

KNOW YOUR HAZARDS CITY OF ABBOTSFORD

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HAZARDS

The Emergency Planning Committee has identified 14 types of hazards that could affect Abbotsford to an extent that might require site support through an Emergency Operations Centre. These are listed alphabetically in Figure 23.

Figure 23. Hazards that Could Affect Abbotsford

HAZARDS MAY REQUIRE EMERGENCY OPERATIONS CENTRE	HAZARDS NOT LIKELY TO REQUIRE EMERGENCY OPERATIONS CENTRE
<ol style="list-style-type: none"> 1. Atmospheric Hazard 2. Dangerous Goods 3. Disease – Human 4. Earthquake 5. Fire, Major Urban 6. Flood 7. Landslide 8. Social Disturbance 9. Structure Collapse 10. Terrorism 11. Transportation - Air, Rail, Road 12. Utility Failure 13. Volcanic Eruption 14. Wildland / Urban Interface Fire 	<ol style="list-style-type: none"> 1. Bomb Threat 2. Disease – Animal, Plant 3. Drought 4. Food Contamination 5. Information Technology Failure 6. Land Subsidence 7. Lost Persons 8. Space Debris

In selecting these potential disasters for consideration, the Abbotsford Emergency Planning Committee acknowledges the potential, however small, that other types of emergency may demand site support in the future.

The following sections examine each of these hazards alphabetically to assess the relative risks to the community and to highlight opportunities for mitigation, preparedness for response, municipal business continuity and coordinated disaster recovery.

Please note: The content in this guide has been adapted from information from Hazards, Vulnerabilities and Risks in the City of Abbotsford (2016). While every reasonable effort has been made to ensure the accuracy of the guides contents at the time of publication, the City of Abbotsford does not guarantee the accuracy of the information.

Last Updated: March 2019

DESCRIPTION

Atmospheric hazards may result in a wide range of community impacts, depending on the weather type.

“Atmospheric hazard” is a general term that includes the following conditions:

- Fog
- Hail
- Heavy Snowfall and Blizzard
- Heavy Rain
- High Winds
- Ice Storm
- Lightning
- Temperature Extremes

Impacts may range from temporary power and utility outages due to thunderstorm and high wind activity to the sometimes, although rare, destructive force of a major snow storm or ice storm. Extreme weather events can lead to long-term economic repercussions. Snowstorms, for example, can result in serious impact to roadways, power transmission facilities and communication networks, closing schools and businesses. Heavy snowfalls can also lead to collapse of public and private structures.

PAST EVENTS

Abbotsford regularly experiences weather events, mostly as winter storms that bring heavy precipitation and strong winds.

January 1935 – Snow and Cold Wave

Winter weather gripped the Lower Mainland with temperatures dipping to -16° C and snowfall greater than 40 cm. While the extreme cold caused fuel shortages and frozen water pipes, a quick thaw followed by 267 mm of rain added extensive roof damage across the region, including the collapse of Vancouver’s rink.

January 1954 – Heavy Snow Month

More than 140 cm of snow fell in the City of Abbotsford in January, making transportation difficult and loading roofs with heavy snow.

October 1962 – Typhoon

Typhoon Freda struck BC’s Lower Mainland, causing 7 deaths and damages in excess of \$10 million. In Abbotsford, winds reached sustained speeds of 90 km/h, with gusts to 145 km/h. Half of the residents from West Vancouver to Hope lost power, some for as long as five days.

December 1996 – Heavy Snowfall

The “Pacific Storm of 1996” dumped 35 cm of snow on Vancouver in a single day. The entire southern region of BC was affected. In the Fraser Valley, the storm closed stretches of the Trans-Canada Highway between Abbotsford and Chilliwack, leaving hundreds of motorists stranded. Economic losses in the region reached about \$200 million.

January 2005 – Warm Winter Day

A Pacific subtropical system bathed southwestern BC in warm wet weather. Abbotsford residents enjoyed 18.1° C, the highest temperature in January recorded anywhere in the province since 1899.

November 2006 – Snow Covers Fraser Valley

A powerful winter storm hit the Lower Mainland, bringing 41 cm of snow to Abbotsford, setting a new one-day record. Vancouver received 19 cm.

August 2015 – Major Wind Storm

Extreme winds pummeled Abbotsford and the rest of the Lower Mainland on August 29, damaging trees, homes, and infrastructure. Several people were injured and first response teams were challenged by downed trees.

HAZARD AREAS

Long-term climate characteristics are similar throughout the Fraser Valley. The coldest months are January and February; the warmest months are July and August. Snow can fall and accumulate in any month of the year except June, July and August, but heavy snowfall events are rare.

Snowfall records for Abbotsford International Airport include:

- Most Snow in Year: 213.3 cm in 1971
- Most Snow in Month: 140.0 cm in Jan, 1954
- Most Snow in Day: 49.8 cm on Jan 21, 1954
- Highest Snow Depth: 69.0 cm on Dec 30, 1996



*Central Fraser Valley Search and Rescue Operations in Snow
(Source: CFVSAR)*

VULNERABILITIES

All major Abbotsford roadways and bridges could be temporarily closed due to severe weather, including heavy snowfall, ice accumulation, fallen trees, or other debris.

Vulnerable routes include:

- Abbotsford-Mission Highway
- Fraser Highway
- Mission Bridge
- Sumas Way
- South Fraser Way
- TransCanada Highway

The City has adopted priorities for snow removal, based on 11 zones.

Neighbourhoods throughout the municipality could be isolated by severe weather events, especially the residents on Sumas Mountain. Populations vulnerable to prolonged power outage in winter include many seniors and citizens with limited mobility, as well as agriculture operations.

Schools and commercial buildings with flat roofs may be threatened with collapse by heavy snowfall. Atmospheric hazards may also result in power outages that could interrupt business in the community. Businesses can collaborate to clear snow and debris, to the benefit of all.

Some critical infrastructure may be affected by weather, e.g., power supply and telecommunication services.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Beyond internal capabilities, identify additional snow removal equipment. Priorities have been established for snow plowing roadways.
- Develop plans to warn occupants and owners of flat-top buildings of snowfall amounts that should trigger monitoring.
- Identify opportunities for businesses and neighbourhoods to share snow- and debris-clearing efforts to quickly return operations to normal.

DESCRIPTION

Dangerous goods are any substances that may be explosive, flammable, poisonous, corrosive, reactive, or radioactive because of their characteristics. A dangerous goods incident involves the uncontrolled release of a hazardous substance during transportation, storage or use. Possible effects from dangerous goods range from straightforward road obstruction to widespread evacuation, injury and possibly death.

The most dangerous types of dangerous goods include toxic gases, such as ammonia and chlorine, that are heavier than air, can travel with a light wind, and can cause harm at very low concentrations.

Flammable gases, such as propane and natural gas, can cause “fireball” situations if ignited in large volumes. Spilled petroleum products, such as crude oil, can pollute soils, surface waters, and aquifers.

PAST EVENTS

May 1994 – Toxic Gas Release

On May 24, an explosion at a Port Moody resin-making factory released 10,000 kg of a potentially toxic chemical into the air. Fortunately, wind conditions dispersed the gas and smoke quickly into the atmosphere and monitoring did not detect significant amounts.

July 2000 – Malahat Propane Tanker

On July 18, a propane tanker released 35,000 litres of propane after overturning on the Malahat section of the Trans-Canada Highway. Langford established an evacuation zone within a 300 m radius of the site.

September 2005 – Abbotsford Fuel Spill

A transport truck accident initiated the evacuation of more than 1,200 people in 400 Abbotsford homes. The spill of 17,500 L of gasoline and 5,000 L of diesel fuels reached the sewer system. Electrical power was disconnected to 9,700 homes as a precaution.

July 2007 – Oil Pipeline Rupture in Burnaby

A Kinder Morgan crude oil pipeline was ruptured by an excavator digging a storm sewer trench. Oil shot 30 metres into the air for 25 minutes before the leak was stopped. Residents of 50 homes were evacuated.

January 2012 – Oil Leak on Sumas Mountain

A leak at Trans Mountain Pipeline on Sumas Mountain was not detected immediately by the pipeline’s operator. Although the spill was contained, residents complained of health effects.

July 2013 – Lac-Mégantic Rail Explosion

A fire and explosions in multiple rail cars carrying crude oil devastated this Quebec town on July 6. An unattended group of 74 rail cars rolled down a shallow hill and derailed in the downtown core, leading to the explosion. Among the impacts were 42 confirmed dead, with 5 missing and presumed dead. The blast and resultant fire destroyed roughly half of the downtown area. Contamination by the petroleum product caused another 36 buildings to be demolished.

January 2014 – Natural Gas Line Explosion

On January 25, a pipeline explosion near Otterburne, Manitoba, left thousands without heat as temperatures drop below -20°C. The fire was out after burning for more than 12 hours, but a natural gas outage affected as many as 4,000 people in nearby communities. The Municipality of Hanover declared a state of local emergency.



Fuel Tanker Spill at Yale Court

HAZARD AREAS

Road – Trucks carrying dangerous goods use the major routes in Abbotsford, including the TransCanada Highway, the Fraser Highway, and Sumas Way (Hwy 11). Dangerous goods carried by truck include gasoline, diesel fuel, propane, ammonia and chlorine.

Rail – Both the CNR and SRY rail lines carry dangerous goods through the community. Although most dangerous goods rail cars hold flammable liquids, flammable gases, or corrosives, some carry toxic gases such as ammonia. The federal recommended evacuation distance for a rail car spill of ammonia in daytime is 1,300 m.

Pipeline – FortisBC Gas operates numerous natural gas transmission and delivery pipelines in the community. Trans Mountain Pipeline carries crude oil and derivatives through the community, and transfers product at the Sumas Mountain Tank Farm. The greatest threat to pipeline safety involves excavation and construction activities on pipeline right-of-ways.

Fixed Facilities – Several industrial facilities in Abbotsford contain dangerous goods, including ammonia used in refrigerated storage. Industrial parks include bulk storage of acids, hydrogen peroxide and potassium permanganate, among other dangerous goods. Some public recreation buildings use large quantities of ammonia for ice-making, including the Abbotsford Recreation Centre and the Matsqui Recreation Centre.

VULNERABILITIES

High density occupancies are vulnerable to toxic and flammable materials due to the potential number of people exposed. In Abbotsford, these include the Abbotsford Entertainment and Sports Centre, adjacent to the TransCanada Highway.

The TransCanada Highway lies within 500 m of several schools, the Regional Hospital, and homes for the elderly. The Sumas First Nation could be affected by a spill on the TCH. Dangerous goods trucks on the Fraser highway pass by a major shopping and theatre center, a trailer park, and an elementary school.

The Matsqui First Nation community lies immediately adjacent to the CNR line. The FortisBC main gas line runs through the Matsqui Correctional Facility complex.

Dangerous goods spills on the TransCanada Highway or SRY rail line could impact the Abbotsford-Sumas Aquifer. However, the CN Rail line and the Trans Mountain pipelines and Tank Farm are located north of the aquifer.



Trans Mountain Tank Farm on Sumas Mountain

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Communicate risk information to key institutions, businesses and schools within 500 m of the TransCanada Highway, the CN Rail line, and the FortisBC natural gas line regarding their preparedness for evacuation and shelter-in-place.
- Develop a plan to address a major oil spill on Sumas Mountain or in a pipeline that could affect the Abbotsford-Sumas Aquifer and agriculture operations, working with Trans Mountain Pipeline.

DESCRIPTION

Human diseases include a large number of parasitic, bacterial and viral agents that can cause illness and death. Disease outbreaks and epidemics among Abbotsford residents and visitors may occur at any time of the year. The most notable disasters associated with human diseases include respiratory viruses, such as high-mortality influenza and Severe Acute Respiratory Syndrome (SARS).

Drinking contaminated water has also affected tens of thousands of North Americans in the last decade alone. The protozoa parasite *Giardia lamblia* was the agent most commonly implicated in these outbreaks. Food-borne disease outbreaks, such as *Salmonella* or *Escherichia coli*, could reach disaster levels where large numbers of consumers receive food from a single source. The West Nile virus disease has now been detected in British Columbia, and is found in neighbouring provinces and states.

Response to a widespread and sudden human disease outbreak, such as pandemic influenza, will be limited by the capability of health care services to deal with the large number of expected patients.

PAST EVENTS

March 1862 – Smallpox in British Columbia

A miner brought smallpox from San Francisco to Victoria in 1862. The disease spread quickly, especially among the approximately 2,500 Natives. Banished from the community, the Natives carried the disease to their villages. About 20,000 Indian lives (62 per cent) were lost province-wide as a result.

November 1918 – Influenza Pandemic

Influenza in 1918 hit Canadians hard, affecting more than one quarter of the population. The “Spanish Flu” rapidly spread across Canada along the railway lines, arriving in Vancouver in October of 1918. A second wave arrived in 1919. This pandemic of 1918-1919 resulted in 50,000 fatalities in Canada, and more than 2,000,000 Canadians became ill.

May 2000 – Walkerton, Ontario

The small community of Walkerton faced a sudden outbreak of *E. coli* in the public water supply. Seven persons died and more than 2,300 people suffered health problems.

April 2003 – SARS Outbreak

An outbreak of the SARS virus spread from China to Canada and other countries, affecting residents in Toronto, Ottawa, and Vancouver. The resulting number of cases in BC was low, with only 4 probable and 46 suspect cases, and all cases recovered. No deaths occurred in BC.

October 2005 – Legionnaires Disease

At least 21 people died and more than 100 fell ill during an outbreak of legionnaire’s disease at the Seven Oaks Home for the Aged in Toronto, Ontario. This particular outbreak may be related to a new strain of the bacteria.

April 2009 – H1N1 Pandemic

This pandemic resulted in more than 1,050 hospitalizations and 57 deaths in BC. For the most part, these cases occurred during the second wave of increased influenza activity. In about one-third of the cases, victims had no underlying risk conditions. While children under 10 years old had the highest rates of exposure, those over 50 years of age faced the greatest risk of serious illness or death. More than 40% of the BC population were immunized, exceeding that in the US (20%), Australia (25%), Japan (12%), the UK (7%) and most other European nations.



H1N1 Pandemic Outbreaks 2009

HAZARD AREAS

For respiratory diseases, high-hazard areas are those with dense concentrations of people. In Abbotsford, these include

- Abbotsford Entertainment & Sports Centre
- Cineplex Theatres
- Fraser Valley Tradex
- MSA Arena
- Public and Independent Schools
- Technical Colleges
- University of Fraser Valley

Schools can be particularly vulnerable during outbreaks of communicable diseases.

Most residents draw daily potable water from the Abbotsford water system and, therefore, would be affected by region-wide contamination.



Fraser Valley Tradex Centre

VULNERABILITIES

Populations of special concern in Abbotsford include the frail elderly in the community for the transmission of human diseases. More than 14,000 residents in Abbotsford are age 70 or older.



Jackson Elementary School

Children may suffer more from illness than adults because of under-developed immune systems. The Abbotsford population includes more than 34,800 children under the age of 19.

Municipal staff members are also vulnerable members of the community, particularly where they deliver specialized services. For example, Abbotsford Fire Rescue includes about 88 fire fighters and 100 auxiliary fire fighters. If a substantial percentage became ill, fire services in the community could be affected.

The same holds true for police, public works, recreation and other municipal personnel.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Promote annual influenza vaccinations among municipal staff and elected officials.
- Prepare a City of Abbotsford Pandemic Influenza Plan.
- Work with local schools and Fraser Health to develop collaborative Pandemic Influenza Plans.

DESCRIPTION

The City of Abbotsford is subject to three types of earthquake. Crustal earthquakes are shallow, typically occurring at depths less than 20 km. This type and size of earthquake struck Christchurch in New Zealand in 2011, and a magnitude 7.3 event on Vancouver Island in 1946.

The second type of event is the sub-crustal earthquake, which can occur as deep as 80 km within the North American Plate below Abbotsford. The Nisqually Earthquake near Olympia, Washington, in 2001, offers an example of this type of seismic shaking.

The third type is the subduction earthquake, caused when the Juan de Fuca Plate slides under the North American Plate in the Cascadia Subduction zone. A recent example of these types of quakes is the 9.1 magnitude Great Tohoku Earthquake that hit the north coast of Japan in 2011. The Cascadian Subduction zone is located about 150 kilometres west of Abbotsford.

Experts have roughly estimated a 12 percent probability of damaging ground shaking due to a shallow crustal earthquake affecting the Lower Mainland in the next 50 years, a 60 percent chance of a deep sub-crustal earthquake in the next 50 years, and a 12 percent chance of a subduction earthquake.

Among these types of earthquakes, the inland crustal and sub-crustal events present the most significant danger to the City. Seismic shaking events may not be as intense or long as in the Cascadia Subduction zone, but there are much closer to the community and occur more frequently.

PAST EVENTS

January 1700 – Cascadia Earthquake

On January 26, 1700, Vancouver Island was hit by a major subduction zone earthquake measuring between 8.7 and 9.2 on the Richter Scale. The fault rupture was about 1,000 km in length, with an average slip of 20 meters.

December 1918 – Vancouver Island Quake

On December 6, Vancouver Island was hit by a 7.0 earthquake, resulting in extensive damage on the west coast of Vancouver Island.

June 1946 – Courtenay Earthquake

A magnitude 7.3 earthquake hit Vancouver Island on June 23, 1946. This earthquake caused extensive damage along the east coast of Vancouver Island, affecting rail lines, buildings and schools. The earthquake knocked down 75% of the chimneys in the closest communities, Cumberland, Union Bay and Courtenay.

April 1965 – Seattle Earthquake

On April 29, an earthquake struck Seattle, registering 6.5 in magnitude. The shaking resulted in much damage in the Seattle area.

February 2001 – Nisqually Earthquake

On February 28, a 6.8 earthquake struck 20 km northeast of Olympia, Washington. The earthquake was felt from Portland to Penticton. Extensive damage occurred.

February 2011 – Christchurch Earthquake

On February 22, a magnitude 6.3 earthquake killed 185 people and injured several thousand in Christchurch, New Zealand. The city has been hit by thousands of aftershocks, some as strong as magnitude 7.0 in the years since the main event.



Business Damage in Christchurch

HAZARD AREAS

Most of the seismic hazard in Abbotsford is due to soil types that tend to amplify the intensity of ground shaking. This hazard is greatest where fill organic soils sit on top of thick deposits of soft clay, and lowest where bedrock is exposed.

Areas of moderate seismic hazard are known throughout the community, based primarily on the tendency of the soils to liquefy. Areas of potentially high seismic soil response hazard include:

- Glen Valley
- Matsqui Prairie
- Sumas Prairie

The Sumas Fault line parallels the TCH for 15 km, and lies beneath the Barrowtown Pump Station. Slopes on Sumas Mountain may also fail due to earthquake, especially along the north, east, and south ridges.

Structural fires and the release of dangerous goods may occur where natural gas lines and industrial areas contain bulk quantities of dangerous goods.

VULNERABILITIES

Community elements that are most vulnerable in seismic events include high-density buildings, especially older structures that have not been retrofitted for earthquake protection. In Abbotsford, vulnerabilities include:

- Schools, colleges and the university
- Senior homes, such as Bevan Lodge, Menno Home, and Bevan Hospital
- High-density occupancies, such as the Abbotsford Entertainment and Sports Centre
- Shopping malls, such as Sevenoaks

Critical utilities are also vulnerable to earthquake damage, with possible subsequent impacts to the community. These include:

- Roads and bridges
- Water and sewer services
- Natural gas and oil pipelines
- Electrical power transmission
- Telecommunication services

Overall, outside assistance following an earthquake may concentrate on dense residential areas of Vancouver and Richmond, delaying aid to the Fraser Valley.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Assess the seismic risk of municipal buildings and infrastructure.
- Continue with ongoing replacement of asbestos cement and other vulnerable water mains.
- Secure furnishings in municipal buildings against seismic shaking.
- Promote earthquake mitigation in commercial, industrial, institutional facilities, such as seismically securing bookshelves and other internal furnishings.
- Hold courses on Rapid Damage Assessment for City staff and partners, offered through BC Housing.
- Consider developing a community recovery plan that includes key external organizations.
- Request waste disposal contractor to develop plans for accepting large quantities of diverse and hazardous wastes following a disaster with significant property damage, such as an earthquake.

DESCRIPTION

The threat of fire to buildings in Abbotsford ranks among the most likely and dangerous types of emergency. Although severe fires are rare with today's prevention measures, fire in a residential, commercial, or institutional building could result in catastrophic impacts, especially among high-density occupancies, such as apartment blocks, schools, nightclubs, and homes for seniors.

Major urban fires can be ignited by a number of causes, such as faulty electrical wiring, improper use of home appliances, or smoking materials. Damage to residential units can render occupants homeless for weeks or more and in need of immediate care and shelter. Apartment dwellers often lack the type of insurance coverage needed to provide for temporary accommodation.

In addition to the threat from heat and direct fire contact, Abbotsford occupants face toxic smoke from urban fires, especially when nearby industrial buildings holding dangerous goods are involved. A fire in such a structure could result in evacuation of several square kilometres as a precaution.

PAST EVENTS

June 1993 – Arson Fire in Lumberyard

A suspected arson fire destroyed a Merritt lumberyard, leading to losses between \$3 and \$5 million.

February 1994 – Multi-Family Housing Fire

A fire destroyed a new housing development in Coquitlam. Response required more than 1,000 firefighters to keep the blaze from spreading, and estimated costs reached \$8 million.

January 1996 – Fire in Care Home

In January 1996, about 120 bed-ridden residents were rescued from a burning extended care home in Duncan on Vancouver Island.

November 2001 – School Evacuation

On November 6, a fire burning in a nearby industrial area forced an evacuation of 800 students and staff members from a Junior High School and an Elementary School in Calgary.

June 2007 – Business District Fire

A suspicious fire in Fort St. John destroyed two motels and a number of small businesses and an entire city block. Radiant heat ignited a commercial building in the same block, damaging 12 of the 16 businesses in the narrow building.

March 2010 – Calgary Condo Fire

Careless smoking led to the evacuation of 300 condo residents as fire spread rapidly through their building, pushed by strong winds. The City of Calgary activated their EOC to Level 1 and set up a Reception Centre for the residents.

May 2012 – Abbotsford Mill Fire

An early-morning fire destroyed a lumber mill that employed about a dozen people. The fire at Absolute Lumber Products created smoke so extensive it set off fire alarms at apartment buildings several kilometres away.

January 2014 – Fire in Seniors' Home

The fire that destroyed the L'Isle-Verte seniors' home in rural Quebec killed 32 and injured dozens. Contributing factors identified by the coroner include not enough personnel trained in helping residents in an emergency, questionable home operations once firefighters arrived, and unimplemented emergency response plans.



*L'Isle-Verte Fire
(Source: Montreal Gazette)*

HAZARD AREAS

Severe fire is more likely to occur in the dense, older built-up neighbourhoods of Abbotsford Centre, Clearbrook Centre, and Old Clayburn.

A fire at an industrial building with dangerous goods, such as those in the Riverside and McCallum Industrial areas, or at the Airport, would likely generate the release of highly toxic smoke and gases. This may require the evacuation of the surrounding neighbourhood and temporary closure of some roadways.



Centre Ice Sports Arena

VULNERABILITIES

Some elements of Abbotsford are more vulnerable to fire than others. The Abbotsford Entertainment and Sports Centre, for example, would be particularly difficult to both evacuate and fight fire. Evacuees would likely require assistance with transportation or shelter if they could not access their vehicles.

A fire at a large apartment or condo complex would be especially hazardous if it required the evacuation of residents while fire suppression was underway.

Other buildings of fire concern include the care facility for 196 seniors at the Menno Home on Brundige Ave, and the Menno Hospital for 151 seniors on Marshall Rd.

Structural fires in commercial buildings, such as at the Sevenoaks Shopping Centre in Abbotsford Plaza, would not only present life-safety challenges, but may also result in economic losses felt throughout the community

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Potential City Actions to Reduce Risk
- Ensure all vulnerable occupancies, including schools and theatres, have fire safety plans and regularly practice fire drills.
- Identify potential temporary accommodations for fire victims from multi-family dwellings, and for use in evacuations.
- Prepare alternate measures for continuing essential municipal services in the event of fire in a municipal building, including backup storage of essential records off site.

DESCRIPTION

Abbotsford lies within the potential flood zones of three river systems: The Fraser River, the Sumas River, and the Vedder River. The Fraser River drains a 220,000-square-kilometre area that includes mountain slopes that are subject to rapid snow melt and intense rainfall. Fraser River flooding associated with rain or snow melt are called “freshets” and usually occur in spring or early summer.

The Sumas River feeds the area once known as Sumas Lake, drained in 1924 to create agricultural land. The Sumas Prairie is now protected by the large Barrowtown Pump Station and system of dykes, but may flood with heavy rain and snow melt. The Sumas River can quickly reach flood stage when the nearby Nooksack River in Washington State overflows its banks near Everson in Washington.

The Vedder River becomes the Vedder Canal in Abbotsford. Although the Vedder Canal, shared with Chilliwack, is guarded by dykes on both sides, it is subject to flooding, particularly in the fall and winter when heavy rain or rain-on-snow events occur.

PAST EVENTS

June 1894 – The Great Fraser Flood

A major flood in 1894 still represents the highest water levels in history, and there were few impacts on the human communities.

June 1948 – Fraser Flooding Disaster

Fraser River freshet flooding again inundated Abbotsford, breaching more than a dozen dyke systems in the Valley. This time, the consequences were severe. Floodwaters drowned nearly one third of the entire lower Fraser Valley, severed the two transcontinental rail lines, inundated the TransCanada Highway, and forced many industries to close.

June 1972 – Fraser Dykes Hold

When high temperatures hit the BC Interior near the end of May, rapid snowmelt caused many rivers to reach record levels. On June 16, the lower Fraser River peaked at Hope, with a maximum elevation of 7.1 metres, a metre above danger levels. Dykes were generally effective in preventing large-scale damage, and damage occurred mainly in the Surrey area.

November 1990 – Nooksack Overflow

On November 9, the Nooksack River breached a dyke in Everson, spilling floodwater into the Sumas River Basin and crossing the Canada/USA border into Abbotsford. Flood waters closed the TransCanada Highway for a period of 26 hours. In the West Sumas Prairie, many roads were closed and many buildings were flooded, but the interceptor dyke at Arnold Slough prevented waters from flooding the Old Sumas Lake Bottom.

June 2007 – Fraser River Freshet Threat

The community again faced a significant threat of flood during spring freshet. Although waters subsided without damage, the threat sparked a region-wide effort to understand the risks.

June 2012 – Glen Valley Freshet Flood

On June 19, Abbotsford issued an evacuation order for Glen Valley residents facing localized flooding and the threat of rising Fraser River flood waters.



Rescue from the 1948 Flood

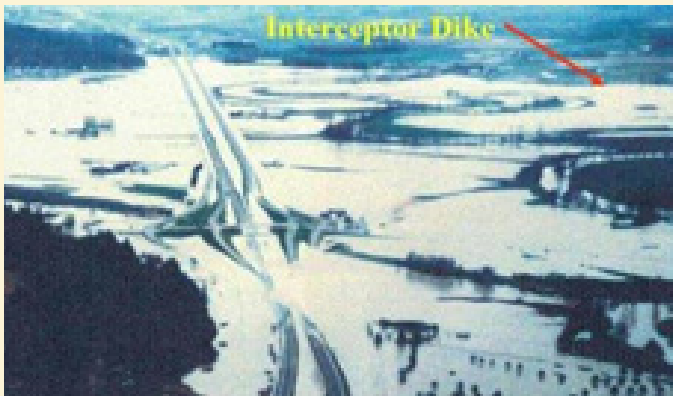
HAZARD AREAS

As surface geology demonstrates, the lowlands of the community have flooded repeatedly since the last Ice Age ended about 12,000 years ago. Flooding has only become a hazard after people settled in the region.

Although the Fraser Basin has changed since the 1948 flood, the geographic areas currently prone to flooding can be predicted with some accuracy. The City has undertaken detailed flood risk mapping, focusing on floodplains in the following areas:

- Glen Valley
- Matsqui Prairie
- Sumas Prairie

Whereas all three flood plains could be inundated by high water levels on the Fraser River, the Sumas Prairie also faces the threat of flooding when the Nooksack River in Washington State overflows its banks. The released water follows the Sumas River into Abbotsford.



*TCH at the Whatcom Road interchange - 1990
(Source: Nooksack International Task Force)*

VULNERABILITIES

Residences, Farms: Vulnerable homes include those on River Road in Glen Valley, and residences affected by dyke over-topping or breaches in Matsqui and Sumas, including the Matsqui Band IR #2 and Sumas Band IR #6.

Road Network: Most rural roads within the flood plains are vulnerable, including these examples: Lefevre Rd and River Rd in Glen Valley; Page Rd and Harris Rd in Matsqui; Vye Rd. and Tolmie Rd. in Sumas.

Rail Transport: Although rail tracks are elevated, high water levels from major flooding may impact the CNR and SRY lines in the floodplains.

Natural Gas: All critical systems at Huntingdon Station are located above the flood plain. Other facilities are designed to operate under water.

Water Systems: A freshet flood could lead to contamination of the water system unless critical air valves are closed, as planned.

Wastewater Systems: Fraser River flood levels above 7.5 m at Page Road could damage 9 sewer pump stations. In the Sumas area, a water elevation of 10.0 m could damage five stations.

Schools: Facilities within floodplains include Matsqui Elementary, Dasmesh, Upper Sumas Elementary, and Barrowtown Elementary.

Economics: Throughout the lower Fraser Valley, an estimated 300,000 people presently live on the floodplain. Damage could exceed \$2 billion if dykes fail. Indirect economic losses would likely far exceed direct costs.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Provide specific flood risk information to homeowners, renters, business owners, and farmers occupying parcels within the Glen Valley, Matsqui, and Sumas flood plains to assist mitigation.
- Adapt the Abbotsford Flood Response Plan (2014) to include use of the City SCADA gauge on the Nooksack River, the USGS gauge in Everson, and the updated hydraulic model when an overflow event occurs.

DESCRIPTION

“Landslide” is a general term used to describe the down-slope movement of soil, rock and earth materials caused by the force of gravity. The generic term includes rockfalls, rock slides, mud slides, debris slides and debris flows. Landslides represent the normal geologic process of erosion, but unwise human development can increase the risk.

Factors that influence the chance of slope movement include the steepness of a slope, the integrity of the soil and rock materials, and the moisture content of ground conditions. Extreme weather events, such as heavy rainstorms in fall and winter, can trigger landslides in the Abbotsford community. The geology of the Fraser Valley is complex and, with contributions from heavy precipitation at times, can result in land slippage in predictable locations. Climate change could substantially impact the amount of water introduced to unstable slopes. The chance of earthquake in the region also contributes to the risk of landslide in the region.

Landslides can result in localized damage to infrastructure and buildings, and can cause injury or death. In British Columbia history, more lives have been lost to landslide than to other natural hazards, including earthquakes and flooding. Concern for landslide effects increase as development moves into the steeper slopes and mountain sides adjacent to built areas.

PAST EVENTS

January 1935 – Slide on Sumas Mountain

Repeated January slides hit the Kilgard Rd. area of Sumas Mountain. Ten homes were swept down the mountain, killing several residents.

November 1990 – Yale Landslide

On November 9, road access between the Lower Mainland and the rest of Canada was interrupted as rock and mudslides closed the TransCanada Highway at Yale.

October 1995 – North Vancouver Landslide

A major landslide into the Capilano water reservoir forced a shutdown of the reservoir.

February 1997 – Abbotsford Landslide

A landslide in Abbotsford carried one home away. No one was injured or needed to be evacuated after the event.

January 2005 – N. Vancouver Mudslide

Three days of heavy rain triggered a January 19 mudslide that killed one and forced the evacuation of many residents. Rainfall at Vancouver International Airport over the preceding three days exceeded 130 mm. Following the event, the District of North Vancouver installed a storm sewer and removed fill from six properties to reduce risk.

January 2005 – Mission Landslide

On January 24, an elderly couple left their trailer voluntarily following a mudslide near the Lougheed Highway in Mission. Emergency assistance was provided.

October 2013 – Slide Closes Water Service

A 300-metre landslide cut a water supply pipe for the Abbotsford and Mission areas. The slide forced Abbotsford to close its Norrish Creek water source, and rely on Cannell Lake and city wells to provide water to the public.



*Slide Damages Abbotsford Water System
(Source: Abbotsford News)*

HAZARD AREAS

For the most part, landslides occur in locations that can be predicted. Considering the risk factors of steep slopes and unconsolidated soil or rock, experts can assess landslide risk with confidence.

The presence or absence of former landslides in an area may be one important factor to consider. The steepness and direction of slope are also factors when determining potential future events. Exposure to water is critical; water is the major contributing factor in about 95 percent of all landslides.

Most of Sumas Mountain (excluding McKee Peak) has been assessed for the potential of mass wasting and found to be at moderate to very high risk. Additional steep terrain in the Bradner Escarpment presents a landslide hazard.

Unstable slopes in the watersheds serving the City near Cannell Lake and Dickson Lake also threaten to interrupt the supply of clean water to citizens.

VULNERABILITIES

Past events have damaged or destroyed residences and related infrastructure, and have changed the landscape so drastically that residents cannot rebuild at the same location.

Landslides have the potential to damage and break critical infrastructure, including:

- Roadways
- Rail lines
- Water supply pipelines
- Wastewater collections systems
- Oil and gas pipelines

The negative economic effects of landslides include the cost to repair structures, loss of property value, disruption of transportation routes, medical costs in the event of injury, and direct impact to the natural environment.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Train staff in landslide field recognition skills.
- Develop maps and hazard information to support timely and effective early response.

DESCRIPTION

The International Association of Chiefs of Police defines a social disturbance as “an unlawful assembly that constitutes a breach of the peace, or any assembly of persons where there is danger of collective violence, destruction of property, or other unlawful acts.”

A public demonstration may trigger an emergency response where an unlawful gathering has the potential for violence or destruction. A street protest, for example, may be unlawful when it is not peaceful, or when the protest is prohibited by law.

A riot is a specific type of social disturbance that may demand emergency response. A riot occurs when a group of people is moved to commit acts of civil disorder, including random intent to destroy property or to assault persons. The initial group may be subsequently joined by other individuals with no interest in the issue, but take advantage of the opportunity to loot and destroy property.

The publicity generated by riots and demonstrations may dissuade people from visiting the affected area, fearing a repeat event. This often adds to the economic losses associated with a social disturbance.

PAST EVENTS

July 1991 – Penticton M.C. Hammer Riot

As many as 2,000 fans looted and pillaged the community of Penticton. Windows were smashed, a department store was robbed, and a mob of rioters broke into a liquor store while police lobbed tear gas in an attempt to quell the violence. The tally: over 50 arrests, 60 injuries.

May 1996 – Long Beach (Tofino) Party

About 2,000 drunken youths held a pre-grad party at the campground. The party got out of control and resulted in arson, vandalism and injuries.

June 1996 – Vancouver Hockey Riot

Following the loss of the Vancouver Canucks in the final game of the Stanley Cup, a large crowd of 40,000 to 70,000 people became increasingly unruly and some began smashing windows, looting and throwing rocks at the police. Tear gas was used to disperse the crowd. 92 businesses were vandalized.

July 1997 – Parksville Sand Castle Riot

Following the Sand Castle Festival weekend, store windows were smashed by a crowd of 600 to 1,000 young people. Police arrested more than 100 individuals.

November 1997 – APEC Demonstration

Dozens of demonstrators clashed with Vancouver Police, were pepper-sprayed, and arrested on the final day of the Asia-Pacific Economic Cooperation meeting at UBC.

November 2002 – Guns & Roses Concert

The Guns & Roses concert was canceled right before the doors were set to open and this act set in motion a demonstration by angry fans.

June 2011 – Stanley Cup Riot

Vancouver Police fired tear gas, pepper spray and flash bombs to try to disperse angry rioters who set fire to cars and looted stores after the Canucks lost in the Stanley Cup final. Witnesses were encouraged by social media organizers to post pictures of rioters to help identify them. Abbotsford Police supplied more than 60 members.

October 2011 – Occupy Vancouver

On October 15, between 4,000 and 5,000 people participated in rallies at the Vancouver Art Gallery. Volunteers brought more than 150 tents, food, and health and safety services. After more than four weeks of occupation, Justice Anne MacKenzie granted the city's request to order the removal of all structures.

HAZARD AREAS

Facilities used for sports entertainment or special events may draw participants who may riot, especially where alcohol is consumed. Potential locations include:

- Abbotsford International Airport
- Abbotsford Entertainment, Sports Centre
- Exhibition Park

Sites of political or religious significance may draw protesters, including:

- City Hall
- Places of worship
- Matsqui Prison Complex

Community gathering places may also draw protesters, including:

- Jubilee Park
- Thunderbird Square (Civic Centre Park)
- South Fraser Way

The number of environmental protests in Canada has increased in this decade. In 2014, a small group protesting Kinder Morgan’s planned expansion of the oil pipeline set up camp on Burnaby Mountain. Similar protests are possible on Sumas Mountain.

VULNERABILITIES

Innocent bystanders and participants can be injured in riot situations, as may be the case in sports or special events where a few engage in violent activities.

Police personnel are often targeted when they attempt to restore public order, and may experience injury. Fire fighters have also been subjected to violence as they respond to fire threats related to the public disturbance.

When riots and looting occur, there is often a significant loss of property to nearby businesses, especially small retail outlets. Physical damage may impact random buildings, vehicles, and storefronts in the immediate area. Police vehicles and Fire Rescue apparatus may be damaged.



Abbotsford Sports and Entertainment Centre

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Prepare a hazard-specific emergency response plan to address major social disturbance, such as a riot.

DESCRIPTION

Structure collapse is a general term that refers to any failure of integrity in a designed building, walkway, or other community infrastructure. Structure collapse may be caused by engineering or construction problems, metal fatigue, severe weather events, or changes to the load bearing capacity of the structure.

When buildings collapse, there may be a significant number of injuries or fatalities, and fires may result. Such events also cause damage to support infrastructure, such as gas lines, electricity, water, sewer and telephone lines. Factors that may contribute to structure collapse include building age, design, time of year, use levels and seismic events.

PAST EVENTS

April 1988 – Food Store Collapse

The Metrotown Save-on-Foods roof collapsed during opening ceremonies, only minutes after the Mayor, who was presiding over the grand opening, directed the evacuation of about 1,000 people. There were no fatalities. Fifteen people were briefly hospitalized.

November 1992 – School Collapse

On November 12, a school roof at Cedar Drive Elementary School in Port Coquitlam collapsed and destroyed one classroom and damaged another. Fortunately the collapse occurred on a Sunday and no students were in the classroom.

January 1997 – Arena Collapse

On January 8, the roof of the 3,000 square-metre Memorial Arena in Dawson Creek collapsed within minutes on an unusually windy night. The arena housed a hockey ice rink, bleacher, and dressing areas. At the time of failure, the roof held less than the design snow load on the structure.

August 2007 – Bridge Collapse

A steel truss arch bridge failed catastrophically during the evening rush hour, killing 13 motorists and injuring 145 in Minnesota. First responders received immediate assistance from mutual aid partners in the region, including charities and volunteers.

March 2008 – Snow Causes Structure Collapse

Record snow fall caused a Quebec food factory roof to collapse, killing three women. The deaths prompted volunteers at hundreds of businesses and schools to shovel snow off roofs in anticipation of further snow fall.

April 2008 – Church Floor Collapse

The collapse of a church floor in Abbotsford injured more than 40 persons attending a concert. At least 23 people were sent to the local hospital, and 16 others were diverted to hospitals in Mission, Chilliwack, Langley, and Vancouver. RCMP from the nearby communities of Langley and Mission were called in to assist the Abbotsford police.



*Church Floor Collapse
Source: CBC News*

August 2011 – Roof Collapses Into Crowd

A temporary roof at an Indiana State Fair stage collapsed during an outdoor concert when it was hit by a wind gust from a thunderstorm. The structure landed among a crowd of spectators, killing 7 people and injuring 58 others.

HAZARD AREAS

Buildings of concern in Abbotsford include older structures that were poorly designed or have not been maintained.



Flat Roof at Yale Secondary School

Buildings with large roof spans, such as school gymnasiums, are more susceptible to weather effects, such as heavy snow falls and high winds.

Commercial buildings with tilt-up construction performed poorly in the 1989 Loma Prieta earthquake. Engineering guidelines call for firm connections between walls and roof sections.

The bridge crossing to Mission has been seismically upgraded to help ensure continued operation following an earthquake.

VULNERABILITIES

Buildings in Abbotsford that are more vulnerable to collapse include structures where large numbers of people may be present at any given time. Several large faith-based buildings are capable of accommodating 1,200 to 2,500 people at a time.

Other large capacity structures include schools, commercial facilities, or recreation complexes. Many of the commercial buildings along South Fraser Way have flat roofs that may be susceptible to failure in extreme snowfall events. Buildings at the Airport and in the industrial areas have flat roofs that may collapse in extreme snowfall events.

Bridges and culverts are subject to collapse following major earthquake events, which could severely restrict road transportation.



TransCanada Highway over Vedder Canal

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Ensure plans for response to structure collapse identify dog-search teams and heavy equipment.
- Promote Rapid Damage Assessment training for City staff and community partners.

DESCRIPTION

Even with international terrorism events common in today's news, it is difficult to imagine an attack in Abbotsford. However, there have been past incidents in BC that, if repeated, could affect local residents and businesses.

Terrorism uses violence or the threat of harm to engender fear in the public or any section of a community. The intent of terrorists typically is to draw widespread attention to a specific cause and, therefore, attempt to gain the greatest public pressure to meet their demands.

A wide variety of actions could be taken by terrorists to disrupt society, including the use of chemicals, biological agents, radioactive and nuclear materials and explosive devices. Typical targets of terrorism include political, religious, or economic symbols in communities.

PAST EVENTS

1960 to 1963 – Sons of Freedom

Dozens of arson and bomb attacks were carried out by the Sons of Freedom. Their targets were railways, utility poles and power lines belonging to the Kootenay Power and Light Company and the homes of orthodox Doukhobor's. One person was killed during this time, by his own bomb.

June 1985 – Bombing of Air India Flight

Air India Flight 182 was a Boeing 747 that exploded on June 23, 1985 while at an altitude of 9,500 m above the Atlantic Ocean, south of Ireland. Flight 182, which had departed Mirabel Airport in Montreal bound for London, England, disappeared from radar. All 329 on board were killed, of whom 82 were children and 280 were Canadian citizens.

December 1999 – Bomb Ferried from Victoria

On December 14, 1999, Ahmed Ressam drove his rental car onto the ferry from Victoria to Port Angeles, Washington. Ressam planned to detonate a bomb on or around January 1, 2000, at the Los Angeles International Airport. Customs Inspectors examining Ressam's rental car found explosives concealed in the spare tire well.

July 2001 – Suspected Water Contamination

In July, 2001, tampering of the Ladysmith water supply was suspected after a cloudy film appeared on the water. The reservoir was drained, but lab tests failed to determine exactly what caused the film on the water.

May 2004 – Chemical Release on City Bus

On May 25, passengers on a Vancouver city bus began to feel ill when a male suspect released methyl chloride. About 50 people, including police, news reporters and firefighters, were later quarantined in and around Waterfront station.

Oct-Dec 2008 – Pipeline Bombings

Pipelines carrying sour gas in northwestern BC were bombed on four separate occasions in apparent cases of eco-terrorism. No one was injured in the blasts, but two pipelines were damaged and there was a small leak of toxic sour gas at a wellhead.

November 2015 – ISIS Attacks Paris

Coordinated shootings and grenade attacks hit a music venue, a sports stadium, and an ethnic restaurant in Paris, killing at least 129 and injuring more than 300 others. Police evacuated fans at a football match between France and Germany after three separate suicide bombings over the course of about 40 minutes.

HAZARD AREAS

It is difficult to predict which specific elements of the Abbotsford community may attract terrorist activity. The close proximity to the US border is a source of concern.

Overall, past attacks elsewhere have targeted critical infrastructure, government buildings and religious symbols.

Examples of critical infrastructure include:

- Energy and utilities (e.g. electrical power transmission and natural gas systems)
- Communications and information technology (e.g. telephone and broadcasting systems)
- Finance (e.g. banking institutions)
- Health care (e.g. hospitals and health care facilities)
- Food (e.g. distribution and food industry)
- Water (e.g. drinking water and wastewater management)
- Transportation (e.g. air, rail, road, and pipeline)
- Government (e.g. facilities and key national sites)
- Manufacturing (e.g. chemical industry)

VULNERABILITIES

Virtually all members of the Abbotsford community could be affected by terrorist action against critical infrastructure. As with atmospheric hazard or human disease, the most vulnerable populations are the very young and elderly.

Disruption of transportation, energy, and communication systems could directly affect commercial and industrial operations in Abbotsford, particularly in commercial and agriculture sectors.

Gas Pipeline at Queen St & Marshall Rd
Terrorist actions could have a direct impact on tourism in the community, as evident following the attacks in the USA on September 11, 2001.

The Canadian Security Intelligence Service (CSIS) operates the Integrated Threat Assessment Centre, which evaluates the probability and potential consequences of terrorist activities in Canada and works with first responder organizations, such as local police.



Gas Pipeline at Queen St & Marshall Rd

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Continually reassess the critical infrastructure in and affecting the City for appropriate security measures.
- Include in response plans the requirement to treat emergencies that may have been caused by terrorist action as potential crime scenes, and to preserve evidence.

DESCRIPTION

Transportation accidents largely represent mass casualty incidents that may trigger site support efforts from an Emergency Operations Centre. These are situations where the number of injured persons may overwhelm available rescue and medical personnel and facilities. In Abbotsford, three major types of transportation accident present hazards:

Aircraft Crash – An aircraft crash creates the potential for multiple explosions, intense fire, injuries, fatalities, and the destruction of property at and adjacent to the impact point. The location of the crash has a significant effect on the number of dead and injured among people on the ground.

Passenger Rail Accident – A collision and/or derailment of a passenger train on the CN Rail line would likely result in dozens or hundreds of injured persons. Response to a rail crash may require fire suppression, victim extrication, and transportation of the injured to regional hospitals.

Road Accident – Motor vehicle crashes can require emergency site support activities when accidents involve large numbers of casualties. Some crashes lead to major injuries or fatalities that require specialized response. Motor vehicle crashes typically require localized response to fuel spills, and may result in traffic congestion and detours.

PAST EVENTS

August 1995 – Plane Crash in Richmond

On August 19, a DC-3 cargo plane passed between two apartment buildings, crashed at the airport, and burst into flames. Three people were pulled to safety by a jogger. The plane was full of fuel and came close to a residential area.

March 1992 – Bus Accident

On March 12, a bus traveling south on Highway 99 toward Richmond crashed into a parked tractor-trailer that had broken down in the bus lane. Two people were killed and many injured.

July 2002 – Air Show Crash

On July 27, in the deadliest air show disaster in history, the left wing of a Sukhoi Su-27 aircraft struck the ground during a low altitude roll maneuver. The aircraft then struck a parked Ilyushin Il-76 transport aircraft and cartwheeled into a crowd of spectators, killing 77, including 19 children, and injuring over 500 others.

March 2003 – School Bus Rolls in Snow

A bus carrying Pacific Christian's basketball team went into a ditch and rolled on the TransCanada Highway in Langley in very poor, snowing winter conditions, the bus went into a ditch and rolled. There were no serious injuries.

October 2007 – Plane Hits Apartment Building

On October 19, a Piper Seneca took off from YVR and crashed into the ninth floor of a nearby apartment building in Richmond. The 15-storey building was immediately evacuated after the plane hit. Residents were allowed to return when the building was confirmed structurally sound.

August 2014 – Tour Bus Crash

On August 27, forty-three people were injured, several critically, in a tour bus crash on the Coquihalla Highway, 30 kilometres south of Merritt, BC. The bus was on a tour with passengers from Hong Kong, China, Taiwan and other locations. The highway was closed with air ambulances landing on the roadway.

February 2012 – VIA Rail Crash

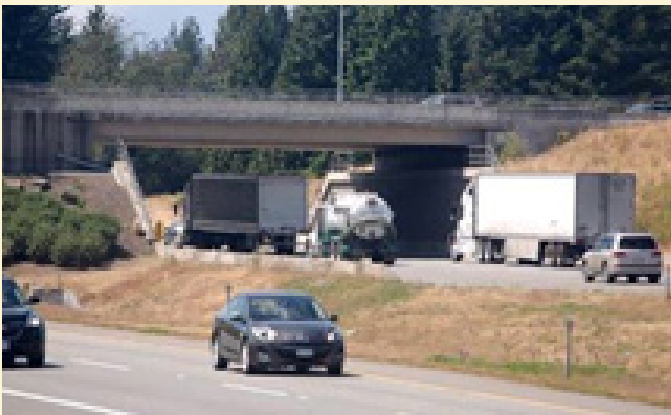
On 26 February, a VIA Rail train carrying 70 passengers derailed at a track switch. The locomotive rolled on its side and struck a building killing 3 crew members and injuring 45 people. A subsequent investigation found the crew misinterpreted a signal and was running the train at an excessive speed for the switch.

HAZARD AREAS

Air – Due to the proximity of the Airport, the southwestern portion of Abbotsford is more exposed to the risk of aircraft crash. The South Poplar neighbourhood experiences more small aircraft and helicopter takeoffs, landings, and overflights than other neighbourhoods.

Rail – Passenger rail service through Abbotsford makes use of the CN Rail line, which transits the northern border of the City. There are 11 at-grade road crossings of this rail line within Abbotsford; all have vehicle control signals and barriers.

Road – The most likely location of a mass-casualty incident involving road transport is the TransCanada Highway. Known bus routes in the community include South Fraser Way, Sumas Way, and Abbotsford-Mission Highway, which accommodate transit buses, Greyhound Bus, and school buses for the community.



TransCanada Highway

VULNERABILITIES

High density areas of Abbotsford are more vulnerable in the event of aircraft crash. These include neighbourhoods with high-rise apartment buildings or shopping centres, such as on South Fraser Way. Motorists on local streets could also be affected by aircraft crash, either directly or by traffic congestion for extended periods.

Rail passengers are most exposed to injury from a derailment. There are no buildings adjacent to the CN Rail track through Abbotsford.

School-age children using bus transportation are among the most vulnerable groups affected by road accidents. Regional bus transportation service offered by Greyhound is exposed to road accident, with the potential for multiple casualties.

Tourist buses can carry dozens of visitors who lack English as their first language, which could challenge first-responders and site support efforts to inform family members.

Closure of most Abbotsford roads for a substantial time period due to a mass-casualty accident would challenge residents and business owners.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Develop a hazard-specific plan that addresses response if a large commercial aircraft crashes in the community, working with the Abbotsford International Airport and airlines.
- Meet with Via Rail and CN Rail to confirm emergency response plans in the event of passenger car derailment within City limits, such as use of ICS and Unified Command.
- Host practice exercises for response to mass casualty bus accidents among Fire-Rescue, Police, and Ambulance personnel utilizing the Incident Command System.

DESCRIPTION

Utilities include a variety of infrastructure-based services that support community standards of living. Because of the reliance of Abbotsford residents and business-owners on public and private utilities, any interruption in service could result in an emergency situation. Possible utility failures include:

Power Failure – Threats to public safety can occur when power is lost for prolonged periods when the ambient temperature is very low. Electricity is considered an essential service to maintain heat and cooking facilities, and to support other critical utilities.

Fuel Shortage – Disruption of natural gas in extreme cold conditions could threaten public safety.

According census data, most BC residents (59%) rely on natural gas for heat. About 32 percent of dwellings are heated by electricity; 9 percent use other fuels, including wood for heat.

Water System Failure – Interruption of potable water can occur due to insufficient water access or contamination, or both. Prolonged incidents of either can affect the health of Abbotsford residents and lead to economic impacts for local businesses and farms.

Wastewater System Failure – As with potable water, much of Abbotsford depends on sewer systems. Prolonged wastewater system disruption could lead to health impacts among residents and the interruption of business, industrial, and institutional activity in some sectors. Solid Waste System Failure – Solid waste disposal services under contract with the City are subject to failure due to strike, earthquake, fire and other causes.

Communications Failure – The communications infrastructure in the Fraser Valley can be considered a basic necessity in today's world. The telephone, fax, computer networks, data lines, and wireless radio and cellular phone systems are subject to failure through a number hazards, including windstorms, ice storms, solar flares, and earthquakes.

PAST EVENTS

July 1996 – Power Outage

A major power outage in western USA and Canada began when a 345,000-volt transmission line failed in Idaho. More than two million customers were affected.

January 1998 – North East Power Outage

A prolonged power outage in severe weather was blamed for 30 deaths and for leaving more than 3.5 million people in the dark.

December 2000 – Natural Gas Failure

On December 21, a 15-cm gas line supplying Dawson Creek with natural gas froze and had to be shut down. Gas supply to all major industries was shut off, all schools were closed, and about 4,000 homes and users were impacted.

October 2003 – Vancouver Telephone Outage

A construction crew damaged Telus cable infrastructure, impacting service for 2,000 residential and business customers in the Vancouver area for 72 hours.

August 2006 – Tofino Water Shortage

On August 29, Tofino's Mayor declared that all local food service and lodging businesses were to shut down due to a severe water shortage.

February 2011 – Christchurch Earthquake

Ongoing earthquakes badly damaged the Christchurch Wastewater Treatment Plant in New Zealand, forcing effluent discharge directly into the ocean. Seismic shaking cracked pipe joints and walls, allowing groundwater and liquefaction silt to enter, reducing the carrying capacity. City officials distributed about 30,000 chemical toilets to quake-affected residents.

HAZARD AREAS

Utilities in Abbotsford may be exposed to risk from earthquakes in high hazard liquefaction zones and landslide impact areas. These include delineated hazard zones in Matsqui Prairie and Sumas Prairie, among others.

Abbotsford receives transmitted power via a number of lines managed by BC Hydro. Power outages can be caused by heavy winds, ice storms, snowstorms, falling trees, and earthquakes.

Interruptions of piped natural gas are most frequently caused by digging during building or road construction, which most often occur in urban neighbourhoods.

Water supply is robust, with several separated sources serving Abbotsford. The wastewater system relies, however, on a single treatment plant located on the Fraser River without an alternate facility.



Power Lines on Lower Sumas Mountain

VULNERABILITIES

Institutions are among the community features most likely to be affected by utility failure. Schools will likely be closed without access to power and water. Elderly care facilities rely on water, sewer, power and communications systems for safe operation. The Matsqui Prison Complex depends on municipal utilities for water and wastewater services.

Many agriculture operations rely on the municipal water supply for livestock and crops.



Agriculture Operations in Abbotsford

Power and water interruptions can cause businesses to close temporarily, and result in economic hardships for business owners and employees. Prolonged telecommunications failures are likely to have devastating impacts on Abbotsford businesses, including home-based business sector. As a result, economic impacts are likely to be immediate and wide spread.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Prepare a plan to advise agricultural organizations on water supplies for livestock and crops during water supply disruption.
- Develop plans for public information sharing and warming centres in case of prolonged natural gas system failure during winter months.

DESCRIPTION

Volcanoes pose serious hazards to human populations in many parts of the world. In addition to destruction caused by ash fall and lahars in the immediate vicinity of an erupting volcano, ash plumes injected into the atmosphere may pose dangers to people living far away down wind.

The International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) has identified 16 volcanoes in the world as worthy of particular study in light of their history of large, destructive eruptions and proximity to populated areas. Mount Rainier in Washington State is on the IAVCEI list. Mount Baker is not.

Although Mount Baker is currently active, as evidenced by hot springs, the probability of a volcanic eruption is less than once in 1,000 years. A major eruption may cause lahars and generate volcanic ash that could affect the region. Mount Rainier is more likely to erupt in the coming years, but poses less of a threat to Abbotsford because it lies more than 100 km to the south.

Natural Resources Canada suggests that volcanic fallout from either of these potential volcanoes is possible but not likely in the coming decades.



Mt. Baker from Abbotsford

PAST EVENTS

June 1912 – Novarupta, Alaska

The eruption of one of a chain of volcanoes on the Alaska Peninsula was the largest volcanic blast of the 20th century. The eruption sent 12.5 cubic km of magma and ash into the air and covered an area of 7,800 square km.

May 1980 – Mount St. Helens, Washington

This well-known eruption on May 18 killed 57 people and caused damage for tens of kms. Prevailing winds blew millions of tons of ash eastward, and caused complete darkness in Spokane, Washington. The stratovolcano blasted a column of ash and dust 24 km into the air in just 15 minutes, and caused the largest landslide in Earth's recorded history. Ash from the Mount St. Helens eruption was later deposited on the ground in 11 states, as well as in southern British Columbia. Some of the ash drifted around the globe over two weeks.

November 1985 – The Armero Lahar

After 69 years of dormancy, this volcanic eruption caught nearby towns unaware in Tolima, Colombia, on November 13. Multiple volcano science organizations had advised the government to evacuate the area a month earlier, but there were delays. The eruption melted the mountain's glaciers, sending four enormous lahars down slope at 50 kilometers per hour, moving into six major rivers at the base of the volcano. One lahar flooded the town of Armero, killing more than 20,000 inhabitants.

June 1991 – Mount Pinatubo, Philippines

This June 15 eruption ejected more than 5 cubic kilometers of material into the air and created a column of ash that rose to a height of 35 km. Some roofs collapsed under the weight of the ash that fell across the countryside. The blast also released millions of tons of sulfur dioxide and particulates into the air, which caused global temperatures to drop the following year.

HAZARD AREAS

An eruption of Mt. Baker could produce a number of lahars, thick flows of water, rock and mud that can cover large areas surrounding the volcano.

One potential lahar path follows the Nooksack River, spilling over to the Sumas Valley and subsequently into Abbotsford.



*Possible Lahar Paths from Mt. Baker
(Source: Clague, et. al., 2006)*

Although unlikely in the near future, a lahar from a Mount Baker eruption could rapidly flow into the Sumas Valley, burying residential and agricultural properties, as well as roadways and other critical infrastructure.

VULNERABILITIES

Unwary citizens could be trapped and killed if a lahar occurs without warning. Potentially vulnerable community elements include the Upper Sumas Elementary School, the FortisBC Huntingdon Station, the SRY Rail line, and Sumas Reserve #6.



*Lahar in Armero, Columbia, 1985
(Source: USGS)*

Experience with lahars elsewhere in the world has shown that recovery within the impact area would be very difficult, if not impossible.

High levels of respirable ash in the air (less than 10 microns in diameter) can lead to eye, nose, and throat symptoms, especially in persons with chronic bronchitis, emphysema, and asthma.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Develop a plan for responding to an eruption of Mt. Baker, addressing such issues as a potential lahar and ash fallout.

DESCRIPTION

Wildfires rank among the prime hazards of concern for the City, especially in Sumas Mountain residential neighbourhoods that border forested areas. Fire suppression in the region has created a densely spaced, second growth forest in some areas with thick ground cover and ladder fuels that present a major risk of rapid fire spread, potential crown fires, and extreme fire behaviour.

From June to October of most years, the community faces a threat from wildland-urban interface fires. While the cooler region of the Fraser Valley may be less susceptible to wildland fires than the province's interior, occasional periods of high temperatures, low humidity, and high winds may exacerbate the risk. Ongoing drought conditions linked to global climate change are likely to increase the risk of wildland-urban interface fires in the coming decades.

Wildfires may require immediate evacuation of persons and animals to preserve safety. Response requires careful planning to be effective in removing citizens from harm.

PAST EVENTS

July 1994 – Garnet Fire, Penticton

Unpredictable winds plagued fire crews from the day the Garnet Fire began on July 20, 1994. Eighteen homes were destroyed, 3,000 people were evacuated and fire suppression costs exceeded \$5 million.



*Silver Creek Wildfire, 1998
(Source: BC Forest Service)*

July 1998 – Silver Creek Interface Wildfire

On July 26, lightning struck a tree on a steep slope in the mountains just southwest of Salmon Arm, BC. The steep terrain hampered attempts to contain the blaze, and high winds pushed the fire across Silver Creek valley, destroying more than 40 structures. Continued high winds led to the evacuation of 7,000 from Salmon Arm, the largest evacuation in BC history to that date.

July 2003 – McLure / Barriere Fire

High winds and 40°C temperatures turned a carelessly tossed cigarette into a fire storm within a few hours. Thousands of residents from Barriere were evacuated from their homes from the 178-square-kilometre fire.

August 2003 – Okanagan Mountain Park Fire

The Okanagan Mountain Park Fire was the most significant interface wildfire event in BC history. After changing directions a few times, the fire eventually reached 25,600 hectares in size. The communities of Naramata and Kelowna suffered the largest effect when officials evacuated 33,050 people and fire destroyed 238 homes.

July 2014 – Smith Creek Fire

This wildland fire forced about 2,500 people from their homes near West Kelowna. The fire burned within 100 metres of the main feeder powerline that service the towns of Peachland, Westbank, and West Kelowna. A reception centre was established at a secondary school in West Kelowna. Evacuated residents were provided with food and accommodation vouchers.

August 2015 – Rock Creek Homes Burn

A fire suspected to be caused by humans led to damage and the destruction of 30 homes and an additional 15 buildings in Rock Creek. The Regional District of Kootenay Boundary issued evacuation orders and alerts for all areas of Rock Creek, Westbridge, and Christian Valley.

HAZARD AREAS

The City of Abbotsford contains wildland-urban interface fire areas that periodically experience high fire danger during the summer and early fall.

The City contracted for a thorough assessment of the risk of wildfire in 2009. The report identified several areas of moderate to high probability and moderate consequence on Sumas Mountain.



South West Slope, Lower Sumas Mtn.

VULNERABILITIES

Areas of concern include vulnerable Sumas Mountain residential neighbourhoods that have one-road access adjacent to forested areas, such as these example locations:

- Auguston Parkway
- Dawson Road
- Westview Boulevard
- Willet Road

Smoke, darkness, and flying embers can lead to poor visibility and hinder quick evacuation during a fire threat. Residents with reduced mobility and dependence on others are most vulnerable in wildfire situations.

Assistance with wildland-interface fires may be close at hand. The BC Wildfire Management Branch has located a fire base at the Abbotsford International Airport, and allocates aircraft and crew to the site as dictated by the fire risk.

POTENTIAL CITY ACTIONS TO REDUCE RISK

- Meet with neighbourhood groups and homeowners in high risk areas to promote Fire Smart mitigation within specific neighbourhoods.
- Ensure the Abbotsford Official Community Plan identifies wildland-urban interface risk areas, and controls development through the permit process.
- Investigate options for rapid public alerting in wildfire situations, including priority dial telephone, use of a small-scale FM radio station, Facebook, and text messaging.

OTHER HAZARDS

A number of hazards could trigger response through an Incident Command Post without requiring the site support efforts available through an Emergency Operations Centre. To complete the list of concerns, the following paragraphs summarize other hazards that may require specific emergency response procedures.

Bomb Threat – While specific buildings or infrastructure in Abbotsford may fall victim to the threat of bombing, it is unlikely that such a bomb threat would require the activation of an Emergency Operation Centre. The Abbotsford Police have procedures in place for responding to bomb threats.

Disease – Animal, Plant – In the event of an outbreak of foreign animal disease, such as Avian Influenza or Foot and Mouth Disease, the Abbotsford Emergency Program Coordinator would likely work within the Joint Emergency Operations Centre established by the federal and provincial governments.

Drought – Although a long-term drought situation may trigger City action to assist citizens and farmers, such an event is unlikely to call for activation of an Emergency Operations Centre.

Food Contamination – Food service to large numbers of people sometimes occurs in Abbotsford, such as at the Sports Centre. However, it is unlikely that the municipal emergency program will be expected to respond. The Vancouver Island Health Authority deals with threats of and responses to food contamination at health facilities.

Information Technology Failure – Severe geomagnetic storms are natural hazards that may cause temporary disruptions to telecommunications and GPS, affect aircraft transportation, and influence the orbits of spacecraft and satellites. No municipal response actions are required in such incidents.

Land Subsidence – Land subsidence occurs when the earth's surface has been undermined, deformed, and subjected to ground movement. Subsidence can be caused by mining, excavation, extraction of underground liquids, and the flow of water through limestone and other soluble rock. Land movement resulting from subsidence is highly localized and would not likely demand site support through an EOC. Subsidence causing structure collapse is addressed under that hazard in the text.

Lost Persons – The Central Fraser Valley Search and Rescue organization has engaged in many operations where persons become lost, and would not likely request assistance from the City Emergency Operations Centre.

Space Debris – It is possible, although highly unlikely in the next few decades, that an object from space may penetrate the earth's atmosphere and crash into or near the community. Threats range from small meteorites to large debris, such as a comet. Space craft have also impacted the Earth's surface in the past after leaving orbit.

PRIORITY CONCERNS

One purpose of this Community Risk Assessment is to identify priorities for action. The Abbotsford Emergency Planning Committee considered the risk information presented above to identify hazards that are most likely to result in large consequences for the community.

Risk represents the potential for loss and is made up of two components: Probability and consequence. The greater the probability of an adverse event, the greater the risk. The frequency of events over a given time period is a commonly applied measure of probability. Also, the greater the potential consequences of an incident, the greater the risk. Consequences may include physical, social, and economic impacts.

Considering both components of risk becomes important when allocating limited time and effort for emergency management. The highest priority is given to hazards that are both probable and likely to lead to severe consequences. Low priority is allocated to low probability occurrences of little consequence.

With these considerations in mind, a review of the 14 primary hazards presented above yields the hazards and priorities identified in Figure 24.

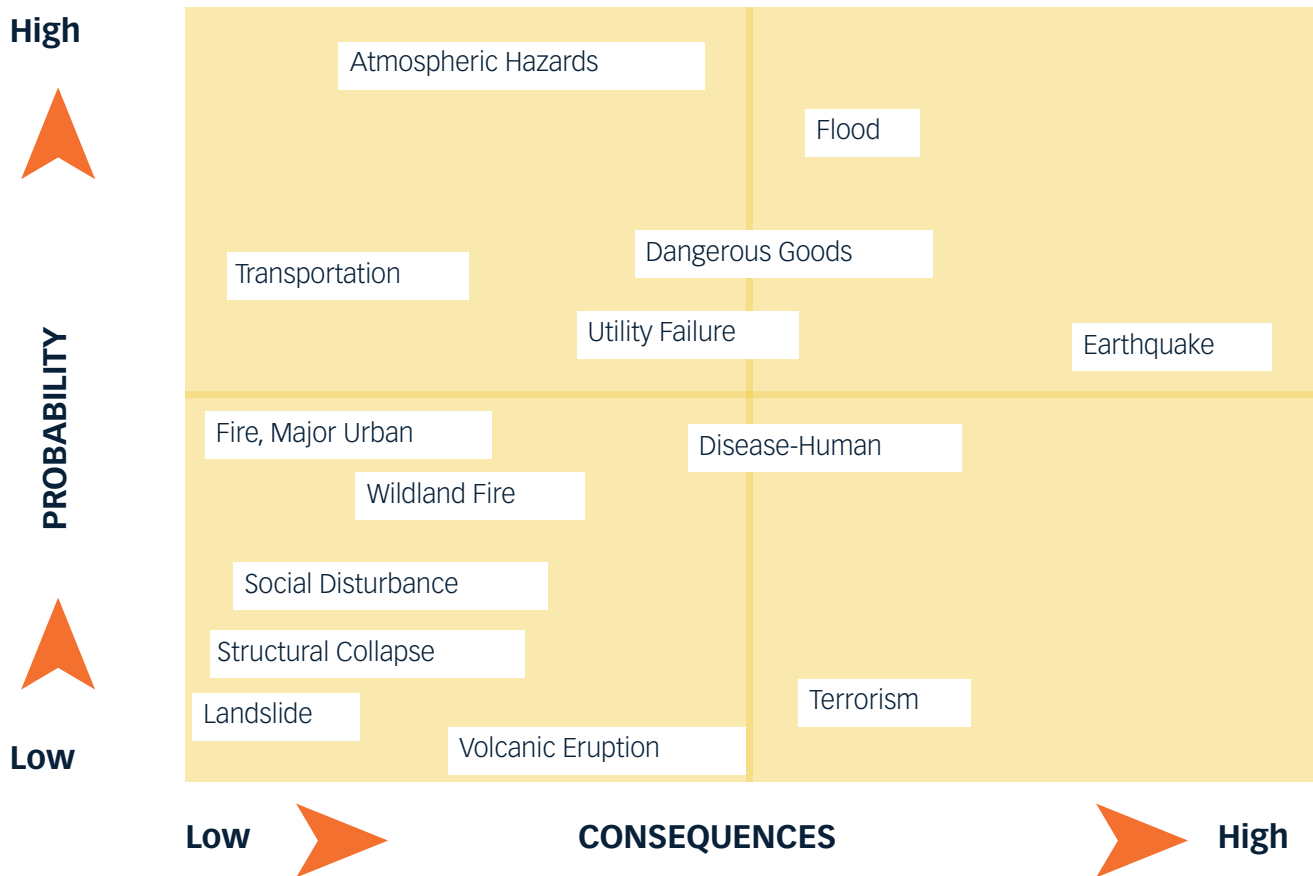


Figure 24. Priority Risk Concerns for Abbotsford

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INTERNET RESOURCES

Abbotsford International Airport | www.abbotsfordairport.ca/

Abbotsford News | www.abbynews.com

Aboriginal Affairs and Northern Development Canada | <http://pse5-esd5.ainc-inac.gc.ca/>

BC Emergency Health Services | www.bcehs.ca/

BC Hydro | www.bchydro.com

BC Min. of Education – Emergency Planning Guide | www2.gov.bc.ca/gov/content/education-training/administration/kindergarten-to-grade-12/safe-caring-and-orderly-schools/emergency-management-planning-guide

BC Min. of Energy, Mines and Petroleum Resources – Earthquake Hazard Map | <http://www.empr.gov.bc.ca/Mining/Geoscience/TerrainandSoilMaps/Pages/default.aspx>

BC Min. of Environment | www.env.gov.bc.ca/

BC Min. of Transportation and Infrastructure - Traffic Data | www.th.gov.bc.ca/trafficData/tradas/tradas.asp

Canadian National Railway | <https://www.cn.ca/>

Central Fraser Valley Search and Rescue | www.cfvsar.bc.ca

City of Abbotsford | www.abbotsford.ca

Emergency Management BC | www.embc.gov.bc.ca/index.htm

Environment Canada | <http://climate.weather.gc.ca/>

FortisBC Gas | www.fortisbc.com/NaturalGas/Homes/Pages/default.aspx

Fraser Health | www.fraserhealth.ca/

Fraser Valley Regional District | www.fvrd.ca/

Kinder Morgan | www.kindermorgan.com/business/canada/transmountain.aspx

Matsqui First Nation | www.angelfire.com/empire2/matsquifirstnation/

School District 34 | www.sd34.bc.ca/

Southern Railway of BC | www.sryraillink.com/about-sry/

Statistics Canada | www.statcan.ca/start.html, www12.statcan.ca/

Sumas First Nation | www.sumasfirstnation.com/

University of the Fraser Valley – Emergency Management | www.ufv.ca/emergencymanagement/

VIA Rail | www.viarail.ca