



MERRITT

City of Merritt

HAZARD RISK AND VULNERABILITY ASSESSMENT

FINAL REPORT

January 2007

Prepared For:

Tom Lacey
Emergency Program Coordinator
City of Merritt
2185 Voght Street
Merritt, British Columbia
V1K 1B8

Prepared By:

EmergeX Planning Inc.
Suite 1202 - 700 W. Pender Street
Vancouver, B.C. V6C 1G8
Tel: (604) 688-0888 - Fax: (604) 688-0188
www.emergexplanning.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	4
RECOMMENDATIONS.....	5
1.0 INTRODUCTION.....	1
1.1 HAZARD RISK AND VULNERABILITY ASSESSMENT.....	1
1.2 SCOPE.....	1
1.3 METHODOLOGY.....	2
1.4 RISK ASSESSMENT.....	4
1.5 OVERVIEW OF HAZARDS.....	5
2.0 CITY OF MERRITT OVERVIEW.....	10
2.1 SETTING.....	10
2.1.1 Demographics.....	10
2.2 ECONOMY.....	11
3.0 VULNERABILITY.....	12
3.1 SOCIAL VULNERABILITY.....	12
3.1.1 Language Groups.....	12
3.1.2 Age groups.....	12
3.2 CRITICAL RESPONSE FACILITIES.....	13
3.3 CRITICAL INFRASTRUCTURE.....	13
3.3.1 Water.....	14
3.3.2 Energy.....	15
3.3.3 Telecommunications.....	15
3.3.4 Transportation.....	16
4.0 RESPONSE CAPABILITIES.....	17
4.1 FIRE AND RESCUE.....	17
4.2 POLICE.....	17
4.3 AMBULANCE.....	18
4.4 SEARCH AND RESCUE.....	18
5.0 EMERGENCY SUPPORT AND PREPAREDNESS.....	19
5.1 PUBLIC WORKS.....	19
5.2 EMERGENCY OPERATIONS CENTRE (EOC).....	19
5.3 EMERGENCY SOCIAL SERVICES.....	19
5.4 HEALTH AUTHORITIES AND HOSPITALS.....	20
5.5 HAZARDOUS MATERIALS (HAZMAT).....	21
5.6 RADIO SUPPORT.....	21
6.0 HAZARDS.....	23
6.1 RISK ASSESSMENT.....	23
6.2 PRIORITY HAZARDS.....	24
6.2.1 Epidemic and Pandemic.....	24
6.2.2 Pipeline Explosion and Leak.....	26
6.2.3 Hazardous Materials Accident– In-Situ and Dangerous Goods Transport.....	26

6.2.4	Flood	28
6.2.5	Ice Jam	30
6.2.6	Mass Crowd Event Hazard.....	31
6.2.7	Pest Infestation.....	32
6.2.8	Snowstorm	34
6.2.9	Structure Fire	35
6.2.10	Wildland Urban Interface (WUI) Fire.....	36
7.0	REFERENCES	39
APPENDIX A – RISK QUANTIFICATION INDEX FOR THE CITY OF MERRITT.....		42

Executive Summary

EmergeX Planning Inc. (EmergeX) conducted this Hazard Risk and Vulnerability Assessment (HRVA) for the City of Merritt Emergency Program. An HRVA is a critical part of every emergency program and is a requirement mandated by the Local Authority Emergency Management Regulation of the BC Emergency Program Act. Section 2(1) of this regulation requires local authorities to prepare emergency plans that reflect the local authority's assessment of the relative risk of occurrence and the potential impact on people and property of the emergencies or disasters that could affect all or any part of the jurisdictional area for which the local authority has responsibility.

No government has unlimited resources allowing them to plan for every hazard event possible, therefore some form of ranking is required when deciding which hazards are most important to plan for. EmergeX has identified 32 hazards that could affect the City of Merritt. This assessment identifies the risk that each hazard presents to the City, thereby allowing staff to plan for mitigation, response, and recovery efficiently within budgetary and other constraints. The information presented in this assessment can be used by the City of Merritt to:

1. Update its emergency plan.
2. Allocate resources for risk mitigation of applicable hazards beginning with the highest-risk hazards.
3. Enhance community preparedness.
4. Prepare budgets for cost-effective, on-going emergency planning.

This assessment uses both quantitative and qualitative methods to determine risk ratings for various hazards. Based on the information obtained in the course of this assessment, EmergeX has assigned each hazard with a risk rating that has determined the priority hazards affecting the City of Merritt. EmergeX proprietary tools have been utilized in conjunction with provincial emergency management standards to provide the most accurate assessment possible.

The results of this assessment identify the following ten hazards as priority risks:

- Wildland-Urban Interface Fire
- Flood
- Epidemic and Pandemic
- Dangerous Goods Transport Accident
- Mass Crowd Event Hazard
- Structure Fire
- HazMat *in-situ* Accident
- Pest Infestation
- Snowstorm
- Ice Jam

The Risk Quantification Index in Appendix A shows the relative ranking of all hazards analyzed. These rankings were determined using EmergeX Best Practices methodology combined with insight from local experts and therefore may not be identical to risks assigned using other methods or criteria.

Recommendations

While there are some recommendations discussed throughout the document, additional considerations are noted here regarding the five highest priority hazards affecting the City.

Wildland Urban Interface (WUI) Fire

Wildland Urban Interface fire has been determined as the highest priority risk within the City, and improvements can be made to manage the hazard. In terms of response, the National Fire Protection Association 1710 standard assists fire departments in evaluating and improving the levels of firefighter safety and service delivery. Specifically, it sets strict staffing level, response time, and level of service requirements for various situations including forest and WUI fire (NFPA, 2006). The meeting of this standard will assist the City in maximizing response measures in case of future, high risk events. The Merritt Fire Department has pursued some NFPA standards such as 291 – the fire flow testing and color coding of hydrants to coincide with available flow.

An in-depth network analysis of the fire response network is an additional option to improve the efficiency and speed of response to problem areas. This could be accomplished through a Geographic Information System (GIS), with needed information gathered in cooperation with City planners. This would also act as a useful analysis on many levels, such as determining gaps in the response network.

Community Wildfire Protection Plans (CWPPs) and Awareness Programs

Merritt has pursued and completed a Community Wildfire Protection Plan for the City, which is an essential due diligence step relating to WUI fire management. Due to the constant changes in fuel load (e.g. From pine beetle infestation) and accelerated development practices, it is important to ensure that this CWPP remains current. Hazardous fuel reduction, protection of essential infrastructure, and treatment of structural ignitability are among the variables considered in a completed CWPP. Reviewing the plan and ensuring current priorities will assist the City on many levels. An example of this could include altering priority areas for increased FireSmart awareness, aiding the community on a grassroots level.

Raising public awareness regarding WUI fire threat, impact and personal due diligence steps (FireSmart principles) is also discussed in Section 6.2.10, which are all helpful in preventing major fires and reducing the potential impact of these events. It is recommended that important information remains transparent to the public regarding WUI fire threat and awareness is raised in areas that are deemed a priority following the in-depth wildfire assessment - in progress at the time of writing (see Appendix D).

Flood

The potential for significant flood incidents to affect people, property and infrastructure in the City of Merritt has been proven over time and in recent years. Ice jams have been a primary trigger of Merritt flood events in the past and have required additional resources such as excavators and external human resources to assist in the response of this hazard and flood impact. Although the City of Merritt has a significant number of sandbags available for flood response, it is clear that a *reactive* approach has been taken in recent years concerning flood risk. Geotechnical analysis of Coldwater River sections has taken place in the past, and was effective in providing specific recommendations relating to dike widening and strengthening, among other considerations.

The City has taken action recently to detail a Flood Preparedness / Response Plan for Merritt, which is discussed further in Section 6.2.4. This plan includes "pressure points" and areas of general vulnerability, including the number of homes potentially at risk in defined Threat Areas. It is recommended that the City consult a third party to review its current findings and confirm the points of vulnerability along the Coldwater River as well as points near the confluence of the Coldwater and Nicola. Regular assessment of the dike system should also continue, with widening or heightening possibilities considered where feasible following the advice of a qualified third party.

Epidemic and Pandemic

With respect to human disease and pandemic risk, the advancement of business continuity planning in the City of Merritt (with a priority on government) will help to reduce the service impacts on the population. There is room to improve pandemic planning and to detail actions and procedures with a specific focus on predicted outbreak of the Avian Influenza. For example, by protecting municipal infrastructure and staff, the City will set a precedent by which local business may follow, while safeguarding against administrative collapse.

Resources such as the BC Pandemic Influenza Preparedness Plan, prepared as a guide for BC local governments, may be used as the basis for a specific City plan. Protecting employees, ensuring the delivery of essential service, supporting health authorities, and assisting community members are among top priorities (BCM0H, 2005). Specific business continuity plan information should be communicated to the public, particularly to major mill operations that help to drive the local economy.

To achieve success with a pandemic / business continuity plan, a community should:

1. Identify a coordinator or team with defined roles and responsibilities
2. Determine essential employees and critical inputs supporting the city by location and function (e.g. Raw materials, suppliers, sub-contractors, services)
3. Train and prepare ancillary workforce such as contractors, employees in other job titles, or retirees to maintain key business operations.
4. Develop and plan for scenarios resulting in an increased/decreased demand for your products/services in a pandemic.
5. Determine potential impact on business financials, also using scenarios that will affect different products lines or production sites.
6. Determine impact on business-related travel (e.g. Quarantines, border closures)
7. Stay informed with up-to-date, reliable pandemic information from sources such as Interior Health (e.g. IHA Pandemic Influenza Preparedness Plan 2005).
8. Establish an emergency communications plans and revise periodically. This includes key contacts with backups, chain of communications, and processes for tracking the status of businesses and employees.
9. Implement an exercise or drill to test the plan and revise periodically.

Dangerous Goods Accident

The primary challenges surrounding a potential hazardous materials incident in Merritt are the lack of training, lack of response resources and gaps in the knowledge of specific HazMat transport that is taking place throughout the community. Although the Fire Chief is trained to a Technician level, there remains a shortage of staff and equipment to deal with a significant HazMat spill relating to dangerous goods transport, which has a recognized potential to occur.

A geographic HazMat inventory is recommended as an initial step to determine where the majority of transport is taking place within the City, including characteristics of the materials and the resources needed to contain a potential spill. A GIS-based HazMat inventory is one possibility that would help first responders and local emergency coordinators gain access to potentially lifesaving information when needed, and prioritize response inventory and training. With limited resources, an additional option is to conduct placard tracking and recording which has been done on a basic level in the past, but needs to be revisited by Merritt Fire-Rescue.

In order to follow through with the above recommendations, the primary concern surrounding the lack of long-term staff at the Fire Department must be alleviated. The department is involved in a number of proactive emergency planning endeavours but time constraints and minimal staff have introduced limitations in the process.

Mass Crowd Event

As discussed in Section 6.2.6, this hazard refers to the Merritt Mountain Music Festival (Mountainfest) and the plethora of concerns that surround this annual event. This situation is unique, and as such it is important to recognize not only the hazards posed from the large crowd itself but also the amplification of external hazard impacts given the population of festival goers and the City during this time.

With many minor social disturbances occurring each year, vast alcohol consumption and the potential for a riot to occur, focus should steer towards a review of law enforcement presence and ensuring that additional forces are available in short request. Cooperation between the City of Merritt, Active Mountain Entertainment Corp., and the RCMP should be streamlined to ensure that this is accomplished.

In addition to riot risk, the vulnerability of festival visitors during a mass evacuation event is very high. With limited routes of ingress and egress, and public routes shared by the fire department, the advancement of an interface fire would prove very challenging to cope with. As detailed in Section 6.2.6, it is recommended that a full review of the festival Fire Safety Plan takes place with full cooperation and insight from the Merritt Fire Department. Evacuation has remained a minor focus of this plan and requires additional attention.

Additional recommendations are given in Section 6.2.6, including working with Active Mountain Entertainment to exercise the Fire Safety Plan to a level that is suffice from the perspective of Merritt Fire-Rescue.

1.0 Introduction

This Hazard Risk and Vulnerability Assessment (HRVA) was conducted by EmergeX Planning Inc. for the City of Merritt Emergency Program.

1.1 Hazard Risk and Vulnerability Assessment

Considering **hazards** alone may lead to a skewed set of priorities for action. It is equally important to consider the **severity** of possible impacts from the hazard as well as the frequency or **likelihood** of a hazard event occurring. The combination of severity and likelihood is termed the **level of risk**.

In determining the severity of a hazard event, a community's vulnerability must be examined. Vulnerability is defined as people, property, infrastructure, industry and resources, or environments that are particularly exposed to adverse impact from a hazard event (Ministry of Public Safety and Solicitor General, 2004).

Likelihood reflects the frequency of occurrence for a particular hazard event and can range from rare events occurring every 200 years to more frequent events, which usually have a high number of recorded incidents or anecdotal evidence.

For example, a community with a fire hall located on a floodplain is more vulnerable than a similar community with a fire hall built outside the floodplain area due to the possibility that the fire hall will be out of commission as a consequence of flooding. Such as a fire hall on the floodplain (a *vulnerable facility*), a community may have areas with a high proportion of elderly or very young residents, thereby increasing the vulnerability of the community.

A Hazard Risk and Vulnerability Assessment examines the hazards that may impact a community and the risk that each hazard event poses to the community as a whole and to vulnerable elements of the community.

1.2 Scope

This HRVA is designed to provide an assessment of the hazards that may present risks to the City of Merritt (City). The objective of the HRVA is to:

- Investigate prominent natural and human-caused events, and
- Identify any threats that may require a timely and coordinated response to protect lives, property, and to reduce economic losses.

The intent of this Hazard Risk and Vulnerability Assessment is to provide a basis from which local planners, politicians, and responders can create or update the City's emergency plan, allocate resources for risk mitigation, enhance community preparedness, and prepare budgets for cost-effective, on-going emergency planning.

This assessment is based on both primary and secondary sources, and at times relies on anecdotal evidence. EmergeX verifies sources to the best of its ability given the project's time restrictions. Both quantitative and qualitative methods are used to determine hazard ratings for the area of interest. EmergeX proprietary tools have been utilized to provide the most accurate assessment possible, taking into consideration that the assessment – because it is qualitative and quantitative

– includes subjective components. Duplication of this assessment by third parties may not yield exactly the same results.

The scope of this assessment will cover areas within the administrative boundaries of the City of Merritt. Factors considered in developing a list of hazards for the City of Merritt include:

- Demographics
- Geography
- Industries and other technologies
- Transportation modes and routes
- Weather and climate

EmergeX has identified 32 hazards that could potentially affect the City of Merritt. In selecting these events for consideration, EmergeX acknowledges the potential that other hazards might exist. However, the hazards identified in this assessment are considered more likely to impact the City than others. It should be noted that the hazards described in this report are not necessarily unique to the City of Merritt and other jurisdictions with similar industrial, economic, residential, and physical characteristics may also be subject to the same hazards as they apply elsewhere.

1.3 Methodology

This risk assessment begins with an introduction to the different man-made and natural hazards that can pose an unacceptable level of risk to people and property. This risk assessment draws general conclusions about vulnerable populations, facilities and infrastructure as well as the City of Merritt's capacity to respond to emergencies.

For this risk assessment, each hazard was evaluated based on the severity of its impact and the likelihood of occurrence. The severity of a given hazard is the sum of four factors which includes its impact on people, property, the environment and the economy/society. The categories of impact for each factor were individually ranked on a numeric scale from the least to the most severe. Each of these categories of impact and score are related as shown in Table 1. Injuries and fatalities to people have been weighted more heavily for severity score, as seen in the right column. This was done to correspond to the priorities of BCERMS response objectives, which strive to provide for the health and safety of responders, save lives, reduce suffering, and protect public health – priorities that take precedent over the protection of property and the environment.

Table 1 – Severity of Impact

CATEGORIES	CRITERIA	SCORE
PEOPLE		Max Sub-Score: 15
Injuries and Fatalities	None	0
	Single	5
	Multiple	10
	Mass	15

PROPERTY		Max Sub-Score: 12
Response and Recovery Facilities	No disruption	0
	Temporary disruption	1
	Multi-day disruption	2
	Partial loss	3
	Total loss	4
Critical Infrastructure	No disruption	0
	Temporary disruption	1
	Multi-day disruption	2
	Partial loss	3
	Total loss	4
Property Damage	Not significant	0
	Single property damaged	1
	Multiple properties damaged	2
	Single property destroyed	3
	Multiple properties destroyed	4
ENVIRONMENTAL		Max Sub-Score: 4
Environment	No damage	0
	Little damage	1
	Resources damaged with short term recovery	2
	Resources damaged with long term recovery	3
	Resources damaged beyond recovery	4
ECONOMIC & SOCIAL		Max Sub-Score: 4
Economic and Social	No impact / No costs	0
	Temporary impact / Low costs	1
	Short term impact / Medium costs	2
	Long term impact / High costs	3
	Long lasting impact beyond recovery	4

The sum of these scores was taken to create an overall severity of impact score which was then multiplied against a likelihood score of one to six, with one being the least likely and six being most likely (Table 2).

To determine which hazards are of priority for the City of Merritt, a Risk Tolerance Boundary is determined for the City following the same criteria. A comparison of the risk scores for each hazard

against the Risk Tolerance Boundary score provided the basis for determining the City of Merritt priority hazards. This is further described in the next section.

Table 2 – Likelihood rating for occurrence of hazards

LIKELIHOOD OF OCCURRENCE	SCORE
Highly unlikely or anticipate less frequently than 1 in 200 years	1
101-200 yrs occurrence	2
26-100 yrs occurrence	3
6-25 yrs occurrence	4
2-5 yrs occurrence	5
Once a year or more occurrence	6

1.4 Risk Assessment

This section of the report examines the hazards that may impact people and property in the City and the risk that each hazard event poses.

A quantitative assessment of the risk each hazard poses is summarized in the Risk Quantification Index (Appendix A). EmergeX has established a **Risk Tolerance Boundary of 28 points** based on an evaluation of an acceptable level of risk to the City of Merritt. When the Risk Tolerance value (severity multiplied by likelihood) exceeds 28, the hazard poses an unacceptable level of risk and is discussed as a priority hazard. The example in Table 3 outlines a hazard that remains at an acceptable level of risk – with the final score not exceeding 28. It is important to note that many different combinations of criteria values are possible, and even with a high severity ranking the hazard may still fall below the Risk Tolerance Boundary (depending on likelihood), and vice versa.

Table 3 – An example of the hazard scoring process

People Injuries & Fatalities	Property			Environment	Econ. & Social	Total Severity	Likelihood	Risk Tolerance
	Response & Recovery Facilities	Critical Infrast.	Property Damage					
0	1	1	2	1	2	7	3	21
None	Temporary Disruption	Temporary Disruption	Multiple properties damaged	Resources damaged with short term recovery	Short term impact, medium cost		6-25 yrs or occurrence	

No community has unlimited resources allowing them to plan for every hazard event possible. Therefore, the purpose of determining a Risk Tolerance Boundary is to determine which hazards are of the highest priority for mitigation. Hazards will be prioritized based on a comparison of their risk scores to the Risk Tolerance Boundary score.

Even though this report has determined a list of priority hazards, all hazards should be addressed from highest to lowest risk in the order of their priority. EmergeX believes that hazards above the Risk Tolerance Boundary warrant review and development of mitigation actions to reduce the risk to an acceptable level. For these hazards, mitigation measures should be planned in the near future. For hazards below the Risk Tolerance Boundary, these should be addressed with an appropriate level of urgency.

1.5 Overview of Hazards

The following hazards were considered for assessment in the City of Merritt HRVA. Not all hazards listed here are priority hazards or discussed in length throughout the document, but are possible so were included in the Risk Quantification Index (Appendix A).

1. Aircraft Crash

An aircraft crash involves the impact of one or more aircraft either striking the ground, another aircraft or structure. Depending on the nature of the crash, direct and corollary effects can include injury, fatalities, destruction of property and forest fire.

2. Animal Disease

Classified into three categories, animal diseases can be non-infectious, infectious and parasitic disease. These diseases have the potential to pass from animal to animal and from animal to human.

3. Avalanche

An avalanche is the movement of snow and ice as a result of the force of gravity down a sloped surface. The type of snow, ambient temperature and wind conditions are critical factors.

4. Blizzard

A blizzard is similar to a snowstorm. However, it combines low temperatures, blowing snow and wind speeds ranging from 90 to 130 km/h. Conditions are most severe in open or deforested areas where there are no trees or structures to act as wind breakers.

5. Dangerous Goods Accident

A hazardous material is a substance that may be explosive, flammable, poisonous, corrosive, reactive or radioactive. When a hazardous material is transported it is termed dangerous goods, with potential for spill occurring during a truck accident or during the physical transfer to a storage unit.

6. Debris Avalanche and Debris Flow

A debris flow is a rapid down-slope movement of a slurry of loose soils, rocks and organic matter. Whereas, a debris avalanche is a high velocity debris flow of mud, rocks, brushes, trees and other debris propelled by torrential rains.

7. Drought

A drought is an abnormal shortage of water, typically occurring throughout the summer months over an extended period of time. Results of a drought can include crop failure, depletion of municipal water sources, increase in forest fire risk and insufficient water flow through waterways.

8. Earthquake

An earthquake is the violent shaking of the earth's surface. There are three types of damaging seismic categories which could affect British Columbia.

Crustal Earthquakes: Typically low magnitude ground movement occurring along faults at an average depth of 10 – 20 km.

Sub-crustal Earthquakes: Occur at a depth of 30 – 70 km are produced by fracturing and frictional slipping of preexisting faults along a tectonic plate.

Subduction Earthquakes: The most powerful type of earthquake, these occur when there is a massive shift at the junction of multiple tectonic plates.

9. Epidemic and Pandemic

A pandemic refers to an epidemic that spans a large geographic area and can often become a global situation. An epidemic is a situation where a disease affects many people in a given area, resulting in illness and potential death.

10. Erosion and Sedimentation

Erosion is the weathering away of land through the action of natural forces and increases the risk of slope failure. Sedimentation is the buildup of land by natural or artificial means, increasing the likelihood of flooding.

11. Explosion and Gas Leak

An explosion is the ignition of a flammable substance resulting in instantaneous combustion. A gas leak can be caused ruptured pipelines or faulty valves and can potentially result in an explosion.

12. Flooding

Local flooding is an increase in water level associated with an extreme hydrological event, such as record rainfall or poor / blocked drainage. Whereas, freshet flooding is an overall increase in water level due to late spring event caused by the melting of snow pack. Further definitions of *minor* and *major* flooding are given in Section 6.2.4.

13. Hailstorm

Hailstorms consist of precipitation in the form of balls or irregular lumps of ice formed when updrafts in thunderclouds carry raindrops into extremely cold areas of the atmosphere. By convention, hail has a diameter of five millimetres or more, while smaller particles may be classified as either ice pellets or snow pellets.

14. Hazardous Materials Accident – In Situ

A hazardous material is a substance that may be explosive, flammable, poisonous, corrosive, reactive or radioactive. An accident of this type can result from an uncontrolled release from storage or during use. For a hazardous material incident during transport, please see the *Dangerous Goods Transport* definition.

15. Heat Wave

A heat wave can take a number of forms. Such events can be characterized by temperatures significantly above the mean for an extended amount of time, or by a combination of high temperatures with high humidity and a lack of air motion.

16. Ice Jam

An ice jam is the accumulation of ice fragments in a waterway which build up and restrict the flow of water causing a temporary obstruction. Typically, these occur during the spring breakup, often resulting in local flooding; however, ice jams can also occur when the water way is freezing up.

17. Ice Storm

High winds combined with freezing rain and temperatures below freezing create ice storm conditions. The resulting freezing rain has a tendency to adhere to roads, buildings, trees, power lines and electrical towers; with the weight potentially causing these structures to collapse.

18. Landslide

A landslide is the downslope movement of soil, rock and organic materials as a result of gravity. Landslides can damage property, homes and other standing structures in its path.

19. Land Subsidence

Land subsidence occurs when a surface has been undermined or dug out via human or natural processes resulting in deformation and ground movement.

20. Lightning

Lightning is caused when atmospheric conditions create moisture laden instable air, ascending air and thunderclouds. The combination creates an electrical charge of up to 100 million volts of electricity leaping from cloud to cloud or cloud to ground and vice versa.

21. Mass Crowd Event Hazards

For the purposes of this report a mass crowd event is defined as a gathering that is likely to attract greater than 50,000 people. The Merritt Mountain Music Festival greatly exceeds this number every year and is the focus of discussion under this definition. Hazards discussed here include *riot*, which is a violent outbreak involving many individuals with either a common or random intent to destroy property, assault persons or otherwise disturb the peace.

22. Pest Infestation

A pest infestation is typically caused by foliage or root feeding insects, as well as bark beetles which are a focus in this I-IRVA. In both cases, usually large areas of forest and/or crops are affected.

23. Plant Disease

Plant diseases are generally defined as any series of harmful physiological processes caused by irritation of the plant by some invading agent. These agents are typically referred to as plant pathogens and include viruses, bacteria, fungi, and algae.

24. Power Outage

A power outage is the loss of electricity delivery to homes and businesses. Generally, a power failure of short duration is not a concern; however the threat rises with increase length of time without electricity.

25. Rock Fall

A rock fall occurs when one or more rocks fall freely from a cliff edge or rock face.

26. Snowstorm

A snowstorm involves the accumulation of several centimeters to several metres of snow. Similar to blizzards, the resulting storm can cover roads and infrastructure; however, snowstorms are not associated with high winds as are blizzards.

27. Structural Collapse

When a building or structure falls as a result of faulty construction, metal fatigue, or changes to the load bearing capacity of the structure. Most commonly, structural collapse occurs because of a seismic event in which case older or poor design or inadequately maintained structures are most susceptible.

28. Structure Fire

A structure fire is one which occurs within the developed area of a community, including residential or industrial areas; compromising homes, offices, factories and other structures.

29. Volcanic Ash Fallout

When volcanic ash (tephra) is ejected out of a vent into the atmosphere the ash has the capacity to travel long distances by upper level winds and can be deposited on the earth. This volcanic ash fallout can pollute water sources, cause health hazards and disrupt aircraft services.

30. Water Contamination

Water contamination refers to both dangerous bacteria found in drinking water as well as intentional contamination of the water supply. These events have the potential to cause serious health effects or illness.

31. Wildland Fire

A wildland fire burns in forested areas that are relatively unpopulated with very few homes such as cabins and occasional dwellings.

32. Wildland Urban Interface Fire

A wildland urban interface fire is a wildland fire which has encroached on a developed and populated area, such as the fringe areas of the City itself.

2.0 City of Merritt Overview

2.1 Setting



Figure 1 – Location of the City of Merritt in British Columbia (Source: Wikipedia, 2006).

The City of Merritt (Figure 1) is located in the Nicola Valley within the Thompson-Nicola Regional District (TNRD), and has a total land area of 24.9 km² with an elevation of 595m (Wikipedia, 2006). Merritt is made up of five general residential areas including Bench, Collettsville, Central, Diamondvale and Lower Nicola, and has an estimated population of 7,561 (BC Stats, 2005). The population of Merritt at the time of the last census was 7,088 (Statistics Canada, 2001).

2.1.1 Demographics

Demographic and background information should be considered as a vital resource to any emergency plan, as vulnerable populations may be particularly exposed to adverse impacts from a hazard event. The City of Merritt recognizes the importance of social well-being within the City and has vowed to act on this through its planning decisions.

Table 4 provides a summary of important demographic information concerning the City of Merritt, contrasted with the province of British Columbia for comparison (Statistics Canada, 2003).

Table 4 – City of Merritt Demographics and Background Facts¹

Demographics	Merritt	BC
Total Land Area	24.9 km ²	9,012,112 km ²
Population	7,561 (2005 estimate)	4,254,522 (2005 estimate)
Percentage of Aged Population (65yrs and older)	13.7%	13.6%
Percentage of Young Population (14 yrs and younger)	21.7%	18.1%
Percent of People Using Non-Official Language Most Commonly at Work	0.7%	3%
Households	Merritt	BC
Median household income	41,069	46,802
Households containing a couple married or common law with children	740	423,455

(Source: Statistics Canada, 2001 Census Data)

2.2 Economy

The Nicola Valley has a long history of ranching and logging, with the latter being quite evident as you enter the City of Merritt. Tolko Industries, Aspen Planers and Ardev Forest Products are among the major mill operations in the city, with other specialized forest manufacturers present as well. Forest sector operations have grown in recent years, with a contributing factors being the increased role that selective logging has taken in the management of the Mountain Pine Beetle and Wildland Urban Interface fire risk.

In March of 2005, the Nicola-Similkameen Innovative Forestry Society (NSIFS) made application for a yearly 500,000 cubic metre increase in Allowable Annual Cut, on the basis this will assist with pine beetle management. Taking into account the 330,700m³ previously awarded, 830,700m³ per year was officially designated in July of 2005 and divided up between six licensees (MoFR, 2005). Further discussion of local mill operations, Mountain Pine Beetle and WUI fire management can be found in Section 6.2.10.

¹ EmergeX has utilized demographic information based on the most recent survey performed by Statistics Canada in 2001. However, it is recommended that the City of Merritt update the demographics section of this report once the 2006 census data is made available from Statistics Canada.

3.0 Vulnerability

3.1 Social Vulnerability

Hazards such as Wildland Urban Interface (WUI) fires, earthquakes, floods and human health emergencies can have particularly serious impacts on vulnerable populations such as the elderly and very young. In this assessment, social vulnerabilities reflect "...the degree to which societies or socio-economic groups are affected by stresses and hazards, whether brought about by external forces or intrinsic factors – internal and external – that negatively impacts the social cohesion of a [municipality]" (United Nations Development Programme, 2000).

For the purpose of this report, social vulnerability is the ability of an individual within a household to recover from a natural hazard impact.

3.1.1 Language Groups

The vast majority of residents within the City of Merritt (99%) speak English as a *language first learned and still understood*, and a very small percentage (0.7%) use a non-official language most regularly at work, so communication barriers in times of an emergency situation are not likely to be an issue.



Figure 2 – Nicola Valley Seniors Residence being constructed on Belshaw St. (73 units)

to cater to seniors which the City of Merritt is actively promoting. These demographic trends are relevant in times of an emergency situation, as the elderly face more challenges, have greater needs, and require specialized attention. Specific challenges include transporting older adults who use assistive devices, providing appropriate health services and nutrition, meeting the needs of people with limiting conditions (such as hearing and dementia), and respecting the emotional state of senior individuals, who may experience "transfer trauma" (Wade, 2005).

3.1.2 Age groups

Although the 2001 statistics of elderly population (13.7%) within Merritt are on par with the BC average, recent trends are moving towards an influx of seniors into the City. These trends are backed by senior housing developments such as Nicola Meadows Seniors' Assisted Living at 2670 Garcia St. which opened in 2005 as well as the Nicola Valley Seniors Residence, a new complex that was being constructed on Belshaw St. at the time of writing (Figure 2). Both of these senior residences provide 24/7 care aid for its tenants, designed for assisted living.

Merritt also has a Seniors Centre and many community groups and amenities

Approximately 22% of the population of the City is 14 years of age or younger, which is above the provincial average. Special considerations for these young individuals are relevant, especially when separated from their parent or guardian.

3.2 Critical Response Facilities

Within this HRVA, *critical response facilities* are defined as facilities that are essential in order for the City of Merritt to carry out emergency response activities. However, it is important to note that there are numerous critical facilities outside of the City that are essential in order for the Province to support the City of Merritt in an emergency (e.g. BCAS Dispatch Centre and the Provincial Regional Emergency Operations Centre, both located in Kamloops).

The primary critical response facility for coordination of any large-scale disasters or emergencies is the City of Merritt Emergency Operations Centre (EOC). More information on the City's EOC can be found in Section 5.2. Before, during, and after a hazard event, the EOC is essential for site support, including the coordination of special resources, information, multiple departments and external agencies.

In addition to the EOC, emergency first response facilities are of critical importance to carrying out emergency response activities. These include police, fire, emergency health centres, ESS reception centres, and other facilities.

3.3 Critical Infrastructure

Critical infrastructure consists of those physical and information technology facilities, networks, services and assets which, if disrupted or destroyed, would have a serious impact on the health, safety, security or economic well-being of the City of Merritt or the effective functioning of the government. According to Public Safety and Emergency Preparedness Canada (2005), critical infrastructure spans ten sectors:

1. Energy and Utilities (e.g. electrical power, natural gas, oil production and transmission systems)
2. Communications and Information Technology (e.g. telecommunications, broadcasting systems, software, hardware and networks including the Internet)
3. Finance (e.g. banking, securities and investment)
4. Health Care (e.g. hospitals, health care and blood supply facilities, laboratories and pharmaceuticals)
5. Food (e.g. safety, distribution, agriculture and food industry)
6. Water (e.g. drinking water and wastewater management)
7. Transportation (e.g. air, rail, marine and surface) (J)
8. Safety (e.g. chemical, biological, radiological and nuclear safety, hazardous materials, search and rescue, emergency services, and dams)

9. Government (e.g. services, facilities, information networks, assets and key national sites and monuments)
10. Manufacturing (e.g. furniture, glass, truck canopies)

Throughout the HVRA, EmergeX has highlighted four sectors of critical infrastructure for the City of Merritt: **water, energy, (tele)communications** and **transportation**.

3.3.1 Water

According to Public Safety and Emergency Preparedness Canada (PSEPC), approximately 423m³ of water is needed to sustain a population of 7,561 (2005 Merritt estimate) for 14 days. This equates to four litres per person per day.

Merritt is supplied by five groundwater wells, including: Fairly Park, Voght Park Gas/Electric, Voght Park Electric, May Street and Colletville. Each well, with the exception of Fairly Park are located immediately adjacent to the Coldwater River (Urban Systems Ltd., 2005). Daily consumption is approximately four million gallons during peak summer periods. In the winter months, between 1.5 and 2 million gallons are consumed. Standards for water lines are six inch diameters with a maximum of 14 inches (City of Merritt, 2006b).

Two reservoirs exist, one with a capacity of 664m³ and the larger with a capacity of 4550m³ which is located north of Grimmet Street. Merritt wells pump directly into the distribution system and are controlled by the Grimmet Reservoir water levels.

While water contamination is not determined as a *priority* concern, it should be noted that there is fairly limited ground cover over the aquifer serving the City – approximately 30 ft in contamination areas – and this (Personal coupled communication, with well supply H. sourcing Kroeker, can October lend itself 12, 2006). to ease While of no significant events causing injury or death have occurred in the recent past, the relative vulnerability of the water system is worthy of mention.

Merritt Emergency Plan for Potable Water

Initially, in July of 1998, the City contracted a third party to develop a plan to aid in the *detection, assessment, control and clean-up of any anticipated emergency situation relating to the supply of clean, safe water* (Urban Systems, Ltd., 2005). Components of this plan were updated in February of 2005. Possible emergencies dealt with in this potable water plan include (1) well contamination, (2) reservoir contamination, (3) distribution system contamination and (4) pump failure. The plan mentions the possibility of all wells being rendered unusable in the event of a chemical contamination, although slow migration from one well to another is likely, lessening the vulnerability (*ibid*).

If a major contamination event did occur, options that were documented by Urban Systems included:

1. Drilling additional wells in a different aquifer and connecting them to the existing distribution system.
2. Arrange with River Ranch to connect temporarily to the high production irrigation well there.

3. Put an emergency river intake in place with a connection to the City's distribution system.

There is a significant amount of useful information included in the plan Appendices as well, including main contacts, contractor call-out lists, American Water Works Association (AWWA) standards for well, water storage and water main disinfection, emergency chlorination procedures and finally a composite map of the water infrastructure including fire hydrants (Urban Systems, Ltd., 2005).

3.3.2 Energy

Energy related infrastructure within the City includes a network of electricity transmission and natural gas lines and facilities. BC Hydro's provincial grid system serves the region, with the Nicola Substation located near the City of Merritt. It is established that in the event of a hazard directly affecting the Nicola Substation to a level of disrepair, the City of Merritt could suffer a prolonged power outage event, as well as others dependent upon its continued operation.



Figure 3 – Power substation near Merritt, BC

Terasen Gas provides service to communities within the City of Merritt (2006b), a portion of Terasen's 900,000 customers across B.C. Terasen is committed to ensuring their pipelines are well-protected and also offer earthquake preparedness and other advice to customers through their website.

3.3.3 Telecommunications

Television and radio broadcasting, as well as cellular and land line telephones are considered essential in emergency operations. Communications infrastructure is essential for the Emergency Operations Centre, broadcasting systems, and front-line responders in communities in the aftermath of a disaster. Communication is necessary for: assessing damage and need, collecting information on supplies and other resources, coordinating rescue and relief activities, accounting for missing people, and motivating public, political, and institutional responses. It is important that communication infrastructure in a hazard prone area be resilient.

Telus is responsible for the provision of telecommunications service to the City of Merritt. Telus will strive to keep its equipment operational with primary emphasis on vital communications infrastructure needed by the City in order to respond effectively to a major emergency. All radio support (including equipment) supporting Merritt is discussed in Section 5.6.

3.3.4 Transportation

During and after an emergency or disaster, transportation is an essential component for effective emergency response and recovery. The City of Merritt is accessible directly via surface and air transport. Major thoroughfares for surface transportation into and within the City include: Highway 5 (Coquihalla Hwy.), Highway 5A, Highway 97C (Nicola Ave.) and Voght St. These highways and major roads are vital to the connection of Merritt with other communities such as Kamloops (to the north) and Kelowna (to the east).

There are no major international or regional airports within the City of Merritt. There is currently one municipal Code 2B (non-instrument) airport located on Airport Road – code ICAO: CAD5 – with terminal facilities and aircraft fuel sales available. The paved runway is 1239x23 metres with a partial parallel taxiway (10.5x300m) and apron (61x91m). A light helicopter landing pad is also in operation at the airport (City of Merritt, 2006a).

There are currently no direct rail services provided in the Nicola Valley including the City of Merritt. Rail service is made use of through intermodal services located in Kamloops and the Lower Mainland (*ibid*). Merritt can be accessed by bus through Greyhound Bus services that provides scheduled passenger service.

4.0 Response Capabilities

This section provides a summary of the City of Merritt's response capabilities that are considered when assessing the City's overall risk to the hazards defined in Section 1.5.

4.1 Fire and Rescue

The City of Merritt is supported by the Merritt Fire and Rescue Department, located at 1799 Nicola Ave, which responds on average to approximately 350 calls per year. Normally, close to half of these calls are auto extrications.

Bylaw No. 1904 (see Appendix B) outlines the establishment and regulation of a Fire and Rescue department within the City of Merritt, which was last updated and amended with Bylaw 1936 in 2006. The rescue response area is set to coincide with that of Merritt

RCMP and as shown in Schedule C of Bylaw No. 1904, with the "PEP Highway Rescue Boundaries." Fire and Safety Regulations, including fireworks, hydrant maintenance, burning permits and other matters are detailed in Bylaw No. 1905, also included in Appendix B.

At the time of writing, the City of Merritt Fire Department was equipped with the following apparatus:

- 2 - 1050 gpm pumpers, 1000 gal. capacity
- 1 - 850 gpm pumper, to be replaced in 2 years by aerial unit (with 65-70ft. extension)
- 1 - MOF strategic interface engine, 500 gal. capacity
- 1 - Highway rescue truck
- 1 - Mini-pumper, older unit
- Chiefs truck and Deputy's ½ ton Bush Truck
- Additional water supply – Public Works Sewer Utility Truck (1250 gal.)

There are 2 career staff members at the Merritt Fire Department, with the Deputy Chief in charge of training, buildings, apparatus and equipment as well as the Fire Prevention division. Public education and community preparedness is an important component of prevention, but with low staff numbers and limited time to execute these activities it is not easily accomplished. The Fire Chief is eager to advance the fire protection program but the above concerns have come to the forefront as new endeavours are pursued.

4.2 Police

Merritt is served by a local RCMP detachment located at 2999 Voght St. Merritt has also established a Citizen's Patrol program initiated through the Merritt RCMP detachment.

4.3 Ambulance

In the City of Merritt, emergency medical service is provided by the British Columbia Ambulance Service (BCAS), which is dispatched by the regional 9-1-1 system. There is one BCAS station in Merritt, with the regional dispatch for the City located in Kamloops at 1257 Dalhousie Drive. In addition, there is a Provincial Air Ambulance Coordination Centre (PAACC) located north of Victoria that will handle air-evacuations, transfers between regions, other provinces, and other countries (APBC, 2006).

4.4 Search and Rescue

The City of Merritt is supported by various Search and Rescue (SAR) groups within the Thompson-Nicola Regional District, with the closest established² groups being Nicola Valley Search and Rescue as well as Logan Lake SAR. Nicola Valley Search and Rescue was founded in 1992 and is experienced primarily in ground searches. This group has also received training and support from the BC Provincial Emergency Program (BCSARA, 2005).

Logan Lake SAR also provides support in the Merritt area, with members experienced in ground, embankment and cliff searches. Two members are trained SAR managers and there is one SAR instructor on staff. A new Command Unit was added to the Logan Lake SAR resources in 2005 and has been put to use.

Past support of the Logan Lake SAR team in the Merritt area has included a search for a missing male hiker in the Mellin Lake area in September of 2004, on Sunset Main logging road. The subject was located in an injured state and transported out with final search team numbers exceeding 120 volunteers (*ibid*). Also involved during this incident were volunteers from the Central Okanagan Regional District, Kamloops, Merritt, PEP support from numerous regions, ESS and amateur radio volunteers.

² "Established" is defined here as (a SAR group) recognized by the British Columbia Search and Rescue Association (BCSARA) at the time of writing.

5.0 Emergency Support and Preparedness

In addition to primary response organizations, the City of Merritt utilizes a number of organizations and programs to prepare for and support response and recovery in an emergency or disaster. The City may also draw on the resources of several external organizations.

5.1 Public Works

Ideally, an administrative member of Public Works will assume the role of EOC Operations Section Chief during events that require Public Works as the lead agency, such as during a flood or snowstorm event. This is confirmed to be the situation in Merritt, with full cooperation from Public Works. Responsibilities of the Operations Chief may include: EOC staffing, road clearing, managing traffic, alleviating water disruption issues, firefighting water provision, sewage services, spill containment, vehicle supply, building security, garbage/debris management and equipment supply.

Supporting resources are also available from both provincial and private sources. This includes the Central Provincial Regional Emergency Operations Centre (PREOC) which is located in Kamloops, the PECC in Victoria and various private sources within the City of Merritt.

5.2 Emergency Operations Centre (EOC)

The establishment of an Emergency Operations Centre (EOC) is vital to the management of disaster events from a central facility using the Incident Command System. It is also important to specify a secondary EOC in the event that the primary EOC is deemed unsuitable for use due to safety (or other) concerns. The City of Merritt has designated their primary EOC at City Hall (2185 Voght St.) with Council Chambers set up for primary operations (Personal communication, Tom Lacey, September 29, 2006).

Partitions are stored here that can be quickly set up to provide some organization and privacy between personnel working in the EOC. Cameras are also set up in the boardroom for media purposes during regular operation, which can also be used to record and communicate proceedings if needed. Built-in backup generation is not present at the primary EOC but options for mobile generation are available. The secondary EOC has been designated as the basement of the Terminal Building at the airport located on Airport Road on the northeast side of the city (City of Merritt, 2005b). At the time of writing there was mobile backup generation available at the Airport building which was currently stored at the site. It is recommended that this source of backup generation is tested on a regular basis to ensure its complete functionality and reliability.

5.3 Emergency Social Services

The City's Emergency Social Services (ESS) provides short-term (72 hours) assistance to people impacted and forced to evacuate their homes due to an emergency. Essential services are also provided to emergency workers during this time. ESS reception centres, temporary lodging, food and clothing needs, family reunification, First Aid and other required services are provided by ESS. In the case of a small scale event, a Personal Disaster Assistance program provides support as part of the City's ESS. The ESS is supported by several volunteer agencies including: Canadian Red Cross, Salvation Army and St. John Ambulance.

An Emergency Social Services (ESS) team is established in Merritt, with the primary reception centre designated as the Merritt Civic Centre (1950 Mamette Ave). This facility includes a kitchen to serve 500+ as well as small and large rooms, a divisible auditorium, tables, chairs, a P.A. system and other amenities. The ESS team in Merritt has been involved in many important planning endeavors including an evacuation planning exercise pertaining to the Merritt Mountain Music Festival grounds, in cooperation with the RCMP (ESSABC, 2005).

5.4 Health Authorities and Hospitals

The Interior Health Authority (IHA) provides service to the City of Merritt and other communities within the Thompson Cariboo Shuswap Health Service Area (TCSHSA). The city falls within Local Health Area (LHA) #31 – "Merritt", one of nine LHAs within the Thompson Cariboo Shuswap Health Service Area. A general breakdown of health-related services is depicted in Figure 4. This map shows the Nicola Valley Health Care Centre (NVHCC) which is the only acute site within the Merritt LHA and one of five Level 1 Community Hospitals in the TCSHSA – the others are located in Clearwater, 100 Mile House, Revelstoke, and Lillooet (IHA, 2005).



Figure 4 – The relative location of health-related services within the City of Merritt
 (Source: BC stats, DMTI Spatial)

Acute care is defined as *treatment for a short-term or temporary injury or illness, administered frequently in a hospital or by nursing professionals*. The NVHCC has eight approved acute care beds (2002), eight acute care beds staffed (2004), and no on-site residential care beds (2004). Prior to 2001, 16 beds were available at this care centre after which cuts occurred. Debate has surrounded this situation including a recent discussion in a Debate of the Legislative Assembly in February of 2006 (BCHS, 2006). Nonetheless, there are alternative sources of community care in the Merritt LHA such as 31 beds for intermediate care at the Coquihalla House and 25 extended care beds at the adjoining Gillis House (City of Merritt, 2006c).

Other nearby health centres within the TCSHSA include St. Bartholomew's hospital in Lytton and the Logan Lake Health Centre, although these facilities are significantly less adequate than Royal Inland Hospital in Kamloops (88km) which is the primary acute care health facility for the TCSHSA, or Kelowna General Hospital (129km).

A major local health-related and environmental issue is that of air quality in the City. A recent study released by the Ministry of Environment (2006) states that smoke and dust are at concentrations that can negatively affect health of residents and degrade visibility. Sources of smoke include Tolko Industries' beehive burner, trucks, and various industrial operations, among other entities. This issue is a health hazard that is not in the scope of this HRVA and will not be assessed further, but should nonetheless be explored by the City.

5.5 Hazardous Materials (HazMat)

Hazardous materials are located at various locations in Merritt, and transported primarily by road transport since there is no direct rail transport into the Nicola Valley. The primary responsibility for on-site response to hazardous materials accidents rests with the spiller. However, local governments with their emergency services (fire, police, and ambulance) are responsible for operational support to the extent that expertise and resources are available and to the extent that the response functions are within their mandate.

CANUTEC, the Canadian Transport Emergency Centre of the Department of Transport, does not respond on site, but does offer communications and data support. CANUTEC can assist in the activation of industry emergency response plans such as TEAP, the Transportation Emergency Assistance Plan, operated by the Canadian Chemical Producers' Association or on-site assistance from other industry or government specialists (Transport Canada, 2005).

At the time of writing, there were approximately 15 members of the Merritt Fire Department trained to a HazMat Awareness level. Chief David Matteucci is trained to a Technician level, and has highlighted the concern that there is limited ability to respond to and mitigate any significant hazardous material incidents (Personal communication, Chief Dave Matteucci, November 27, 2006). There is also a lack of formal agreements with third party HazMat response services. Additional information regarding *in-situ* hazardous materials and dangerous goods transport is detailed in Section 6.2.3.

5.6 Radio Support

In preparation for a disaster event, it is important that radio resources are evaluated and frequencies are established to maintain adequate communications mediums. Doing so will provide options for first responders, EOC members, administrators and volunteers involved in the response effort and ensure constant communication.

The City of Merritt has prepared an Incident Radio Communication Plan which was in draft form in September of 2006. This basic plan outlines channels, frequencies and assignments of those involved in response, and outlines the specific uses of select frequencies. These frequencies are detailed in Appendix C. At the time of writing the City had recently established eight radios and a base station for dedicated emergency use, as well as six portables from MoFR to assist the City (Personal communication, Tom Lacey, January 2, 2007). Communications have been tested at the primary and secondary EOCs (i.e. City Hall and the airport respectively) and are ready for use (*ibid*).

There are amateur radio activities within the City of Merritt and also in nearby Logan Lake. At the time of writing, there was no formal agreement established between the City and local amateur radio clubs for emergency services support, although it was acknowledged that there is a locally active amateur radio group (Personal communication, Tom Lacey, November 14, 2006).

In addition, the Provincial Emergency Radio Communications Service (PERCS) is a group of dedicated volunteers that provide radio support. The nearest Regional Emergency Radio Station (VE7EFL) is at 1255-D Dalhousie Drive in Kamloops, with Ken McEachern acting as Station Manager at the time of writing (PERCS, 2006).

6.0 Hazards

This HRVA is designed to provide an assessment of the hazards that may present risks to the City of Merritt. These hazards may require site support through the Emergency Operations Centre.

In selecting these events for consideration, EmergeX acknowledges the potential, however small, that other types of emergencies may demand site support in the future. However, the following hazards are most likely to occur and may result in significant consequences. For an overview of all hazards considered for analysis in this HRVA, refer to Section 1.5.

Each hazard is examined to assess the relative risks to the community and to highlight opportunities for mitigation and coordinated response. In this analysis, extensive background and historical research was compiled and considered in the context of severity and likelihood to assess the hazard risk.

6.1 Risk Assessment

This section of the report examines the hazards that may impact people and property in the City of Merritt and the risk that each hazard event poses.

A quantitative assessment of the risk each hazard poses is summarized in the Risk Quantification Index (Appendix A). EmergeX has established a Risk Tolerance Boundary of 28 points based on an evaluation of an acceptable level of risk to the City of Merritt (Table 5). An example of this is also given in Section 1.3.

Table 5 – Risk Tolerance Boundary

People	Property			Environment	Economic & Social	Severity Limit	Likelihood Limit	Risk Tolerance
Injuries &	Critical	Lifelines	Property					
0	1	1	1	2	2	7	4	28
None	Temporary Disruption	Temporary Disruption	Multiple properties damaged	Resources damaged with short term recovery	Short term impact, medium costs		6-25 yrs occurrence	

No community has unlimited resources allowing them to plan for every hazard event possible. Therefore, the purpose of determining a Risk Tolerance Boundary is to determine which hazards are of the highest priority for mitigation. Hazards will be prioritized based on a comparison of their risk scores to the Risk Tolerance Boundary score.

Even though this report has determined a list of priority hazards, all hazards should be addressed from highest to lowest risk in the order of their priority. EmergeX believes that hazards above the Risk Tolerance Boundary warrant review and development of mitigation actions to reduce the risk to an acceptable level. For these hazards, mitigation measures should be planned in the near

future. For hazards below the Risk Tolerance Boundary, these should be addressed with an appropriate level of urgency.

6.2 Priority Hazards

A *priority hazard* is one that exceeds the EmergeX Risk Tolerance Boundary and that is worthy of further discussion due to its potential impact (severity * likelihood). These hazards do not necessarily pose an immediate threat, but should be managed to an acceptable level of risk prior to other hazards listed in Section 1.5. The following priority hazards are discussed in alphabetical order and not in order of risk ranking; please refer to the Risk Quantification Index (Appendix A) for specific scores.

6.2.1 Epidemic and Pandemic

Yearly epidemics cause serious illness and death, especially among those who have weakened immune systems due to age or underlying medical conditions. A pandemic is an epidemic that affects a very large geographic area and is often global.

Influenza is a common infection that affects large numbers of people annually. Among the general population, influenza is recognized as a very uncomfortable but self-limiting, and ultimately benign, illness. However, occasionally the virus mutates and becomes much more dangerous to humans. The last 100 years has seen three occasions of worldwide pandemic outbreaks of severe influenza. The worst of these pandemics was the infamous Spanish Flu of 1918 which killed an estimated 20 to 40 million people around the globe more than the casualties of the First World War. The Spanish Flu of 1918 is considered to be the most devastating pandemic in world history. According to the BC Centre for Disease Control (BCCDC), pandemics occur every 20 to 40 years. With today's global transportation networks, the potential for a pandemic to spread rapidly is high.

The BCCDC estimates that 20 to 50 per cent of the BC population will become infected with the next influenza pandemic, with 15 to 35 per cent becoming clinically ill. The rate of hospitalizations is estimated at 40 to 400 people per 1000 people. These estimates are based on the impacts of the 1957 and 1968 pandemics which were relatively mild when compared to those of the 1918 Spanish Flu. Actual rates of the next pandemic may be significantly higher and it should be noted that disease agents other than influenza, such as SARS, may also be the cause of a pandemic.

Due to the unusually high number of hospitalizations during a pandemic, local health authorities will likely be overwhelmed. Municipalities should work with local health authorities to create contingency plans on how they will handle the surge in patients. In addition, municipalities will need to continue providing essential services and support to residents. As employees of the City may also become infected and be unable to work, contingency plans to operate with a reduced workforce are very useful.

Due to the widespread nature of pandemics, neighbouring communities may not be able to provide assistance regardless of the presence of mutual aid agreements. Due to the City's geographic characteristics, the disease may be detected in cities higher up on the urban hierarchy (i.e. Vancouver) before it arrives in Merritt. This may provide some advanced warning to the City; however, with today's transportation networks, the mobility of today's population and numerous

points of access to the City, this should not be relied upon, especially during high season for visitors.



Figure 5 – Predicted migration of Avian Influenza to Canada

Avian Influenza has recently become an increased concern for many, especially in areas with significant poultry farming operations. The H5N1 strain of the Avian Influenza is one of sixteen varieties of the virus, the only one that has shown ability to pass from one human to another. Figure 5 suggests, based on expert opinion, that migration of the bird flu is likely to occur through Canada, potentially affecting western Canada including the City of Merritt. Although the most dangerous strain of the virus has been most active outside North America, the virus has been detected in Canada, including a strain of H5 found on various commercial farms in British Columbia (CBC News, 2006a).

West Nile Virus (WNV) is another concern for the City of Merritt, but it is important to note that WNV activity has not been reported anywhere in British Columbia as of the time of writing (BCCDC, 2006). However, it should also be noted that historically there have been many confirmed cases and even deaths attributed to WNV within Canada. In 2006 it was reported that there were 127 human cases of West Nile Virus reported; 24 in Alberta, 11 in Saskatchewan, 50 in Manitoba and 41 in Ontario (PHAC, 2006). In 2003, 14 people died due to information for residents West Nile-related illnesses (CBC News, 2006b). Of all large land mammals, horses are particularly susceptible to West Nile virus. In 2003 in Canada, a total of 445 confirmed cases of West Nile virus in horses were reported to the Canadian Food Inspection Agency.

There have been confirmed and/or probable cases of infected horses in Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan and Alberta, but none in British Columbia (Public Health Agency of Canada, 2005). The City of Merritt has made efforts to keep mosquito control information transparent to the public, which is a necessary step in the management of mosquito-borne viruses

like WNV. In 2005, the City consulted a third party to outline a comprehensive Mosquito Control Program, which among other accomplishments provided control services to residential and rural property owners, businesses, parks, campgrounds, and other outdoor recreational and tourist facilities including the Merritt Golf and Country Club and the Mountainfest grounds (D.G. Regan & Associates, Ltd., 2005). The presence of local larvacide and awareness programs has helped lead to lower cases throughout Canada.

Due to current predictions associated with the next pandemic and its likely severity (among other factors), pandemic outbreak (particularly influenza) is considered a priority hazard for the City of Merritt.

6.2.2 Pipeline Explosion and Leak

The risk of pipeline rupture and subsequent explosion is a concern within the City of Merritt. A major high pressure pipeline runs across the eastern boundary of the city and has various commodities that run through it. Gas pipelines often run in close proximity to important infrastructure such as the Public Works Yard as seen in Figure 6, and have been dug up accidentally in the past. In June of 1999, a natural gas line was dug up which resulted in a gas leak in a populated area (near 1749 Menzies Ave).



Figure 6 – Gas pipeline in the City of Merritt near the Works Yard

The pipeline rupture spurred an evacuation of the immediate vicinity with the RCMP, BC Gas (formerly) and the Merritt Fire Department responding (PEP, 1999). In addition to pipeline rupture hazard, fuel storage and hazardous materials are also prevalent in the City, which is discussed in the next section.

6.2.3 Hazardous Materials Accident— In-Situ and Dangerous Goods Transport

In terms of in-situ HazMat storage, there are various gas and fuel sites located around the city that pose a potential threat. While significant propane plots have been tracked and recorded, there are other instances of HazMat storage not discussed here. Merritt Fire-Rescue has compiled evacuation buffer maps for five main locations housing propane within the City of Merritt, along with additional information pertaining to these sites. Table 6 outlines statistics regarding these key

sites, including minimum evacuation buffers. For detailed evacuation maps of each site please refer to the specific documentation contained within the Merritt Emergency Plan binder.

Table 6 – Major propane holdings within the City of Merritt

Site Name and Location	Volume	Fire Ball Radius	Exclusion Zone ³	Minimum Evacuation	Preferred Evacuation
Clean Machine 2026 Houston St.	8,000L	44m	176m	661m	1323m
PetroCan 3591 Voght St.	20,000L	60m	230m	900m	1750m
Super Save Gas 2349 Nicola Ave.	16,000L	55m	220	850m	1600m
School Board Office 1550 Chapman St.	8,000L	44m	176m	661m	1323m
Husky Truck Stop 3999 Airport Rd.	20,000L	60m	230m	900m	1750m

(Merritt Fire-Rescue, 2006)

The contain numerous storage mill that and is classified industrial as operations HazMat. Some that exist of these within businesses the City of may Merritt also receive may also shipments classified as dangerous goods, although a detailed assessment has not taken place. Tracking of dangerous goods shipments through placards has been done in the past to a minor extent, but there is room for improved tracking on this front to improve detailed knowledge of transport through the City.

A rupture of fuel tanks by way of accident or malfunction could lead to an explosion, HazMat spill or subsequent fire. In addition, the threat of WUI fire as discussed in Section 6.2.8 is an additional concern relating to *in-situ* hazardous material storage and the protection of these vulnerable plots. Figure 7 shows the Shell bulk fuel cardlock located on Douglas St, housing a significant fuel load.

³ An exclusion zone is defined here as the area buffer that should be free of firefighters for safety reasons



Figure 7 – Shell bulk fuel cardlock housing diesel and gasoline (Douglas St.)

A major accident involving a vehicle transporting dangerous goods can necessitate the evacuation of surrounding communities and homes. Depending on the location of an accident, access and evacuation may be impaired and alternative means of moving people and resources between communities and municipalities should be considered. If evacuation is not possible due to incident location or type of incident (i.e. ammonia spill), Shelter in Place (SIP) options should be considered. In such instances, local residents must be informed as to what SIP means, how to do it and how to access situation updates on response and recovery.

The majority of dangerous goods transport serving or passing through Merritt occurs on Highway 5, Highway 5A (Voght St.), and Highway 97C which merges into Nicola Ave. At the time of writing, an extensive inventory of dangerous goods and *in-situ* hazardous materials had not been compiled or tracked by local authorities. Nonetheless, there have been reports of a wide variety of dangerous goods passing through the city when placard checks have taken place. Among the confirmed substances transported into the City are ammonia and chlorine, that are delivered to the Nicola Valley Memorial Arena located at 2075 Mamette Ave.

6.2.4 Flood

For the purposes of this report, a **minor** flood is defined as a flooding incident that involves a single or small number of dwellings in a small geographical area and is confined to a single jurisdiction.

Minor, localized flooding is primarily caused by poor or blocked drainage, usually associated with heavy precipitation. Areas that depend on pumps and pump stations to assist with drainage can experience local flooding when water inflow surpasses the pumps' capacities. In addition, storm drains, drainage ditches, and natural drainage channels can become blocked by sediment, debris or ice causing local flooding.

Much of Canada is affected by spring freshet events. This occurs when huge quantities of water are released from snow and ice pack (or when heavy rainfall occurs) as temperatures warm in the spring.

A **major** flood is defined as a flooding incident that extends over a large geographical region, normally expanding outside the boundaries of a single response agency and its mutual aid agreements, and normally requiring a coordinated response from multiple agencies and/or jurisdictions.

The possibility of major flooding is a reality in the City of Merritt, with significant floodplains existing around the Coldwater and Nicola Rivers. There is currently 272 hectares that are potentially at risk, with the Nicola River affecting 190 of these hectares.

Various minor and major floods have occurred in recent past, including a significant flood event in June of 2002. During this spring freshet event, various homes were put at risk while over 19,000 sandbags were deployed in an attempt to lessen the impact, with some sections being very effective. Values protected during this response effort included ranch and residential houses, apartment buildings, major roadways, trailer homes, condominiums, commercial and recreational property (*ibid*).

Although the City of Merritt has a significant inventory of sandbags, City Council recognizes the need to pursue proactive rather than reactive solutions to future flooding possibilities. Flood management possibilities relating to planning and preparedness include the following:

- Ensuring the efficient and active monitoring of river levels and fluctuation potential, especially concerning seasonal freshet events
- Reviewing flooded areas of the past and determining areas particularly vulnerable to ice jam-induced flooding and overflow
- Communicate flood mitigation practices with the community while including them in the decision-making process

The City of Merritt has undertaken a detailed Flood Preparedness/Response Plan that was past the first draft stage at the time of this HRVA writing. Discrete action plan steps are outlined based on river flow rates and depth, corresponding to various levels of alert and ice jam potentials (City of Merritt, 2006d).

Threat areas were also mapped with discussion of homes, people and infrastructure at risk. Appendix E outlines these five designated zones within the floodplain that are at risk. The approximate number of people at risk is depicted in Figure 8. A Flood Management Checklist has also been created with incident action plan items simplified to guide the process during a flood event. The following paragraphs provide some highlights of the Flood Preparedness/Response Plan; for further details please refer to the original plan.

Zone 1 (Main Street) contains an estimated 11 homes and 45 residents as well as the City Works Yard. Ice overflow and water crossing banks is a likely if any major jams occur, with major pressure points happening at the bridge across Main Street, the next corner and the junction of the Nicola and Coldwater Rivers (*ibid*). The diversion area will cross two streets, affecting ingress and egress. The plan also notes that warning signs should be posed on the paved hiking trail that runs along the river.

Zone 2 (Collettsville) contains an estimated 75 homes and 300 people, with the City Works Yard sewage ponds and treatment sites potentially impacted. The pressure points are similar to that of Zone 1, as are the safety issues since these zones are geographically opposite of one another.

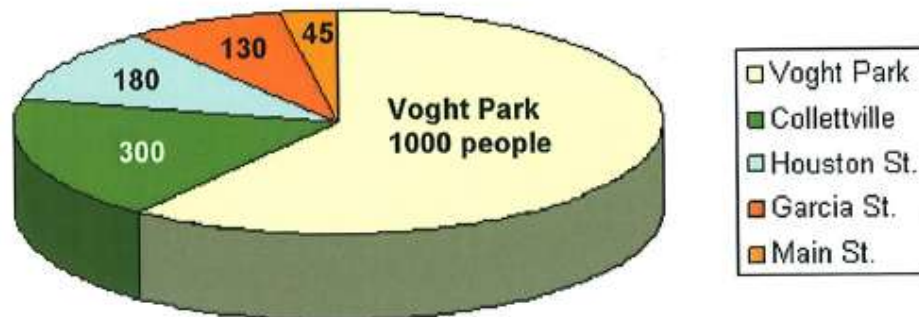


Figure 8 – Estimated number of people at flood risk in each Threat Area as defined by the City of Merritt

Zone 3 (Voght Park) is a 20.7ha area with an estimated 110 homes and 1000 people residing there. Dikes have received some work in the area and there is an ice bypass in place across the park. Ice is expected to breach river banks here in a short period of time with any significant river blockage (City of Merritt, 2006d). Zone 4 and 5 are located in relatively close proximity to one another, with the Houston Street bridge being a major pressure point in the area. Previous ice jams have affected this area with ice and water being pushed into the trailer park (Riverside Mobile Homes).

At the time of writing, the City was affected once again by ice jams with the threat of flooding. On November 28, 2006 an ice jam at the confluence of the Coldwater and Nicola Rivers prompted the City to deploy sandbags to the end of Garcia Street to protect mobile homes in the area (PEP, 2006).

6.2.5 Ice Jam

Throughout Canadian history there has been significant damage incurred and many major flooding events that can be attributed to ice jams. Ice jams are an accumulation of broken river ice in a narrow channel, frequently compromising flows and producing local floods during break-up events. While direct damage to infrastructure from ice jams is not a common concern, ice jams remain a priority due to the flood tendencies that have arisen in conjunction with ice jam events.

There is a significant history of ice jams occurring in the City of Merritt on the Coldwater River, with many ice jams events leading to flooding, a common corollary effect of this hazard. A particularly severe flood event that occurred in Merritt as a result of an ice jam took place in February of 1991, causing an estimated CAD \$1,000,000 in damage to the City. The area surrounding the Main Street Bridge has experienced a number of ice jams in the past leading to overbank flooding, including events in 1962, 1968, 1979, 1980 and 1991 (Beltaos & Doyle, 1996).

A recent ice jam affecting Merritt residents occurred on Christmas Day in 2005 on the Coldwater River. While the ice jam itself was not a danger to infrastructure, it caused a rise in water levels and banks were subsequently breached, with homes on Garcia Street and Clark Road impacted. It was

determined that approximately 50 homes were at risk but no evacuation order was given as water levels receded. Responders included staff from the Ministry of Environment, the TNRD and the City of Merritt among others (PEP, 2005).

Following the major ice jam and flood event of 1991, a detailed study was released in 1996 which analyzed channel morphology, winter hydrology, human and environmental considerations to assist the City of Merritt in planning for mitigation measures. After a simulation model was completed, it was determined that the common practice of placing dikes at the river banks is not a satisfactory solution because it can aggravate ice jam flooding and related damages (*ibid*).

An alternative and preferred solution was to provide ice storage on the floodplain by using setback dikes. The advantages of this include: reduced dike height and length, reduced or eliminated flood-fighting costs, enhanced wildlife habitat, and the possible increase in land value adjacent to the dike (Beltaos & Doyle, 1996). Although this study is now dated, it provides a solid background to the local mechanics of ice jams affecting the Coldwater River in Merritt. A similar study focussing on present-day hotspots is recommended to improve decision support for planning and mitigation purposes.

Additional discussion involving pressure points, ice jams and ice jam-related flooding can be found in Section 6.2.4 - Flood. These events are inherently linked as many ice jams have led to localized flooding within Merritt in the past.

6.2.6 *Mass Crowd Event Hazard*

Merritt is known among other things for its country lifestyle and its yearly music festival and has been branded as the Country Music Capital of Canada. Every year in July thousands of people flock to the City and the festival grounds to enjoy one of the biggest music festivals in North America, the Merritt Mountain Music Festival (Mountainfest). On average, estimates of crowd size during peak festival times are between 100,000 and 150,000 persons.

Active Mountain Entertainment Corp. is the organizing body and owner of the festival grounds land, which is geographically located outside the administrative boundaries of the City of Merritt. Nonetheless, the City is very much involved with many aspects of the festival and must deal with accommodating the tremendous influx of people and their activities during the Mountainfest. Although there is a significant amount of economic benefit gained by the City of Merritt from the Mountainfest, the City must also deal with many of the negative matters and social disturbances that accompany the festivities.

Each year there are numerous people detained by Mountainfest security and local RCMP for infractions such as (but not limited to): impaired driving, assault, public disturbance, property damage, theft and other criminal activity. Additional hazards also pose a threat to visitors of the festival grounds and residents of the City.

The Merritt Fire Department has highlighted some concerns relating to the potential for WUI and structure fire and the enormous risk this could pose to visitors and staff of the music festival, and also to the City itself. The tremendous amount of propane used and stored throughout the festival grounds is one of many concerns relating to fire hazard. Recreational Vehicle (RV) fires have occurred in the past and have been controlled largely without further incident. Nonetheless, if a fire was to rage out of control either from internal sources or sources external to the festival

grounds, the movement of thousands of people would prove very challenging and must be properly planned for.

In addition to the dangers potentially posed from external threats, the possibility of a riot incident occurring on festival grounds or in the City itself is also a reality. With the number of minor disturbances that have occurred in the past and the amount of alcohol consumed, the potential for a minor event to surge into a full scale riot is not an unreasonable possibility.

The report titled *Emergency Preparedness Guidelines For Mass, Crowd-Intensive Events* released by the Office of Critical Infrastructure Protection and Emergency Preparedness (Government of Canada) includes some useful due diligence steps in preparation for a disaster at a large event such as Mountainfest. A selection of the best practices highlighted in the document are as follows:

- Do law enforcement agencies have additional staff on standby or recall should the event require an immediate increase in police services?
- Will a site plan, incorporating access roads, pathways, landmarks spectators, performers and vendor areas be available (to the appropriate authorities)?
- Does the local fire department / rescue services have additional resources in place and plans to activate needed equipment at any time?

A Fire Safety Plan has been developed specifically for the Merritt Mountain Music Festival (MMMMF) and takes into consideration preparedness, prevention and emergency evacuation among other considerations. A strong component of this plan is Part 10 which is dedicated to the inspection, maintenance and testing of the standpipe system, ensuring means of egress, and ensuring fire flow from a dedicated reservoir, along with other priorities (Active Mountain Entertainment, Corp.). These precautions are essential to ensure the safety of all visitors.

It is clearly stated in the plan that evacuation objectives will be met simply without evacuation control officers or the fire safety director's involvement in evacuation control. Additional human resources dedicated to evacuation control are recommended, but may not be achieved due to the resource limitations. While some "safe area" guidelines are given in this plan, it is recommended that a more detailed evacuation plan is pursued and communicated to staff involved in a potential evacuation. The plan should also acknowledge a worst case scenario, such as a mass evacuation required due to interface fire, for example.

In addition, local concerns surrounding the Mountainfest Fire Safety Plan have been centred on the quality and frequency of drills that test the plan itself. While the Merritt Fire Department is invited to observe annual drills and give advice, it is recommended that a full review of the NIMMF Fire Safety Plan is scheduled prior to the 2007 festival and that the Merritt Fire Department has full input into potential improvements. This meeting will also serve to communicate updated priorities to new and existing staff members involved with festival emergency planning endeavours.

6.2.7 Pest Infestation

The Mountain Pine Beetle (*Dendroctonus ponderosae*) epidemic has infected much of British Columbia, affecting more than 8.7 million hectares of forest in British Columbia (2005). The Mountain Pine Beetle attacks primarily Lodgepole pine, which is present in the City of Merritt and

has been affected in certain areas. Figure 9 depicts the relative extent of Mountain Pine Beetle attack throughout BC, which encompasses the City of Merritt and surrounding areas.

The Western Pine Beetle (*Dendroctonus brevicomis*) is also aggressive in its attack, affecting primarily Ponderosa pines which are found mostly on the Lower Benchlands of Merritt. The City has undertaken a strong campaign to manage pine beetle infestation while simultaneously modifying fuel load for wildland fire prevention.



Figure 9 – Primary Mountain Pine Beetle attack areas within British Columbia

Merritt is surrounded by pine that continues to be affected to a large degree by both the Western Pine Beetle and the Mountain Pine Beetle. As stated in the *Merritt Fire and Forest Update* (2005), there are a large number of residential lots with large Ponderosa pine, and the beetle infestations have encroached upon developed areas.

An area that has received a lot of attention is that of the Bench area, where fuel has been modified and infested trees removed. The main goals here surrounded the management of the pine beetle, spacing the stand, and reintroducing fire to reduce surface fuels. Maintaining 50% of the basal area was a component of the plan, and prescribed burning also too place.

Management and treatment of Mountain Pine Beetle affected areas is set to continue around the community with less of a focus on the Bench area in the future. The pest plan is available in the *Bench Fuel Modification Review* which lays out action items until December 2007. Verbenone bait

pouches are also offered by the City of Merritt, which are a pheromone that fools pine beetles into thinking that a tree is already occupied. These pouches are effective for one season. Proactive management has been effective in Merritt, as the City continues to confront this infestation aggressively.

6.2.8 Snowstorm

In Canada, winter storms and excessive cold claim more than 100 lives every year (Environment Canada, 2002). However, blizzards are considered relatively rare throughout the City of Merritt. White-out conditions occur in extreme cases and reduce visibility to such a level that even pedestrians can easily become disoriented.

There is one main weather station present in Merritt which meets World Meteorological Organization (WMO) standards – the Merritt STP station. By viewing the weather station data for the City it is evident that extreme temperatures and snowfall have reached significant levels in harsh winters of the past (see Table 7). Significant weather events in Merritt have produced 40+ centimetres of snow in the past, with the worst being a 42cm snowfall on December 29, 1996. The snowfall average for the City of Merritt in the month of December exceeds 25cm, showing the consistency of snowfall events.

Frigid temperatures are also not uncommon in the City, where they maintain an average of -8.6 oc during the month of January. The City of Merritt has also seen significant extreme drops in the past, when temperatures have reached an all-time low of -42.8 0C. This highlights the potential for extreme cold weather within the city which may lead to corollary hazards such as ice jams.

Table 7 – Winter Climate Normals 1971-2000: Temperature and Snowfall

CLIMATE VARIABLES	MERRITT STP Station – 50 06N 120 48W			
	Nov	Dec	Jan	Feb
Dail Minimum Temperature	-3.2	-7.7	-8.6	-5.6
Extreme Minimum Temperature (°C)	-32	-43	-40	-32
	1985	1968	1969	1986
Snowfall average (cm)	13	25.3	23.2	12.8
Extreme Daily Snowfall (cm)	21	42	31.2	18.5
	1996	1996	1971	1975

(Source: Environment Canada, 2004 – Canadian Climate Normals)

Normally, snowstorms vary from light dustings of snow to accumulations of several metres. Unlike blizzards, they are not associated with high winds. Snowstorms can impact many aspects of the region including transportation, power lines and communications infrastructure, and agriculture. In particular, the wide distribution networks of hydroelectric, communication lines and towers can be affected by heavy snowfall. Accumulation of snow on these lines may cause line breakage, disrupting services and power to wide areas.

An important consideration for the City of Merritt regarding snowstorms is the potential for this type of event to cripple transportation routes. Main thoroughfares in the City of Merritt are discussed in Section 3.3.4 – Transportation.

Emergency response in the form of police, fire or ambulance may be seriously impeded if these routes or infrastructure are blocked in the event of a severe winter storm. Taking into account the City's ability to manage severe weather events and the potential impact it may have on the City, a snowstorm is considered a priority hazard.

6.2.9 Structure Fire

Another hazard that has been deemed a priority for the City of Merritt is structure fire. Various callouts each year are attributed to structure fire within the city. These fires have the potential to spread rapidly in areas of steep grade such as in the Bench area. An example of a recent structure fire (at the time of writing) was at the Trade Winds Terrace, with 60 people displaced and smoking materials concluded as the cause of the fire. There are also old buildings within the city that are cause for concern such as the Coldwater Hotel which was constructed in 1908.

Merritt does have bylaws set in place that require new developments to be sprinklered and renovations that encompass 60% or more of the building must also be sprinklered. Mill fires are also a potential reality in Merritt, and are highlighted as a major concern here due to the vast economic and environmental damage potentially caused by this type of fire. In June of 1997, a fire in Merritt at the Tolko Industries mill caused an estimated CAD \$25,000,000 in losses (CCFMFC, 1997), with no injuries or deaths occurring but at least 250 employees were put out of work (MoFR, 2006).

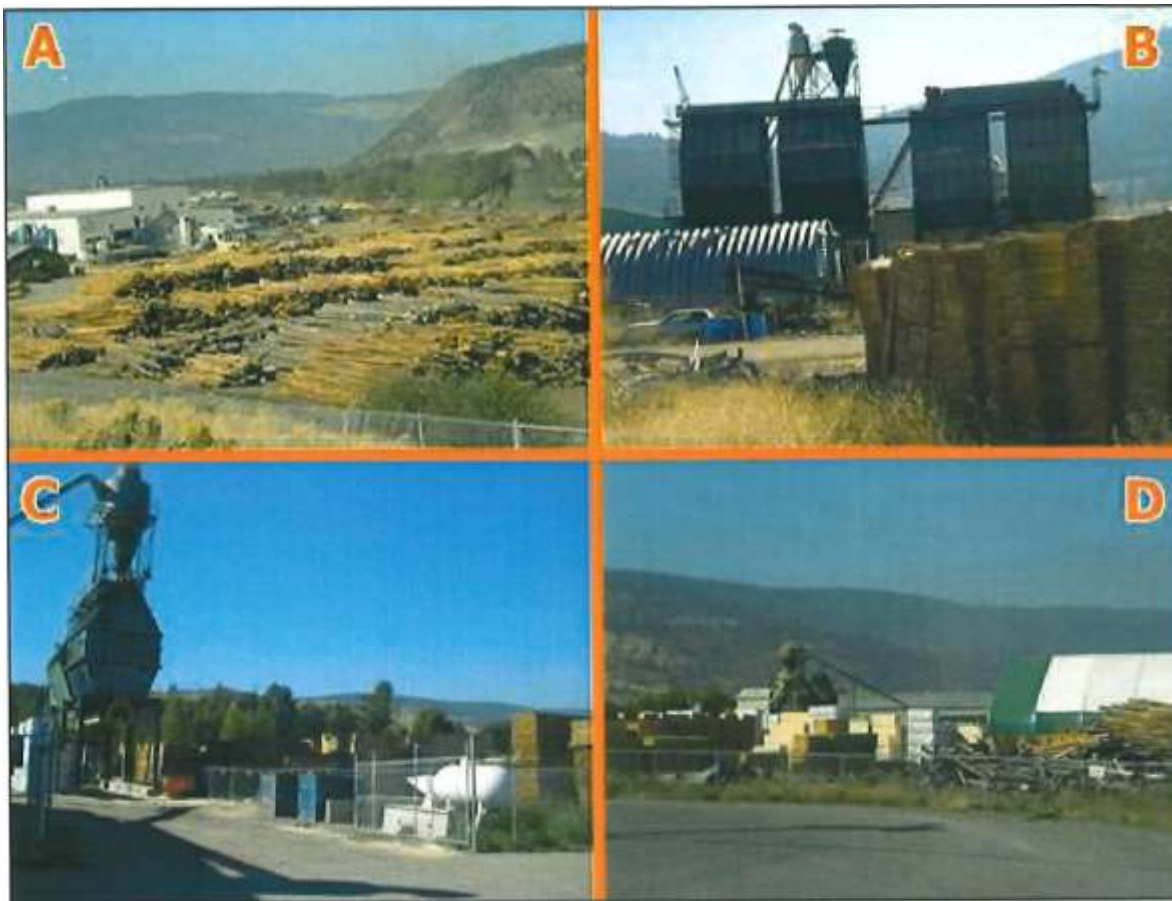


Figure 10 – Tolko Industries, Aspen Planers and Ardeu Forest Products are among the major mill operations within the city.

The significant fuel load present at mill sites, coupled with industrial activity such as welding and mill waste burning can potentially lead to a fast-spreading and devastating fire. Figure 10 shows the general prevalence of mills within Merritt.

Figure 10(A) is Tolko Industries, the largest of the mill sites which continues to use a beehive burner on site (which can be seen in the picture). Other timber manufacturing sites include Pine Ideas, located at 2890 Pooley Ave. who specialize in shelving and storage. This site is depicted in Figure 10(C), which also has significant propane storage.

6.2.10 Wildland Urban Interface (WUI) Fire

Abnormally hot, dry weather and excessive fuel loading often make forest areas particularly vulnerable to lightning strikes and human carelessness. Once burning, a forest fire can spread quickly due to high winds and easily overwhelm the capacity of local response agencies. Aside from the environmental and economic impact, fires become particularly devastating when they encroach on human settlements and critical infrastructure. When this occurs, they are considered Wildland Urban Interface (WUI) fires and can be extremely destructive.

The British Columbia Firestorm of 2003 made the risk of WUI fires clear to communities across British Columbia. In July and August, over 2,500 fires burned throughout the interior of the

province causing the loss of 344 homes and businesses and the evacuation of 45,000 people. Approximately 260,000ha of forest were destroyed. The total cost of the Firestorm was estimated to be CAD \$700 million (Filmon, 2004). The City of Merritt's fire department was also one of nearly 130 fire departments and contractors that responded to the call for help from the Office of the Fire Commissioner in 2003 (OFC, 2003).

Within the City of Merritt there are numerous areas are sites that should be highlighted as potentially vulnerable to the threat of Wildland Urban Interface (WUI) fire. The Bench area of the city is particularly vulnerable and this has been recognized by City Council. In 2005, an Interface Fire Safety Plan was undertaken. Work continues to be been done to mitigate against WUI hazard in the Bench area, including the reduction of fuel load.

The practices undertaken in the Bench area relating to the Mountain Pine Beetle (MPB) and Western Pine Beetle also work to simultaneously assist with WUI fire mitigation. One example of this includes the buffering of tree stands to create gaps using selective clearing methods in an attempt to control the infestation and movement of the MPB. These gaps also help in slowing the rate of spread if and when a wildland fire was to occur. This is very important, as new development on the Bench continues to take place on a steep grade.

Another example is the selective clearing of dead, beetle-infested stands to assist in further infestation. This helps to reduce the fuel load of red- and grey-stage pine on the forest floor and subsequently minimize ignition threat.

The *Merritt Fire and Forest Update* released in April of 2005 mentions that current forest within Merritt has become denser and contains high volumes of surface, ladder and crown fuels. This can often make prescribed burning difficult, making harvesting a more viable option in some areas. Another important consideration is that people are responsible for more than 50% of the fires each year, making communication and awareness programs a continued priority. Increasing community awareness can assist in greatly reducing accidental ignition while also reducing fuel load and educating the public on mitigating practices. One example of raising awareness in the community has been the posting of the *FireSmart Homeowner 's Manual* on the City of Merritt website, keeping useful information transparent to the public.

In 2007, the City is pursuing priority fuel breaks and is hoping to improve the system o considerably by May 1st (Personal communication, Tom Lacey, January 8, 2007). In addition, there has been recent work done concerning Wildland Urban Interface fire threat assessment. As seen in Appendix D in the *WUI Fire Threat Summary Table*, a rating of 57 has been assigned for the 5km zone distinguished as the Interface Planning Zone which surrounds the City of Merritt. The score of 57 corresponds to a *High to Extreme* threat rating based on the criteria that includes access, risk (fire occurrence), fuel load and type, vulnerability (values in area) and historic fire behaviour and potential.

Map 1 in Appendix D outlines the fire planning zones, distinguishing between *Planning, Emphasis* and *Action Zones*. The *Action Zone* is the area marked by red dot fill which highlights the spatial extent of first priority WUI fire management. The total assessed area spans to the 5000m mark which is shown as yellow on the map. Map 2 shows the various areas of spotting potential based on fuel type, with significant patches evident north, west and southeast of the City.

It is important for this spotting to be mapped with a large buffer since the combination of prevailing winds and steep topography surrounding Merritt lends itself to quick advance during a wildland fire incident.

An additional component of the wildfire safety planning was to map forest condition class which can be seen in Map 3 in Appendix D. Here it can be noted that there are similar patches rated high which are marked in red to the north, west and southeast from the City Centre. The fourth map in Appendix D shows a number of historical fire events including the extent of the Lily Lake fire of 1999 that burned approximately 110ha, largely due to strong winds. Lily Lake is located just 14km south of Merritt, so there was potential for the City to be impacted during this event. While the resolution of Map 4 is not ideal, it gives a good overview of fire locations in the past as well as lightning strike occurrences which have shown a general tendency to strike in the northwest.

7.0 References

- Active Mountain Entertainment, Corp. Fire Safety Plan. For: Merritt Mountain Music Festival, Merritt B.C.
- British Columbia Hansard Services (2006). "Official Report of Debates of the Legislative Assembly." Thursday, February 16, Afternoon Sitting. Vol. 6:4. Retrieved on October 23, 2006 from: <http://www.leg.bc.ca/hansard/38th2nd/h60216p.htm#2290>
- British Columbia Search and Rescue Association (2005). "Group Profiles." Retrieved on November 28, 2006 from: <http://www.bcsara.com/profiles.php>
- British Columbia Stats (2005). Municipal Population Estimates. Service BC, Ministry of Labour and Citizen's Services: December.
- Canadian Broadcasting Corporation (2006a). "Avian flu detected on more B.C. farms." April 11, 2006. Retrieved May 1, 2006 from: http://www.cbc.ca/story/canada/national/2004/04/10/birdflu_040410.html
- Canadian Broadcasting Corporation (2006b). "West Nile Virus: Facts – How Common Is West Nile Virus?" Retrieved December 17, 2006 from: <http://www.cbc.ca/news/background/westnile/>
- Chandler, R. (2006). Communication Priorities for Avian Flu Preparedness. 3n National Notification Network. Webinar – August 2006.
- City of Merritt (2002). Flood Report. Merritt Fire Zone, 7 June 2002.
- City of Merritt (2005). "Emergency Operations Centre." Municipal Emergency Plan. Updated March, 2005.
- City of Merritt (2006a). "Doing Business, Infrastructure: Airport." Retrieved on October 25, 2006 from: <http://www.merritt.ca/infrastructure.php>
- City of Merritt (2006b). "Doing Business, Infrastructure: Utilities." Retrieved on October 25, 2006 from: <http://www.merritt.ca/infrastructure.php>
- City of Merritt (2006c). "Living in Merritt – Community Services." Retrieved on November 2, 2006 from: <http://www.merritt.ca/community.php>
- City of Merritt (2006d). Merritt Flood Preparedness and Response Plan. Last updated December 10, 2006 - Draft 2.
- Council of Canadian Fire Marshals and Fire Commissioners (1997). "Annual Report, 1997, Fire Losses in Canada." Retrieved on October 24, 2006 from: http://www.ccfmfc.ca/stats/en/report_e_97.pdf
- D.G. Regan and Associates, (2006). City of Merritt – 2005 Mosquito Control Program Summary Report. File No. 0205.

- Emergency Social Services Association of British Columbia (2005). Regional Reports – Central. Community mESSAges, Vol. 13, Issue 3. Fall, 2005.
- Environment Canada (2004). Flooding events in Canada – Quebec. The Management of Water. Retrieved on November 1, 2006 from: http://www.ec.gc.ca/WATER/en/manage/floodgen/e_que.htm
- Government of Canada (1994). Emergency Preparedness Guidelines for Mass, Crowd – Intensive Events. Office of Critical Infrastructure Protection and Emergency Preparedness, Minister of Public Works and Government Services.
- Interior Health Authority (2005). Merritt Local Health Area Profile. August 2005.
- Merritt Fire-Rescue (2006). Memorandum – Propane Tanks (8,000 litres to 20,000 litres) in the City of Merritt.
- Ministry of Environment (2006). Air Quality in Merritt, British Columbia. BC MOE Thompson Region, Environmental Quality Section, Kamloops. March 2006.
- Ministry of Forests and Range (2005). Merritt Innovative Forestry Practices Agreements. Rationale for Increase in Allowable Annual Cut (AAC) Determination. Zacharatos, T.P., Regional Manager – South Interior Forest Region.
- Ministry of Forests and Range (2006). "Fire Season Reviews." 1997 Notable Fires. C) Retrieved on October 24, 2006 from: <http://www.for.gov.bc.ca/protect/reports/FireSeasonReview.htm>
- Provincial Emergency Program (1999). "Incident Summary for the Week of June 14– June 20, 1999. Retrieved on November 28, 2006 from: http://www.pep.bc.ca/incidents/incidents-1999/06_14-20.html
- Provincial Emergency Program (2005). "Weekly Incident Situation Report, Period: 19 Dec 05 to 25 Dec 2005." Flood. Retrieved on November 10, 2006 from: http://www.pep.bc.ca/incidents/incidents-2005/Incidents-12_19-25.pdf
- Provincial Emergency Program (2006). "Weekly Incident Situation Report, Period: o 27 Nov 06 to 3 Dec 06." Flooding. Retrieved on January 8, 2007 from: http://www.pep.bc.ca/incidents/incidents-2006/Incidents-11_27-03.pdf
- Provincial Emergency Radio Communications Service (2006). "VE7KAZ – Central Region Provincial Regional Emergency Operations Centre." Retrieved on November 23, 2006 from: http://www.percs.bc.ca.ORG_VE7KAZ.htm#Station%20Manager
- Public Health Agency of Canada (2006). "West Nile Virus Monitor: 2006 Human Surveillance." Retrieved on January 8, 2007 from: <http://www.phac-aspc.gc.ca/wnvwn/mon-hmnsurve.html>
- Urban Systems Ltd. (2005). Merritt Emergency Plan for Potable Water.
- Statistics Canada (2001). "2001 Community Profiles – Merritt."

Wade, L. (2005). Preparing Early, Acting Quickly: Meeting the Needs of Older Americans During Disasters. National Association of Area Agencies on Aging. Testimony from October 5, 2005 before the U.S. Senate Special Committee on Aging.

Wikipedia (2006). "Merritt, British Columbia". Retrieved on October 3, 2006 from:
http://en.wikipedia.org/wiki/Merritt%2C_British_Columbia

Appendix A – Risk Quantification Index for the City of Merritt

Hazard	Fatality and Injury	Response & Recovery Facilities	Critical Infrastructure	Property Damage	Environmental Impact	Economic and Social	Severity Total	Likelihood	Aggregate Score
Aircraft Crash	10	0	0	1	1	1	13	1	13
Animal Disease	5	0	0	0	0	2	7	2	14
Avalanche	0	0	0	1	1		2	5	10
Blizzard	0	0	0	1	1	1	3	4	12
Dangerous Good Accident	5	0	1	1	4	2	13	4	52
Debris Avalanche & Flow	0	0	1	0	1	1	3	4	12
Drought	0	0	0	0	2	1	3	3	9
Earthquake	0	0	0	1	0	1	2	3	6
Epidemic and Pandemic	15	2	2	0	0	3	22	3	66
Erosion and Sedimentation	0	0	1	1	1	1	4	4	16
Flooding	0	1	4	4	2	3	14	5	70
Hailstorm	0	0	0	1	1	1	3	3	9
Hazard Materials – In Situ	5	0	1	1	3	2	12	4	48
Heat Wave	1	0	0	0	2	2	5	2	10
Ice Jam	0	0	1	1	2	2	6	5	30
Ice Storm	0	1	1	1	0	0	6	1	3
Landslide	0	0	1	1	1	1	4	3	12
Land Subsidence	0	0	1	1	0	0	2	2	4
Lightning	0	0	1	0	0	1	2	6	12
Mass Crowd Event Hazards	10	1	1	2	1	2	17	3	51
Pest Infestation	0	0	0	0	3	4	7	6	42
Pipeline Explosion and Leak	0	0	0	1	2	2	5	4	20
Plant Disease	0	0	0	0	2	1	3	3	9
Power Outage	0	1	1	0	0	1	3	6	18
Rock Fall	0	0	1	1	1	0	3	4	12
Snowstorm	0	1	1	2	1	1	6	5	30
Structural Collapse	5	0	0	1	0	1	7	3	21
Structure Fire	0	0	3	3	1	1	8	6	48
Volcanic Ash Fallout	0	0	0	0	2	2	4	1	4
Water Contamination	5	0	1	0	1	2	8	3	24
Wildland Fire	0	0	1	0	2	1	4	6	24
Wildland Urban Interface Fire	10	1	4	4	3	3	25	5	125

* All ratings are based on a credible damage scenario, not a worst case scenario