District’s Electoral Area ‘E’, 230 residents of the Soowahlie Indian Reserve, and 300 residents of the City of Chilliwack. Most of the properties within Electoral Area ‘E’, originally established by the Province of BC in the 1960s and 1970s, are clustered into several small hamlets in the lower one third of the valley.

Unfortunately, many of the properties within Electoral Area E and on the Soowahlie Indian Reserve, and the only access route into the valley – Chilliwack Lake Road – are vulnerable to river hazards, including flooding and erosion. This risk was evidenced most recently during a major flood in November 2006, which required evacuation of approximately 250 people and caused several million dollars in damage to infrastructure in the valley.

Flooding and erosion are natural, even essential, processes which change, create, improve, degrade and destroy habitat. Yet, the effects on human settlements, infrastructure and social values are less ambiguous and often severely negative. They include:

- Damage to, or destruction of, roads and private property, which is associated with economic losses and threats to public safety
- Damage to, or destruction of, archaeological sites, which is associated with a loss of traditional knowledge

- Blockage of roads and communication lines and prevention of movement of people and goods in and out of the valley
- Loss of rights to construct infrastructure or utilize land for specific purposes due to the high risk of hazards
- Loss of recreational and economic opportunities due to direct damage to recreational features (e.g., campsites) or indirect damage to resources (e.g., fish populations)
- Damage to fish and wildlife habitat, which can threaten fish and wildlife populations that are vulnerable due to recent natural and human influenced factors (e.g., over-harvesting, resource extraction activities, development, etc)

In order to minimize these impacts, various hazard mitigation works have been undertaken in the watershed (e.g., dykes, setback dykes, rip rap, groynes) and newer incremental development has been approved in safe locations with appropriate hazard safety measures in place. However, many properties and portions of Chilliwack Lake Road remain at risk from river hazards and future works will be required to better protect existing properties and infrastructure. Unfortunately, mitigation works themselves impact the watershed (Hay and Company 1992a). For example:

- Setback dykes can alienate wetlands and side channels in certain areas by infilling, altering drainage patterns and cutting off fish access
- River bank dykes can affect wetland and side channel habitats, mainly by cutting off flows from the main river and by eliminating fish access
- Dykes also affect the habitat suitability of the river bank through the elimination of bank vegetation and wood debris (i.e., fallen trees, overhanging vegetation and undercut sections along vegetated natural banks are important juvenile salmon and steelhead trout rearing habitat features and provide habitat for many other species)
- Riprap banks, when designed with relatively large material set to create an irregular profile can provide rearing value for juvenile steelhead and Chinook – however, the best natural habitats (e.g., logjam pools) are associated with higher densities of these species than well designed riprap banks
- Dredging or gravel removal can disturb spawning grounds, introduce fine sediment into the water column, and influence erosion and hydraulic processes upstream and downstream of the removal site
- Debris removal or control can remove important fish habitat features (e.g., pools) and influence erosion and hydraulic processes upstream and downstream of the removal site
- Rip rap and dikes channelize watercourses, harden banks, and may take the place of riparian vegetation. This reduces recruitment of large woody debris, increases water temperature, decreases food sources, eliminates pool habitats, etc., thereby reducing fish and wildlife habitat.

- If not regularly maintained, settling ponds can actually contribute increases loads of sediment to a watercourse and can increase the risk of damage to private property. In addition, under emergency conditions, settling ponds must be cleaned out outside of the fisheries window, which has the potential to impact fish habitat unnecessarily.
- Dikes can prevent draining of water back into the watercourse after a flood recedes

Therefore, river hazards are a concern from two perspectives: because the hazards themselves impact important social, economic, and natural values, and because hazard mitigation works also have significant impacts on watershed values.

## **2.0 Specific Location/Examples**

### *2.1 River Hazards*

Natural physical processes like flooding and erosion are a concern in locations where they pose threats to human settlements, infrastructure, and other values. In 1992, Hay and Company generated the most recent estimate of the 200-year floodplain and the 100-year erosion line ( Hay & Co., 1992). This mapping indicates which areas are likely to experience flooding in a 200-year event and the estimated possible extent of erosion over a 100-year period if protective works are not provided. Not surprisingly, the extent of the 200-year floodplain is widest in the lower portion of the watershed, where the gradient is much more shallow and the river is braided in nature. Erosion of the river banks and landslides/clay slides are also more common in these lower portions of the watershed that were covered by a glacial lake during the last (Fraser) glaciation. This glacial lake led to the deposition of significant masses of clay in the valley, which are inherently unstable.

Settlements and infrastructure within the 200-year floodplain and 100-year erosion setback line are considered to be at greatest risk from river hazards (e.g., Wilson Road, Slesse Park, Osborne Road, Bell Acres, Soowahile Indian Reserve). It should be recognized that the watershed is not a static entity and the risk posed to human settlements and infrastructure changes as the river morphology changes over time. This was evidenced most recently in the flood of November 2006, which did not pose equal threat to all properties and infrastructure within the 200-year floodplain.

Some feel that accumulations of woody debris may increase hazards. Debris often accumulates at Thurston Meadows and Allison Pool.

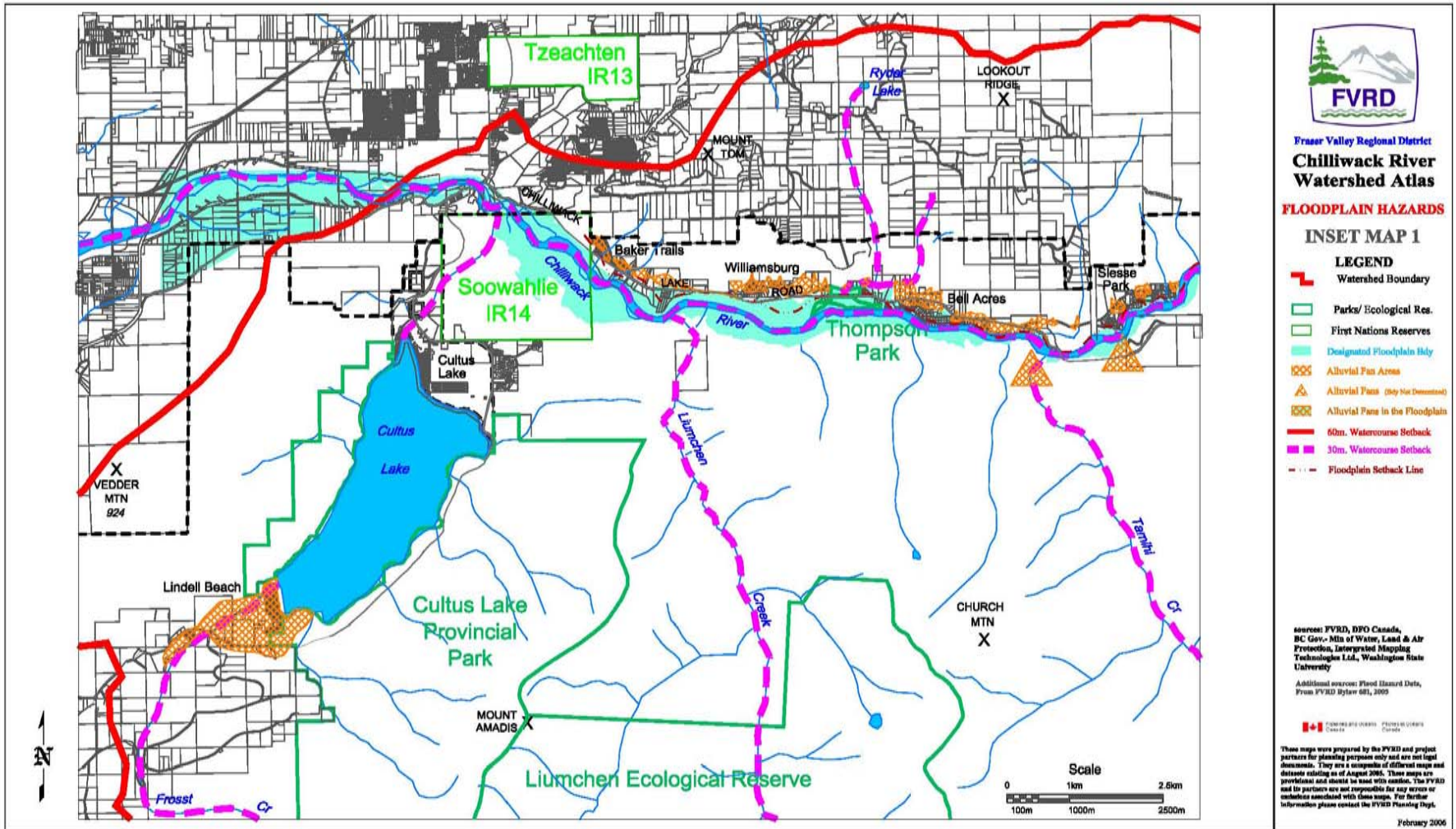


Figure 1 Flood and erosion hazards in the Chilliwack River Valley west (Hay and Company 1992a)

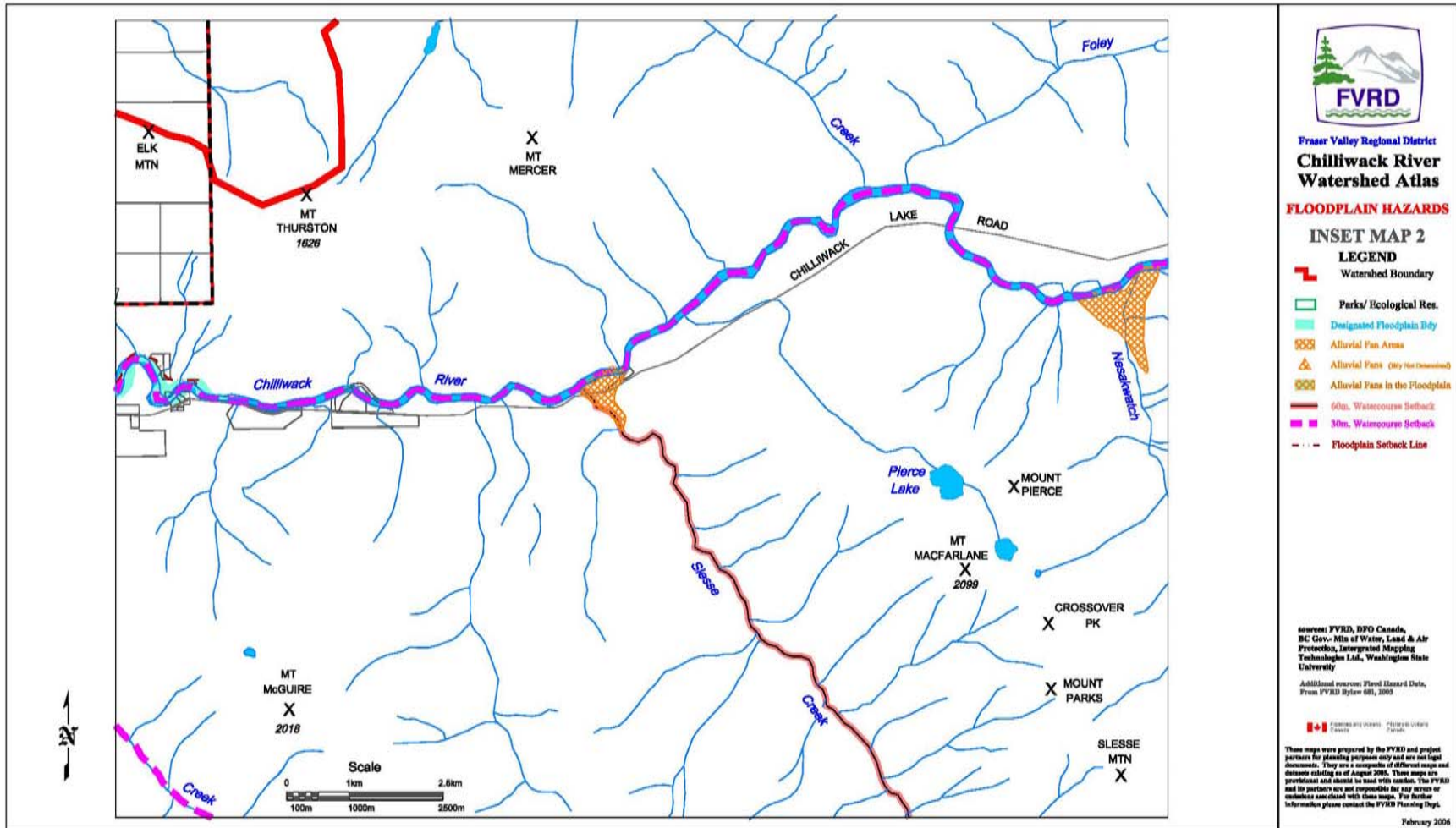


Figure 2 Flood and erosion hazards in the Chilliwack River Valley east (Hay and Company 1992a)

### 3.0 Contributing Factors/Causes

The following factors are known or suspected to be contributing to river hazard risks in the Chilliwack River Watershed:

- The geological history of the watershed and the resulting landscape processes
- The approval by the Province of BC in the 1960s and 1970s of subdivision of lands within what are now understood to be hazard zones
- Ongoing pressures for development within hazard zones
- Road construction
- Resource extraction which may alter sediment and hydrological regimes
- Log debris jams are common on the Chilliwack River. Woody debris is an essential component of riparian habitat but become a hazard concern where it may cause the river to change course rapidly and threaten settlement or infrastructure
- Bridges may serve as ‘pinch points’ along the river which restrict water passage and lead to downstream impacts
- Deposition of material in the mainstem of Chilliwack River from landslides, erosion, etc., which can temporarily alter the level of the channel bed
- Climate change, which is expected to increase the frequency and/or magnitude of large storm events, potentially leading to worse flooding
- An existing statutory and regulatory framework that tends to deal with individual developments and property owners rather than a collective community, which is more appropriate for dealing with new, rather than existing, developments (Hay and Company 1992b)
- Lack of funding for communities located in hazardous areas to develop and implement hazard management plans (Hay and Company 1992b)
- Costs associated with the construction of works on private lands is an impediment to both the provision of mitigation works and habitat improvements associated with the works
- Works constructed during emergency events often become ‘orphan’; they provide an uncertain level of protection and there are no provisions for maintenance
- The propensity of senior governments to fund or undertake restoration works during and immediately following a flood event rather than to proactively plan and fund mitigative works
- Challenges to the establishment of local service areas to fund ongoing maintenance of mitigative works are significant. Rural communities often struggle to afford the costs. Further, the benefits of mitigation works may (or may be perceived to) be unevenly distributed while the costs are often evenly distributed. This leads to perceptions of inequities and potential resistance to the establishment of a service area.

On the other hand, the following factors contribute to the risk posed by flood mitigation works:

- Construction of emergency works during flood conditions may not allow appropriate time to design works and fully consider impacts (particularly habitat impacts)
- Lack of resources for comprehensive analysis of the potential environmental impacts of individual hazard mitigation works

#### **4.0 Overall Level of Community Concern**

River hazards are one of the most significant issues for residents in the Chilliwack River Watershed. Many individuals have been impacted by floods, erosion, slope failures, or other events in the past or feel that they are at risk of future events. Visitors to the watershed are also impacted by these events when recreational areas and transportation routes are affected.

#### **5.0 Past and Current Policies or Actions to Address the Issue**

##### **5.1 *Chilliwack River Flood Hazard Management Plan (Hay and Company 1992)***

Flood and bank erosion events in 1989 and 1990, coupled with ongoing concerns related to slope failures, led to the Fraser Cheam Regional District to commission that Chilliwack River Hazard Management Study. The purpose of this study was to:

Prepare a natural hazards management outline plan for the Chilliwack River Valley, focusing on the long term, to protect development in the study area against damage from river flooding and erosion, and from debris flooding and landslides associated with tributary streams.

A comprehensive two-volume interim report describing the resources, land uses, and natural processes in the Chilliwack River Valley was issued in 1992 (Hay and Company 1992a). The interim report includes hazard maps for the area from Slesse Park to Baker Trails and discussed mitigative options for dealing with the identified hazards. The outline plan, which was finalized several months after the interim report, describes the administrative, financial, and technical management of natural hazards in the valley, and includes specific structure measures for hazard mitigation for the area from Slesse Park to Baker Trails (Hay and Company 1992b).

Some of the recommendations outlined in this hazard management plan have been implemented over the years. For example, the Fraser Valley Regional District and the Province of BC have been successful in regulating new development with the objective of avoiding exposure of developments to natural hazards. In addition, the Fraser Cheam Regional District, the precursor to the FVRD, successfully incorporated the hazard maps produced in the interim report into the development approval process.

This hazard management study provides a comprehensive basis for generating further hazard management strategies.

## 5.2 *Vedder River Management Plan and Committee*

The Vedder River Management Plan and Committee was developed in response to a large flood on the Chilliwack-Vedder River in 1975. Immediately following the flood, setback dykes were constructed and designed to the 1 in 200-year flood with a freeboard of 0.75 m. The Vedder River Management Plan was produced in 1983 with two main objectives: to ensure a floodway is maintained over the long term and to address fisheries concerns. Over the years, its mandate is expanded to include objectives for the Great blue heron, agriculture, recreation and illegal activities.

The Vedder River Management Committee is responsible for implementing the plan and includes representatives of DFO, Ministry of Environment, City of Chilliwack, City of Abbotsford, FVRD, an environmental consultant, and wildlife groups. The committee undertakes an iterative process approximately every two years that involves:

- Surveying the river and canal cross sections
- Hydraulic modeling to look for freeboard shortages, identify problem areas, and test the effects of different activities
- Environmental surveying to identify potential gravel removals sites and develop plans for reducing the flood profile while minimizing environmental impacts
- Applications are then submitted to the appropriate permitting agencies, and when granted, bids are sought by those interested in performing the gravel removal and the gravel is removed

Depending on the volume to be extracted and the value of the gravel, bids can be either negative or positive. If bids are negative, the City of Chilliwack hires contractors to remove the gravel and keeps the gravel for city projects. If bids are positive, the added revenue is used to help pay for the management program.

Environmental considerations are taken into account throughout the whole process (e.g. gravel is typically only removed on even years to minimize impacts to pink salmon and environmental monitors prepare the gravel management plans and are on-site during gravel removal operations).

## 5.3 *Provincial Emergency Program/Disaster Financial Assistance Fund*

With financial assistance from several provincial programs, the FVRD and individual landowners may undertake efforts to protect property and infrastructure in response to emergency situations.

For example, following the flood of November 2006, FVRD hired the engineering firm Kerr Wood Leidal to assess damages to private properties across the region as a result of the November floods. Over \$3.6 million in damages occurred across the region, with an estimated \$340,000 in damages at Slesse Park and \$740,000 at Bell Acres. Property

owners in these areas are eligible to apply for funding under the Provincial Disaster Financial Assistance (DFA) program to mitigate damages. Concern was expressed that in the absence of a coordinated approach landowners may receive these funds and not spend the money on flood proofing – which could have consequences for subsequent owners of the property as well as downstream property owners.

During and immediately after the November 2006 floods, the FVRD received funding from the Provincial Emergency Program to upgrade an orphan dike at Wilson Road that had failed to sufficiently protect properties during the flood. Some of the work to upgrade the existing dyke was done immediately following the flood. Additional work must be completed during to tie the upgraded dyke into high land on the upstream end. A local service area is being set up by the FVRD to provide funds to maintain the dyke over the long term.

#### *5.4 Soowahlie Flood Protection Plans*<sup>1</sup>

Much of the Soowahlie Reserve is within the flood zone of the Chilliwack River. Portions of the Soowahlie Reserve flooded in 1989 and 1990 as a result of high waters and log jams. As a result, a setback dyke was constructed in the late 90's, which was not designed to deal with mainstem flows. Over the years, the course of the river has changed and is now threatening the integrity of Soowahlie's setback dyke.

In order to maintain the integrity of the dike, Soowahlie contracted UMA, a consulting firm from Burnaby, to develop a plan that would encourage the river to move away from its existing course against the setback dyke and back into previous channels. The plan involved extracting gravel from dry bars in order to reopen old channels. After conducting cross sections and hydraulic studies, Soowahlie retained Nova Pacific to work out the details of the first proposed extraction in late 2006. Due to the high flood risk in winter 2006-2007, gravel extractions began in early 2007.

#### *5.5 Mapping of the 2006 Event*

During the flood event of November 2006, the Province of BC paid a contractor to outline the high water mark. This mapping was compiled, and checked against local knowledge of the flooding extent by the FVRD. In addition, the BC Ministry of Environment took extensive photographs of the high water event.

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<sup>1</sup> Information provided by Nelson Kahama, Soowahlie First Nation councilor, and Doug Kelly.

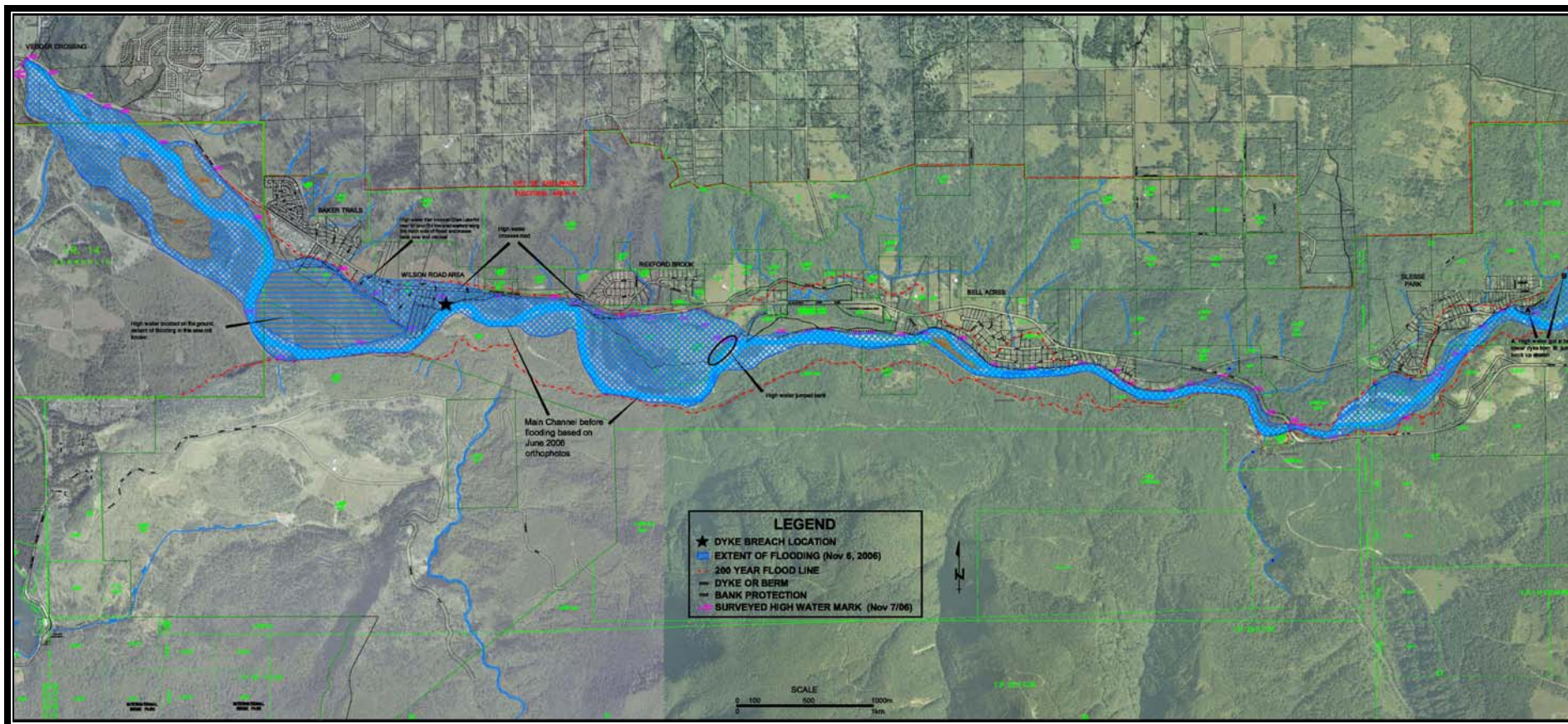


Figure 3. High water mark of the November 2006 flood in the Chilliwack River Valley

## 5.6 Academic Research

Researchers in the Department of Geography at the University of British Columbia (UBC) and Simon Fraser University (SFU) have studied the physical processes in the Chilliwack River Watershed. Saunders, Clague and Roberts (1987) from SFU studied the deglaciation of the Chilliwack River Valley. Dr. Michael Church and graduate student Darren Ham from UBC investigated bed material transport rates and morphological changes of the river between 1952 and 1991 using a sediment budget approach (Ham 1996, Ham and Church 2000). This research quantified bed material transport rates and showed that significant morphological change occurs roughly every 5 years when flows are large enough to erode and entrain large volumes of bed material stored within the contemporary floodplain. Research is currently underway to investigate longer term trends in river morphology and sediment transport (e.g., since the last glaciation) (Church pers. comm.). Sediment transport rates in the reach below Vedder Crossing (e.g., Vedder River) were studied by McLean (1980) and Martin and Church (1995).

## 5.7 Chilliwack River Action Committee & Clay slide Gap Analysis

With funding from the Fraser Salmon and Watersheds Program, the Chilliwack River Action Committee retained a consultant to conduct a gap analysis of past research and remedial work on nine clay slides in the Chilliwack River Valley in 2007. The project involved conducting a summary and analysis of existing works and relevant reports on the effects of clay slide siltation on downstream fish and fish habitat in the Chilliwack/Vedder River (Jacques Whitford–AXYS

2007). Additional information specific to the effects of sedimentation on fish and fish habitat, life stage-specific distribution of over wintering species were also reviewed and discussed in the analysis. The study provides a general geomorphologic assessment of the slide areas, identifies gaps in current knowledge and stabilization works sustainability, and identifies additional studies and works required to stabilize selected landslide and erosion sites in the Chilliwack River.

## 6.0 Relevant Jurisdictions and Legislation

There are a number of pieces of provincial legislation and one piece of federal legislation that deal directly with measures to protect against flooding hazards. There are also several pieces of both provincial and federal legislation that provide protection for fish, wildlife, and watercourses that need to be considered as constraints in the context of river hazard mitigation works. Finally, based on the powers granted local and regional governments under the *Local Government Act* and the *Community Charter* there are potential legislative and policy measures that the Fraser Valley Regional District could utilize to help address natural hazards. The most relevant laws and policies applicable to river hazards within the Chilliwack River Watershed are briefly discussed below.

### 6.1 Federal

#### **Fisheries Act (R.S., 1985, c. F-14)**

Section 35 (1) of the *Fisheries Act* states that “No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat.” This requirement (known as HADD), is permitted with the correct approvals being granted under Section 35 (2) of the *Fisheries Act*, which states that “No person contravenes subsection (1) by causing the alteration, disruption or destruction of fish habitat by any means or under any conditions authorized by the Minister or under regulations made by the Governor in Council under this Act.” Similarly, no “deleterious substances” (Section 36) are allowed to be introduced into fish habitat. In BC, the *Fisheries Act* is administered both by Fisheries and Oceans Canada and the BC Ministry of Environment. Proponents of projects that may result in either HADD or deleterious substance introductions to fish habitat need to consult with DFO for approvals and potential project requirements prior to commencing. In considering the project, DFO may apply their principle of “no net loss” (see DFO Policy for the Management of Fish Habitat) if applicable, and may require suitable compensation or mitigative strategies to prevent or compensate for any potentially negative consequences of the project. This legislation would come into play in cases where proposed hazard mitigation or repair works to address issues such as flooding or slope stability concerns would be classified as a HADD. In these cases an authorization under Section 35 (2) would need to be secured from DFO based on a no net loss compensation/mitigation plan. All river hazard mitigation works whether they represent a HADD or not must not violate Section 36 by discharging a deleterious substance into fish habitat.

#### **DFO Policy for the Management of Fish Habitat (1986, reprinted 1991)**

The Policy for the Management of Fish Habitat outlines the strategy used by DFO in issuing *Fisheries Act* permits, including the principle of “no net loss”. This principle is defined in this Policy as “A working principle by which the department strives to balance unavoidable habitat losses with habitat replacement on a project-by-project basis so that further reductions to Canada’s fisheries resources due to habitat loss or damage may be prevented.” The purpose of this policy is to result in the long-term “net gain” in “productive capacity of habitats for selected fisheries brought about by determined government and public efforts to conserve, restore and develop habitats.” As with the *Fisheries Act*, this policy would apply to river hazard mitigation or repair works that represent a loss of fish habitat.

#### **Species-at-Risk Act (2002, c. 29)**

The federal *Species at Risk Act* (SARA) makes it an offence in sections 32 and 33 to:

- kill, harm, harass, capture or take an individual of a listed species that is extirpated, endangered or threatened;
- possess, collect, buy, sell or trade an individual of a listed species that is extirpated, endangered or threatened, or its part or derivative;
- damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction.

These prohibitions apply to all SARA listed species that occur on federal lands (e.g. lands owned by the federal government, such as national parks, lands used by the Department of National Defence, reserve lands, and most of the land in the three territories). In addition, these prohibitions apply to listed aquatic species (e.g., fish) because of the *Fisheries Act*, and migratory birds covered by the *Migratory Birds Convention Act*, wherever they occur.

For other listed species that occur on non-federal lands, the provinces and territories are given the first opportunity to protect them through their laws. If the province or territory does not act, SARA has a "safety net". The Governor in Council, on the recommendation of the Minister of the Environment, may order that the prohibitions in sections 32 and 33 apply for a given species in a province or territory. The Minister must make a recommendation if, after consultation with the provincial or territorial minister, the Minister finds that the species or its residence is not effectively protected. To date, this power has not been exercised.

In BC, some protection is given to species at risk through the existing BC *Wildlife Act* (see below). In addition, a *Wildlife Amendment Act* has been drafted and will, when passed, increase the protection of species at risk in BC (e.g., expand the number of species protected).

### Protected Species

A total of 233 species were included in Schedule 1 of the *Species at Risk Act* when it was passed by Parliament in December 2002. Other species are put on the list as a result of the work of the scientists and conservationists who are members of the Convention on the Status of Endangered Wildlife in Canada (COSEWIC). SARA also currently includes 39 endangered or threatened species in Schedule 2 and 103 species of special concern in Schedule 3. These species are those that COSEWIC has added to its list over the past 25 years, but, as of the end of 2001, had yet to reassess with its updated criteria and current information.

### Permitted Activities

Agreements, permits, and licences can be obtained to allow someone to do something that would otherwise be a SARA offence. The following activities may be allowed as long as measures are taken to minimize the impact, and the activities do not jeopardize the survival or recovery of the species:

- scientific research about the conservation of the species done by a qualified person
- an activity that benefits the species or enhances its chances of survival in the wild
- an activity whose effect on the listed species is incidental

For example, a scientist may be allowed to handle and tag an endangered species so that its movements can be tracked. Or, water flow could be diverted in a marsh to improve habitat for listed species in the area, although this might disturb some individuals of the species in the short-term. Or, fishermen may be given a permit allowing the by-catch of endangered or threatened fish under certain circumstances.

## Requirements for River Hazard Mitigation and Repair Projects

Currently, SARA has limited applicability to river hazard mitigation and repair projects, especially when projects occur on lands not owned by the federal government (i.e., nearly 100% of the land in the watershed). Only aquatic species and migratory birds themselves, or their residences, are protected on non-federal lands. However, if these species or their residences may be damaged by a proposed project, a permit may be required. In addition, if any project causes a HADD and requires a Section 35 (2) authorization under the *Fisheries Act*, the project will be screened for impact and mitigation efforts with respect to SARA listed species.

Although the legislation affords relatively little legal protection to species at risk, it is hoped that these species will be protected through voluntary efforts (i.e., stewardship). In this case, the SARA process should guide practices on private, First Nations, and crown land. A river hazard mitigation or repair project may be treated the same as a development project and proceed through a similar process. This may involve conducting an assessment to determine which species at risk occur on the site and undertaking steps to ensure that these species are not affected by the proposed project.

### **Navigable Waters Protection Act (R.S., 1985, c. N-22)**

Administered by Transport Canada, the *Navigable Waters Protection Act* regulates instream works within “navigable waters” with the intent of protecting the public right of navigation within Canada. Transport Canada defines navigable waters as “any body of water capable of being navigated by floating vessels of any description for the purpose of transportation, commerce or recreation. This includes both inland and coastal waters. The final authority to determine the navigability of a waterway rests with the Minister of Transport or his/her designated representative.”

Section 5 (1) of the Act states that “no work shall be built or placed in, on, over, under, through or across any navigable water unless (a) the work and the site and plans thereof have been approved by the Minister, on such terms and conditions as the Minister deems fit, prior to commencement of construction.” Work includes:

- any bridge, boom, dam, wharf, dock, pier, tunnel or pipe and the approaches or other works necessary or appurtenant thereto,
- any dumping of fill or excavation of materials from the bed of a navigable water,
- any telegraph or power cable or wire, or
- any structure, device or thing, whether similar in character to anything referred to in this definition or not, that may interfere with navigation.

The Navigable Waters Works Regulations requires that all tools and materials be removed from the stream following completion of the works, and to remove any portion of a works that leads to subsequent debris accumulation.

## Requirements for River Hazard Mitigation and Repair Projects

If a proposed project will take place in navigable waters (e.g., placement of structures such as large woody debris or platforms, or some channel and bank works below the high water mark like gryones, rip rap, or gravel placement), approval may be required under the *Navigable Waters Protection Act*. It is recommended that proponents contact the nearest Navigable Waters Protection Program office of Transport Canada to determine if an approval is required. A Navigable Waters Protection (NWP) Officer will assist the proponent in determining what information and documentation is required for preparing and submitting an application under the *NWPA*. There are two types of processes which can be followed concerning construction of new works. The approval process, subsection 5(1), is followed when the work has the potential to **interfere with navigation**. The determination process, subsection 5(2), is followed when NWPP officer determine that the work **does not** interfere with navigation. The approval process is usually longer and requires public advertisement of the details of the proposed work and an environmental assessment in accordance with the *Canadian Environmental Assessment Act*. If approval of the proposed work is granted, it may include conditions that must be followed to mitigate potential impacts of the project on navigation and the environment. The determination process does not require formal advertisement or an environmental assessment.

## 6.2 Provincial

### **Water Act (RSBC 1996, c 483) and Water Act Regulation (1988, amended 2004)**

The *Water Act*, particularly Section 9 (changes in and about a stream), and Part 7 of the *Water Act Regulations*, regulates the use and protection of water resources in BC, making it an offense to alter or divert a stream without formal approval by the Province. The intent is to ensure preservation of water quality, water quantity, instream habitat, and riparian habitat from instream or nearstream activities not permitted by the Province.

#### Requirements for River Hazard Mitigation and Repair Projects

Proponents of instream or nearstream works that will result in changes to the stream require one of the following:

1. Water Licence from Ministry of Environment (MOE), Water Stewardship Division (WSD), authorizing the works, or
2. *Water Act*, Section 9 Approval from WSD, or
3. Compliance with *Water Act*, Water Regulation, Part 7 including notification to MOE, or
4. Order from the Comptroller of Water Rights or designate, or
5. Authorization under the *Mines Act* or *Forest Practices Code Act*.

The item required depends on both the agency/individual making the change in and about water and the nature of the project. When conducted by the federal government, the provincial government, or their agents, fish habitat or stream restoration projects require notification only. When conducted by other groups, an approval is required.

### **Flood Relief Act (RSBC 1996, c 151)**

The *Flood Relief Act* gives the Lieutenant Governor in Council the power to enter into agreements with any public authority in the province for flood relief and rehabilitation. These agreements can include contributions towards these works or loans for funds to assist with these works. Once the Lieutenant Governor in Council has defined an area as a flood relief area, municipalities within the area are given the power to carry out the activities outlined in the agreement with the Province under the *Flood Relief Act*. These agreements override other relevant Acts and the municipal government does not need to consult or receive approval from the electors within the municipality.

#### **Dike Maintenance Act (RSBC 1996, c 95)**

The *Dike Maintenance Act* articulates the authority and responsibility for the maintenance of dikes within the province. The most relevant section is Section 2 where the powers of the Inspector of Dikes are explained.

“(2) The inspector may

- (a) enter on any land and on a dike, with or without equipment, as necessary to carry out the purposes of this Act,
- (b) require a diking authority or a person on whose land a dike, other than a private dike, is located to repair, replace, renew, alter, add to, improve or remove a dike, or a part of a dike, or anything used in connection with a dike,
- (c) require a diking authority or a person on whose land a dike, other than a private dike, is located to construct or install a work or thing that in the opinion of the inspector is necessary to protect a dike or to increase its efficiency,
- (d) authorize and empower any diking authority or person, on conditions the inspector may impose, to
  - (i) place, construct, renew, alter, repair, maintain, operate and use any buildings, structures, machinery, ways, rails, roads, pipes, poles, towers, cables, wires, conduits, conveyors or other works on, along, across, through, over or under any dike, other than a private dike, or any land on which a dike is located, other than a private dike, and
  - (ii) enter with or without equipment onto a dike, other than a private dike, or on land on which a dike is located, other than a private dike, for the purposes set out in subparagraph (i) or section 3,
- (e) require a diking authority to provide routine or special reports on the construction or maintenance of dikes for which the diking authority is responsible,
- (f) inspect or make an order for the inspection of any books or records in connection with the construction or maintenance of dikes in the possession or control of a diking authority,

(g) carry out or order an audit of a diking authority's program of construction and maintenance of dikes for which the diking authority is responsible, and

(h) subject to this Act and the regulations, do any other thing or require a diking authority to do any other thing relative to the construction and maintenance of dikes, including orders respecting flood hazard planning.

(3) The inspector and those employees considered necessary may be appointed under the *Public Service Act*.

(4) A person or a diking authority must not do any of the following unless it is done either with the prior written approval of the inspector or in accordance with the regulations made under section 8 (2):

(a) lower, or cause or allow to be lowered, the elevation of a dike or decrease, or cause or allow to be decreased, the width or cross section of a dike;

(b) install, or cause or allow to be installed, any culvert, pipe, flood box or any structure through a dike;

(c) construct, or cause or allow to be constructed, any works on or over a dike or dike right of way;

(d) alter, or cause or allow to be altered, the foreshore or stream channel adjacent to a dike;

(e) construct a new dike.

(5) In granting an approval under subsection (4), the inspector must consider the appropriateness of a standard established by regulation under section 8 (2) in relation to the dike that is the subject of the request, in light of

(a) the condition and location of the dike,

(b) the surrounding land and bodies of water and stream channels that are in close proximity to the dike, and

(c) the nature and condition of works related to the dike.”

#### Requirements for River Hazard Mitigation and Repair Projects

Any works that would impact dikes, or involve the creation of new dikes, must be reviewed by the diking authority and approved by the Inspector of Dikes. It is also important to note that the Inspector of Dikes can unilaterally order dike repairs and construction.

#### **Emergency Program Act (RSBC 1996, c 111)**

The *Emergency Program Act* lays out the responsibilities and powers associated with the Provincial Emergency Program. This is important in the context of river hazards as it outlines when a state of emergency or a state of local emergency is issued, the powers a local government has under a state of local emergency, and when compensation and disaster financial assistance are granted.

A declaration of a state of emergency is issued when:

“9 (1) If satisfied that an emergency exists or is imminent, the minister or the Lieutenant Governor in Council may, by order, declare a state of emergency relating to all or any part of British Columbia.

(2) A declaration of a state of emergency under subsection (1) must identify the nature of the emergency and the area of British Columbia in which the emergency exists or is imminent.”

A declaration of a state of local emergency is issued when:

“12 (1) A local authority or, if a local authority consists of more than one person, the head of the local authority, may, at any time that the local authority or the head of the local authority, as the case may be, is satisfied that an emergency exists or is imminent in the jurisdictional area for which the local authority has responsibility, declare a state of local emergency relating to all or any part of the jurisdictional area.

(2) A declaration of a state of local emergency under subsection (1) must identify the nature of the emergency and the part of the jurisdictional area in which it exists or is imminent, and the declaration must be made

(a) by bylaw or resolution if made by a local authority, or

(b) by order, if made by the head of a local authority.”

The powers of a local authority in a declared state of local emergency are:

“13 (1) After a declaration of a state of local emergency is made under section 12 (1) in respect of all or any part of the jurisdictional area for which a local authority has responsibility and for the duration of the state of local emergency, the local authority may do all acts and implement all procedures that it considers necessary to prevent, respond to or alleviate the effects of an emergency or a disaster, including any or all of the following:

(a) implement its local emergency plan or any local emergency measures;

(b) subject to this section, exercise, in relation to the part of the jurisdictional area affected by the declaration, any power available to the minister under section 10 (1) (d) to (l);

(c) subject to this section, authorize, in writing, any persons involved in the operation of a local emergency plan or program to exercise, in relation to any part of the jurisdictional area affected by a declaration, any power available to the minister under section 10 (1) (d) to (l).

(2) If a state of local emergency has been declared under section 12 (1), the minister may order a local authority to refrain or desist, either generally or in respect of any matter, from exercising any one or more of the powers referred to in subsection (1) (b) or (c).

(3) Immediately after making an order under subsection (2), the minister must cause the details of the order to be communicated to the local authority affected by the order and to any other persons the minister considers appropriate.

(4) Immediately after the details of an order are communicated to a local authority under subsection (3), the local authority referred to in the order must comply with the order and must direct every person under its direction or control to refrain or desist from doing any act that the local authority is ordered to refrain or desist from doing.

(5) For the purposes of subsections (3) and (4), the details of an order are communicated to a local authority when those details are communicated to any one of the members of the local authority.

(6) The local authority of a municipality or electoral area may, during or within 60 days after declaring a state of local emergency, by bylaw ratified by the minister responsible for the administration of the *Community Charter*, but without obtaining the approval of the electors or the assent of the electors, borrow any money necessary to pay expenses caused by the emergency.”

Compensation must be paid to persons whose land or personal property is acquired in the process of carrying out an emergency plan. If there are any disputes with respect to the compensation then this dispute is settled under the terms of the *Commercial Arbitration Act*.

Disaster financial assistance is determined as follows:

“20 (1) The Lieutenant Governor in Council may, by regulation, establish criteria by which the eligibility of a person to receive disaster financial assistance is to be determined.

(2) The Lieutenant Governor in Council or the minister may provide disaster financial assistance in accordance with the regulations to persons who suffer loss as a result of a disaster.”

## **Emergency Program Act – Emergency Program Management Regulation**

This regulation articulates which Minister or Ministers are responsible for coordinating provincial government responses to specific hazards. The relevant hazards and responsible ministers are as follows:

<b>HAZARD GROUPS</b>	<b>HAZARD</b>	<b>KEY MINISTERS</b>
Geological	<ul style="list-style-type: none"> <li>• avalanches:               <ul style="list-style-type: none"> <li>– highways</li> <li>– other</li> </ul> </li> <li>• debris avalanches &amp; flows</li> <li>• landslides:               <ul style="list-style-type: none"> <li>– highways</li> <li>– other</li> </ul> </li> <li>• submarine slides</li> <li>• land subsidence</li> </ul>	Transportation and Highways Attorney General Environment, Lands and Parks  Transportation and Highways Attorney General Environment, Lands and Parks Energy, Mines & Petroleum Resources
Hydrologic	<ul style="list-style-type: none"> <li>• drought</li> <li>• erosion and accretion</li> <li>• flooding</li> <li>• ice jams</li> <li>• storm surges</li> </ul>	Attorney General Environment, Lands and Parks Transportation and Highways Transportation and Highways Attorney General

### 6.3 Local Government

#### Local Government Act (RSBC 1996, c 323)

There are a number of tools within the *Local Government Act* that local and regional governments can utilize to regulate land use in areas that may be susceptible to natural hazards. These tools are primarily proactive rather than reactive measures. The sections of the *Local Government Act* listed below outline these tools.

#### Division 1 — Application and Content of Regional Growth Strategy

##### Purpose of regional growth strategy

“849 (1) The purpose of a regional growth strategy is to promote human settlement that is socially, economically and environmentally healthy and that makes efficient use of public facilities and services, land and other resources.

(2) Without limiting subsection (1), to the extent that a regional growth strategy deals with these matters, it should work towards but not be limited to the following:

(k) settlement patterns that minimize the risks associated with natural hazards;”

#### Division 7 — Zoning and Other Development Regulation

## **Construction requirements in relation to flood plain areas**

910 (1) In this section:

**"minister"** means the minister charged with the administration of the *Environmental Management Act*;

**"Provincial guidelines"** means the policies, strategies, objectives, standards, guidelines and environmental management plans, in relation to flood control, flood hazard management and development of land that is subject to flooding, prepared and published by the minister under section 5 of the *Environmental Management Act*;

**"Provincial regulations"** means, in relation to a local government, any applicable regulations enacted under section 138 (3) (e) [*general authority to make regulations – flood hazard management*] of the *Environmental Management Act*.

(1.1) If a local government considers that flooding may occur on land, the local government may, by bylaw, designate the land as a flood plain.

(2) If land is designated as a flood plain under subsection (1), the local government may, by bylaw, specify

(a) the flood level for the flood plain, and

(b) the setback from a watercourse, body of water or dike of any landfill or structural support required to elevate a floor system or pad above the flood level.

(3) A local government, in making bylaws under this section, must

(a) consider the Provincial guidelines, and

(b) comply with the Provincial regulations and a plan or program the local government has developed under those regulations.

(3.1) A bylaw under subsection (2) may make different provisions in relation to or more of the following:

(a) different areas of a flood plain;

(b) different zones;

(c) different uses within a zone or an area of a flood plain;

(d) different types of geological or hydrological features;

(e) different standards of works and services;

(f) different siting circumstances;

(g) different types of buildings or other structures and different types of machinery, equipment or goods within them;

(h) different uses within a building or other structure.

(4) If a bylaw under subsection (2) applies,

(a) the underside of any floor system, or the top of any pad supporting any space or room, including a manufactured home, that is used for

(i) dwelling purposes,

(ii) business, or

(iii) the storage of goods which are susceptible to damage by floodwater must be above the applicable flood level specified by the bylaw, and

(b) any landfill required to support a floor system or pad must not extend within any applicable setback specified by the bylaw.

(5) Subject to the Provincial regulations and a plan or program a local government has developed under those regulations, the local government may exempt a person from the application of subsection (4), or a bylaw under subsection (2), in relation to a specific parcel of land or a use, building or other structure on the parcel of land, if the local government considers it advisable and

(a) considers that the exemption is consistent with the Provincial guidelines, or

(b) has received a report that the land may be used safely for the use intended, which report is certified by a person who is

(i) a professional engineer or geoscientist and experienced in geotechnical engineering, or

(ii) a person in a class prescribed by the minister under subsection (7).

(6) The granting of an exemption, and the exemption, under subsection (5) may be made subject to the terms and conditions the local government considers necessary or advisable, including, without limitation,

(a) imposing any term or condition contemplated by the Provincial guidelines in relation to an exemption,

(b) requiring that a person submit a report described in subsection (5) (b), and

(c) requiring that a person enter into a covenant under section 219 of the *Land Title Act*.

(7) The minister may make regulations prescribing a class of persons the minister considers qualified, for the purposes of this section, to certify reports referred to in subsection (5) (b).”

## **Division 9 — Permits and Fees**

### **Development permits**

“(7) For land designated under section 919.1 (1) (a), a development permit may do one or more of the following:

- (a) specify areas of land that must remain free of development, except in accordance with any conditions contained in the permit;
- (b) require specified natural features or areas to be preserved, protected, restored or enhanced in accordance with the permit;
- (c) require natural water courses to be dedicated;
- (d) require works to be constructed to preserve, protect, restore or enhance natural water courses or other specified natural features of the environment;
- (e) require protection measures, including that vegetation or trees be planted or retained in order to
  - (i) preserve, protect, restore or enhance fish habitat or riparian areas,
  - (ii) control drainage, or
  - (iii) control erosion or protect banks.

(7.1) For land designated under section 919.1 (1) (b), a development permit may do one or more of the following:

- (a) specify areas of land that may be subject to flooding, mud flows, torrents of debris, erosion, land slip, rock falls, subsidence, tsunami, avalanche or wildfire, or to another hazard if this other hazard is specified under section 919.1 (1) (b), as areas that must remain free of development, except in accordance with any conditions contained in the permit;
- (b) require, in an area that the permit designates as containing unstable soil or water which is subject to degradation, that no septic tank, drainage and deposit fields or irrigation or water systems be constructed;
- (c) in relation to wildfire hazard, include requirements respecting the character of the development, including landscaping, and the siting, form, exterior design and finish of buildings and other structures;

(d) in relation to wildfire hazard, establish restrictions on the type and placement of trees and other vegetation in proximity to the development.”

#### 6.4 Fraser Valley Regional District

Fraser Valley Regional District uses two principle means to regulate development in areas of geologic or river hazard within the Chilliwack River Valley (Electoral Area “E”): floodplain management bylaw and development permit areas.

FVRD Floodplain Management Bylaw No. 0861, 2005 was adopted pursuant to Section 910 of the *Local Government Act*. It establishes flood construction levels (FCLs) and floodplain setbacks for the Chilliwack River and tributary streams.

In the Chilliwack River Valley, Bylaw No. 0681, 2005 is complemented by two development permit areas (DPAs) outlined in Official Settlement Plan for Electoral Area “E” Bylaw No. 400, 1982. The authority to establish a DPA is provided in Sections 919 and 920 of the *Local Government Act*.

The potential erosion and flooding hazards associated with an avulsion of the Chilliwack River have been fully documented from Slesse Park to Baker Trail Village by Hay & Company Consultants (HAYCO) in the Chilliwack River Hazard Management Study Interim Report, 1992. The maps produced by HAYCO as part of this study detail lands subject to potential flooding and to potential cumulative and single event erosion. The boundaries of Chilliwack River Development Permit Area 2-E (DPA 2-E) include the lands identified by HAYCO as subject to flood and erosion hazards from the Chilliwack River. The objectives of DPA 2-E are to minimize damage to buildings and properties from flooding; direct development away from areas of avulsion hazards; ensure adequate assessment and mitigation of river hazards; and, protect the river from development-related impacts. These objectives are achieved through the following development guidelines:

- proposed developments within the 100-year Erosion Limit Line may be required to demonstrate through an engineering study, signed and sealed by a professional engineer registered in the Province of British Columbia, that the proposed sewage disposal, water supply and site drainage facilities are adequate and will not result in negative impact on the environment in the long term
- on-site sewage disposal, water supply and storm drainage systems may be prohibited in areas of unstable soil, or areas where water is subject to degradation except as otherwise recommended in engineering studies
- proposed developments within the 200-year Floodplain of a natural water course shall be floodproofed in accordance with the flood construction level established for the site by the Ministry of Environment or a professional engineer with hydraulic geotechnical experience
- the maintenance of streambank integrity and water quality shall be promoted in areas of land adjacent to and including the natural boundary of water courses by maintaining the appropriate vegetation
- a site-specific geotechnical report may be required in order to determine the use and conditions or requirements of use and density, as they relate to health, safety of persons or protection of property

- buildings and structures shall not be sited in areas where the probability of a hazard event documented by a geotechnical engineer exceeds the level of acceptable risk for that event and that specific form of development established in the Hazard Acceptability Thresholds for Development Approvals by Local Governments
- all bank protection measures implemented in advance of the comprehensive mitigative work for the Valley shall be designed to be integrated into the overall hazard management plan
- conditions may be imposed with respect to the sequence and timing of works in or about the River so as to avoid conflict with fish populations and flooding periods

In addition to hazards associated with the river, the Chilliwack River Valley is subject to a variety of channelized and unchannelized slope hazards. HAYCO's *Chilliwack River Hazard Management Study* (1992) also included hazard zone mapping of the areas affected by debris flow, debris flood and steep slope hazards. Chilliwack River Valley Slope Hazard Development Permit Area 3-E (DPA 3-E) was established to protect new development from the geotechnical hazards identified in this report. The objectives of DPA 3-E are to direct development away from lands subject to geotechnical hazards and ensure adequate assessment and mitigation of geotechnical hazards. It achieves these objectives through the following development guidelines:

- a site specific geotechnical report should be required on lands considered to be subject to geotechnical hazards but where the severity and probability of an event is unknown
- on the basis of a site specific geotechnical study, conditions or restrictions may be imposed respecting the uses and densities permitted in the Zoning Bylaw, the sequence and timing of construction, areas to remain free of development, vegetation or trees to be planted or retained, natural drainage to be maintained or enhanced
- where the geotechnical study identifies a hazard which may be a threat to life, no uses should be permitted which involve overnight accommodation or the assembly of people on, or the attraction of people to, the site
- no use should be approved on land unless it is certified, by a professional engineer registered in the Province of British Columbia with geotechnical experience, as safe for the use intended and the level of risk is acceptable
- no alterations to the natural drainage or vegetation, and no construction or excavation should be permitted which might cause or contribute to hazardous conditions on the site or on adjacent lands

## **7.0 Vision & Goals**

### **7.1 VISION**

Threats to existing communities and infrastructure from river hazards are managed to established and acceptable thresholds through a comprehensive, locally developed and coordinated approach that avoids or minimizes negative impacts to and/or enhances ecological and social values.

## 7.2 GOALS

1. Develop a better understanding of the level or risk posed to existing development and infrastructure and factors contributing to hazard risk.
2. Develop a better understanding of important fish and wildlife habitat along the river and the potential impacts (positive and negative) of various hazard management strategies on ecological processes.
3. Implement comprehensive, cost-effective hazard mitigation works or strategies that will best reduce the level of risk to acceptable levels (e.g., 1 in 200 year flood event) while minimizing negative/promoting positive impacts to fish habitat.
4. Encourage better coordination and cooperation between agencies to develop and fund hazard management strategies that reduce risk levels to acceptable thresholds while mitigating impacts to fish and wildlife habitat.

### 7.2.1.1 Analysis

Numerous suggestions to increase the effectiveness of protection from river hazards have been made by the general public, agencies, and stakeholders, including:

- Increased dyking in certain areas or continuous dyking
- Improvements to existing flood mitigation works
- Better monitoring of existing works
- More rip rap/gryones to protect roads and property
- Develop and environmentally sensitive overall design combined with specific localized strategies
- Development an effective system of ditches, culverts and catch basins
- Creation of a local service area for river work
- Gravel removal
- Assistance from Federal and provincial governments
- Development of a warning system in case of a major slide or flood

This list is neither comprehensive nor exhaustive. While all of the suggestions listed above likely have some merit, further research of all the options and analysis of the each option and its potential effectiveness and impacts was not undertaken during this process. Planning for comprehensive hazard mitigation is a highly technical issue and developing concrete recommendations for specific strategies was beyond the scope of this analysis. Rather, it was agreed that the most valuable role for the CRWS with this particular issue would be to facilitate improved planning and management of river hazards for the entire Chilliwack-Vedder system over the long term.

## 8.0 Recommendations

1. Improve knowledge of hazards, including updated 1:200 year flood levels and floodplain mapping, detailed terrain mapping, and slope and creek hazard identification.
2. Develop a comprehensive hazard management strategy for the Chilliwack River that incorporates and accommodates fish and habitat values, while presenting a planned approach to community safety and protection.
3. Consolidate existing information regarding the level of risk posed to existing development and infrastructure, factors contributing to hazard risk, potential hazard management strategies and the effectiveness/impacts of these strategies, and important fish and wildlife habitat along the river to facilitate improved decision making.
4. Develop a Memorandum of Understanding between regulatory agencies (e.g., FVRD, DFO, MOE, First Nations, etc.) that establishes a framework for the long-term provision of hazard protection and river management and facilitates efficient implementation of future hazard management strategies.
5. Investigate the potential to set up a formal inter-agency advisory body to address river hazard risk on the Chilliwack-Vedder River over the long term.

## 9.0 References

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