Hazard, Risk & Vulnerability Assessment - Update

February 2009

Prepared for:

Regional District of Nanaimo

Prepared by:

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ADVANCE STRATEGIC CONSULTING

ABOUT ADVANCE STRATEGIC CONSULTING (ASC)

Advance Strategic Consulting (ASC) is focused on assisting protective services authorities evaluate their current state and determine the appropriate path to follow to continue their development into the best possible model for delivering service to their community.

Advance Strategic Consulting is assisting emergency services by providing a broad range of services including strategic planning, organizational assessment & evaluation, standards of cover, educational workshops, risk and hazards analysis and more.

CONSULTING TEAM

This project was completed by the consulting team of Patrick Downey and Richard Lawrie. Their backgrounds include planning, assessment, analysis, risk management, communications, report preparation, quality control and almost 70 years of experience in emergency planning and operations. As CEOs of fire and emergency services their experience has been augmented by substantial involvement with local, regional, provincial, federal and international task groups assessing emergency services and developing solutions for critical issues. The team has a thorough understanding of emergency services and the challenges faced with delivering critical programs in an environment of scarce resources.

EXECUTIVE SUMMARY

Advanced Strategic Consulting (ASC) conducted this Hazard Risk and Vulnerability Assessment (HRVA) update for the Regional District of Nanaimo (RDN) Emergency Management 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 6(2) of this regulation requires local authorities to prepare or cause to be prepared local emergency plans respecting preparation for, response to and recovery from emergencies and disasters, and reflect in the local emergency plan, the potential emergencies and disasters that could affect the jurisdictional area .

Based on the aggregation in the Risk Matrix, ASC has confirmed several hazards that could affect the Regional District of Nanaimo. This assessment identifies the risk that each hazard presents to the Regional District, thereby allowing the RDN to plan for response, mitigation, and recovery within budgetary and other constraints. The information presented in this assessment can be used by the Regional District of Nanaimo 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 and on-going emergency planning.

Based on the information obtained in the course of this assessment, ASC has assigned each hazard with a rating of *low, moderate*, *high* or *very high*, for the Regional District of Nanaimo. ASC 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 hazards as *Very High Risk and High Risk*:

Very High Risk

- Earthquake

High Risk

- Forest fires and Wildland Urban Interface (WUI) fires
- Flood
- Human Diseases and Pandemic

The Risk Matrix on page 9 shows the relative ranking of *all* hazards analyzed. These rankings were determined using the criteria from the Provincial Emergency Program (PEP) HRVA Toolkit and therefore may not be identical to risks assigned using other methods or criteria.

INTRODUCTION

This Hazard Risk and Vulnerability Assessment update was conducted by Advanced Strategic Consulting (ASC) for the Regional District of Nanaimo Emergency Program. The study was partially funded by a grant from the Union of British Columbia Municipalities.

HAZARD, RISK AND VULNERABILITY ASSESSMENT

The purpose of Hazard, Risk and Vulnerability Analysis (HRVA) is to help a community make risk-based choices to address vulnerabilities, mitigate hazards and prepare for response to and recovery from hazard events. *Risk-based* means based on informed choices of alternate unwanted outcomes. In other words, communities make risk reduction choices based on the acceptability of consequences and the frequency of hazards.

Risk is a total concept of ***likelihood*** of occurrence of identified hazards and the severity of possible ***impacts***. The combination of severity and likelihood is termed the **level of risk**.

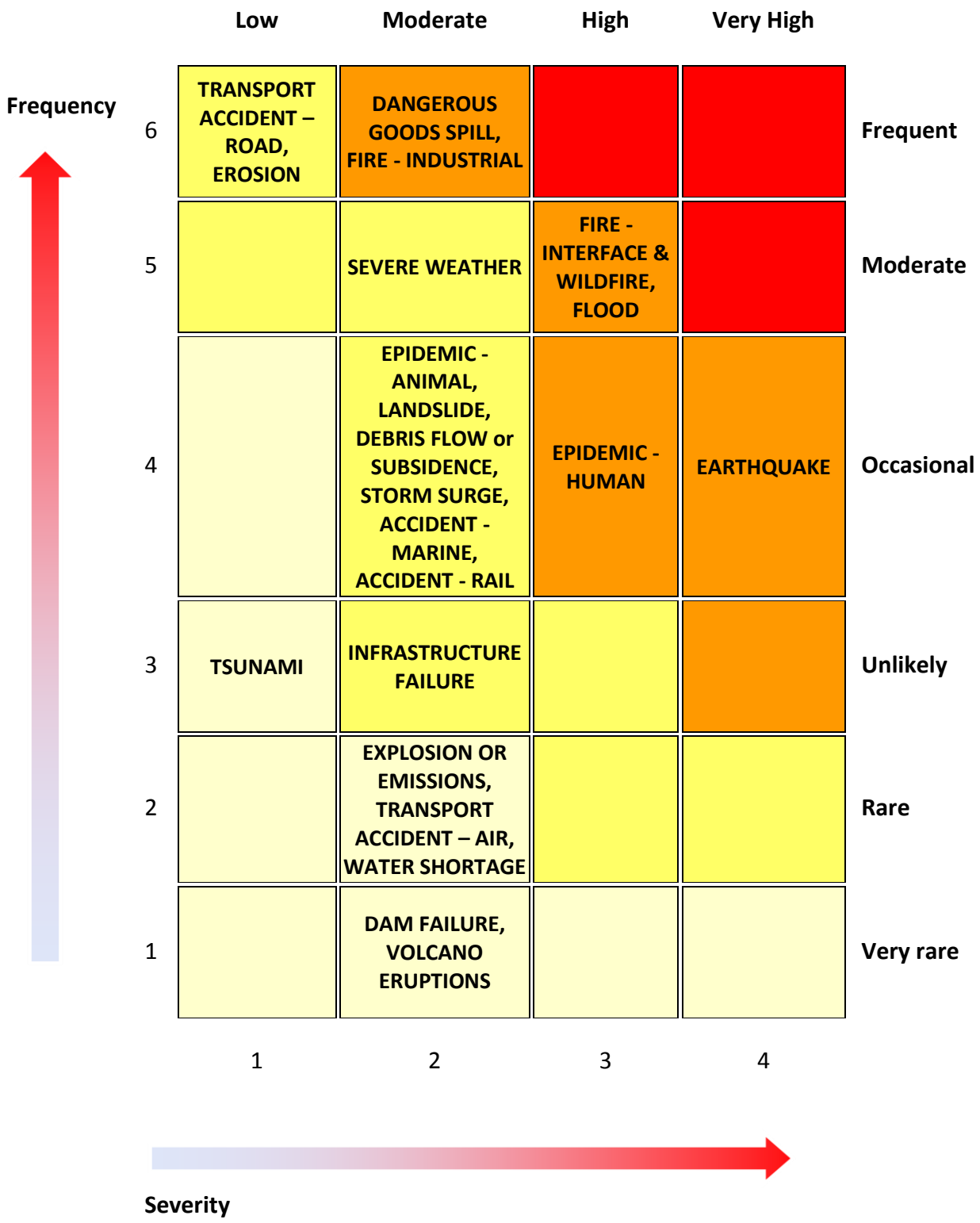
When determining the severity of an identified hazard, a community's vulnerability must be examined. Vulnerability is defined as people, property, infrastructure, industry and resources, or environments that are particularly exposed to adverse impact from a hazard event (Ministry of Public Safety and Solicitor General, Provincial Emergency Program, 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. Just as a fire hall on the floodplain is 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 is the systematic use of information to identify hazards and to estimate the chance for and severity of, injury or loss to individuals or populations, property, the environment, or other things of value.

HAZARD RISK MATRIX – REGIONAL DISTRICT OF NANAIMO



SCOPE

This HRVA is designed to provide an assessment of the hazards that may present risks to the Regional District of Nanaimo (RDN). 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 Regional District'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. ASC has verified 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. ASC proprietary tools have been utilized in conjunction with the Provincial Emergency Program's (PEP) HRVA Toolkit 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 all relevant Electoral Areas (A, B, C, E, F, G, H) within the District, including Gabriola Island (Electoral Area B), which is managed under Islands Trust for land use planning and conservation measures. Due to their respective jurisdiction and individual emergency management endeavours, this HRVA **does not primarily focus on the four municipalities within the RDN,** the District Municipality of Lantzville, the City of Nanaimo, the City of Parksville and the Town of Qualicum Beach. These municipalities **will be addressed to some extent** due to mutual aid agreements, cross-boundary hazard concerns, and supporting response facilities.

Factors considered in developing a list of hazards for the Regional District of Nanaimo include:

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

Using the Risk Matrix, ASC has identified several hazards that could affect the Regional District of Nanaimo. ASC acknowledges the potential that other hazards might exist, but the hazards identified in this assessment are considered more likely to impact the Regional District than others. The hazards described in this report are not unique to the Regional District of Nanaimo; other jurisdictions with similar demographics, industrial makeup and other similar physical characteristics, may also be subject to the same hazards.

METHODOLOGY

In this analysis, extensive background and historical research were combined with informal staff interviews, as well as onsite observations. This information was then reviewed and considered using the seven categories of impact identified within the Provincial Emergency Program (PEP) HRVA Toolkit, outlined in Table 1 below. Each of the categories of impact criteria were individually ranked on a scale from one to four; one being the least severe and four indicating the highest severity. The impact scores were then measured as to the likelihood rating of one to six, one being the least likely and six being most likely (See Measure of Likelihood - Table 2).

Table 1 – Seven Categories of Impact

Categories of Impact	Score
Fatality	**1-4**
Injury	**1-4**
Critical Facilities (Hospitals, Fire-Police Services etc.)	**1-4**
Lifelines (Water, Gas, Power, Etc.)	**1-4**
Property Damage	**1-4**
Environmental Impact	**1-4**
Economic and Social Impact	**1-4**

(Provincial Emergency Program – 2004)

The aggregate score of each hazard, combined with the hazard impact consequence and likelihood provide the basis for a risk ranking of ***low, moderate, high*** or ***very high***. All scores are provided in Appendix A within the "Hazards Table."

Table 2 - Measure of Likelihood

Measure of Likelihood	Return Period (Years)	Score
Frequent or Very Likely	Every 1-3	6
Moderate or Likely	Every 4-10	5
Occasional or Slight Chance	Every 11-30	4
Unlikely or Improbable	Every 31-100	3
Highly Unlikely, a Rare Event	Every 101-200	2
Very Rare Event	Every 201-300	1

(Provincial Emergency Program – 2004)

Table 3 – HRVA Risk Rating Interpretation

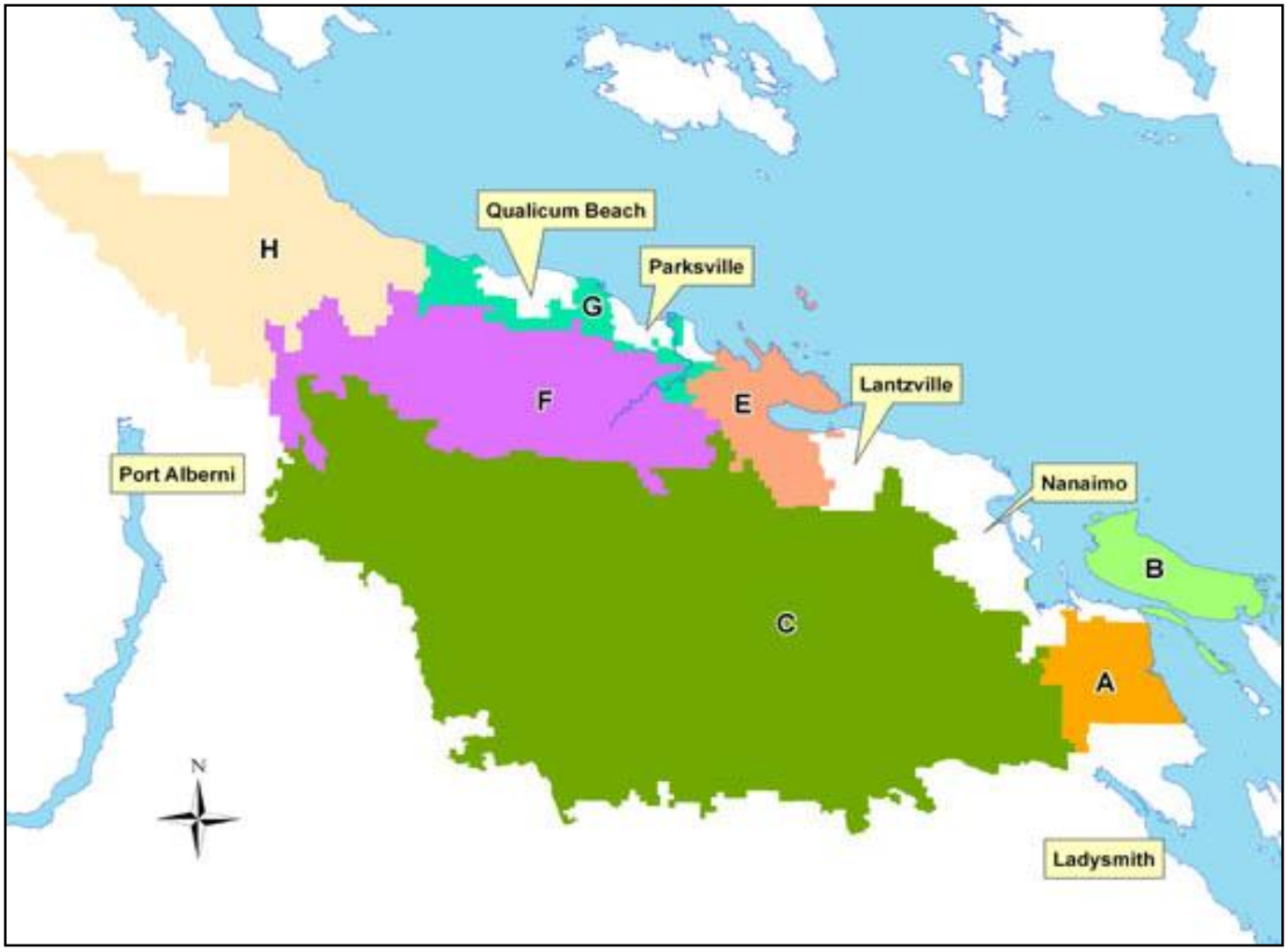
RISK RATING INTERPRETATION	
LOW	Implementation of mitigation measure will enhance emergency preparedness **It is the least urgent.**
MODERATE	Intermediate levels of frequency and severity. More urgent than low risk; often commonplace concerns. **Address with an appropriate level of urgency**
HIGH	These hazards warrant review and development of actions to reduce the risk to an acceptable level. **Corrective measures should be planned in the near future**
VERY HIGH	Frequent and of High Severity. **Immediate review and implementation of corrective measures to reduce the risk to an acceptable level**

Table 3 - Levels of risk rating with interpretation and action recommendations

REGIONAL DISTRICT OF NANAIMO

LOCATION AND SURROUNDINGS

The Regional District of Nanaimo (RDN) is located on the eastern coast of Vancouver Island, and is bordered by the Regional District of Comox-Strathcona to the northwest, the Cowichan Valley Regional District to the south, and to the west by the Alberni-Clayoquot Regional District. A geographic breakdown of each RDN Electoral Area is depicted in Figure 1. The Regional District was incorporated on August 24, 1967, celebrating its 40th anniversary in 2007. The Regional District of Nanaimo is approximately 2,035 km2 and consists of seven electoral areas (designated A, B, C, E, F, G & H) and four municipalities including: the City of Nanaimo, the District of Lantzville, the City of Parksville and the Town of Qualicum Beach.



Electoral Area boundaries - Regional District of Nanaimo (RDN 2008)

DEMOGRAPHICS

GENERAL

Demographic and background information is a vital resource to any emergency plan, in order to identify vulnerable populations which may be exposed to adverse impacts from a hazard event. The Regional District of Nanaimo recognizes the importance of social well-being within the Regional District and has vowed to act on this through its planning decisions. Table 4 provides a summary of important demographic information concerning the Regional District of Nanaimo, contrasted with the province of British Columbia for comparison (Statistics Canada, 2006).

Table 4 - Regional District of Nanaimo Demographics and Background Information

Demographics	RDN	BC
Land Area (sq. km.)	2,034.93	924,815.43
Population	138,631	4,113,487
Male	(67,235) 48.5%	(2,013,990) 48.97%
Female	(71,400) 51.5%	(2,099,495) 51.03%
Aged Population (65 and older)	(28,945) 20.9%	(599,800) 14.6 %
Young Population (younger than 15)	(19,870) 14.33%	(679,605) 16.5%
English speaking	(131,540) 94.88%	(3,341,285) 81.23%
French Speaking	(420) .30%	(15,325) 0.37%
Other Language	(4,310) 3.11%	(639,380) 15.54%
Aboriginal Population	(6,815) 4.92%	(196,070) 4.4 %
Households	**RDN**	**BC**
Total	59,875	1,643,150
Owned	(45,560) 76.09%	(1,145,050) 69.69%
Rented	(14,305) 23.89%	(493,995) 30.06%
Average Value – Owned	$ 340,700	$ 418,703
Average Household Size	2.3	2.5
Average Household Income	$ 47,242	$ 52,709
Incidence of Low Income	15.1%	17.3%
Labour Force by Top 3 Industries	**RDN**	**BC**
Experienced Labour Force	66,620	2,193,115
Retail Trade	9,365	248,950
Health Care & Social Assistance	7,420	213,085
Construction RDN, Manufacturing BC	6,645	189,120

(Statistics Canada 2006 Census Data)

ASC has utilized demographic information based on the most recent survey performed by Statistics Canada in 2006. Language statistics (English, French & Other) are based on ***Language spoken most often at home***. This figure includes incorporated areas; see Table 5 for Electoral Area populations excluding municipalities.

The data in Table 5 shows the population breakdown of the Electoral Areas that make up the RDN and the respective share that each area contributes to the Electoral Areas' population total.

Table 5 – A census profile of Electoral Areas examined within the HRVA

Electoral Area	Neighbourhood/City/Town	Share of Total EA Population	Total Population
A	Boat Harbour, Cassidy, Cedar, Cedar-by-the-Sea, Nanaimo Band Reserves 2, 3 & 4, South Wellington, Yellow Point	16.46%	6,751
B	Gabriola Island, Mudge Island, DeCourcey Island	9.88%	4,050
C*	Arrowsmith Benson-Cranberry Bright, Nanaimo Lakes, Extension, East Wellington-Pleasant Valley	18.44%	7,563
E	Nanoose Bay, Fairwinds, Northwest Bay	13.32%	5,462
F	Errington, Coombs, Hilliers	16.29%	6,680
G	Englishman River, French Creek, Shaw Hill San Pariel, Dashwood	17.13%	7,023
H	Bowser, Deep Bay, Qualicum Bay	8.47%	3,474
TOTAL POPULATION OF ELECTORAL AREAS		100%	41,003

(Statistics Canada 2006 Census Data)

*Based on the amalgamation of the remainder of Electoral Area D with Electoral Area C, following the incorporation of Lantzville in 2003 (RDN, 2004).

LANGUAGE

The vast majority of residents (> 94%) in the Regional District of Nanaimo reported English as the language spoken most at home (Statistics Canada, 2001). The small portion of those who speak neither English nor French regularly (3.11%) may require special arrangements in a response to an emergency. The visible minority population within the RDN showed as (7,930) 5.72%, with South Asian (East Indian, Pakistani, Sri Lankan, etc.) at the highest ratio, followed by Chinese.

AGE

The senior population of the Regional District of Nanaimo is relatively high (20.9%) when compared to the provincial average of 14.6% as compiled by Statistics Canada. A breakdown of elderly population within the RDN Electoral Areas is given in Table 6. The proportions of seniors in each Electoral Area, total senior population, as well as the total area population are provided.

It is evident that Electoral Areas E, G and H still hold a particularly high percentage of elderly residents, with over one-quarter of the total population over the age of 65, representing a vulnerability that should be considered.

Table 6 – Seniors (65+) population statistics within the Regional District of Nanaimo

Electoral Area	Proportion of Seniors by Electoral Area	Total Senior Population	Total Area Population
A	13.92%	940	6,751
B	20.86%	845	4,050
C	14.08%	1065	7,563
E	26.09%	1425	5,462
F	11.30%	755	6,680
G	25.35%	1780	7,023
H	27.49%	955	3,474

(Statistics Canada 2006 Census Data)

VULNERABLE POPULATIONS

These statistics 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 mobility, visual and hearing challenges), and respecting the emotional state of senior individuals during a stressful incident.

Approximately 10% of the population of the RDN is nine years of age or younger, which is also important to note. Special considerations for young individuals, especially when separated from their parent or guardian, should be noted. 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.

ECONOMY

As noted in Table 4, the RDN top three (Statistics Canada, 2006) industries include:

1. Retail Trade

2. Health Care and Social Assistance

3. Construction

The economy within the Regional District of Nanaimo embraces the forestry industry, including pulp and paper, logging, sawmills and veneer production. A wide range of other economic endeavours contribute to the well-being of the RDN such as: commercial fishing, non-timber manufacturing, tourism, education, agriculture and research.

INFRASTRUCTURE

CRITICAL FACILITIES

Within this HRVA, critical facilities are defined as facilities that are essential to carry out emergency response activities of the Regional District of Nanaimo. It is important to note that there are numerous critical facilities outside of the Regional District that are essential in order for the Province to support the Regional District of Nanaimo in an emergency (e.g. the PEP Emergency Coordination Centre and the Provincial Fire Control Centre in Victoria).

The primary critical facility for coordination of any large-scale disasters or emergencies is the Regional District's Emergency Coordination Centre (ECC), located at the Regional District of Nanaimo Office. Before, during, and after a hazard event, the ECC is essential for site support, including the coordination of special resources, information, multiple departments and external agencies.

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

Emergency Coordination Centres (ECC)

Regional District of Nanaimo Office
6300 Hammond Bay Rd.
Nanaimo, BC
City of Nanaimo ECC – Nanaimo Fire Hall #1
Parksville ECC – City Hall
Qualicum Beach ECC – Town Hall

Emergency Volunteer Centre

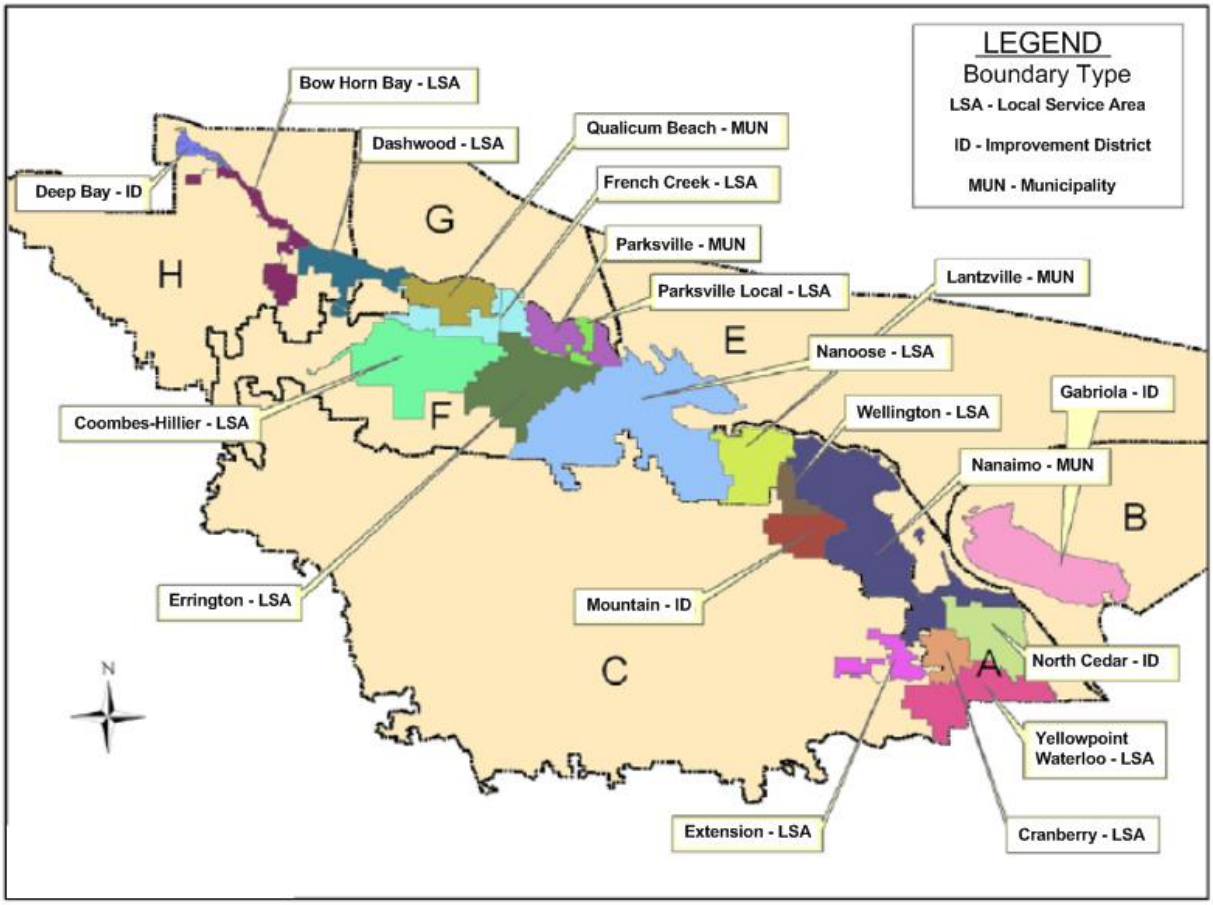
Departure Bay Emergency Volunteer Centre
1413 Wingrove St.

EMERGENCY RESPONSE SYSTEMS

FIRE/RESCUE

Within the boundaries defined for this report, there are a total of 12 fire departments in the various Electoral Areas, with 16 corresponding fire halls. The areas of Coombs-Hilliers, Errington, Gabriola and North Oyster each have two fire halls. There is also inter-agency support that exists from the neighbouring municipality fire departments of Lantzville, Nanaimo, Parksville and Qualicum Beach – where there are a total of 9 halls.

A list of fire halls within the RDN and their respective fire protection areas and district locations is seen in Appendix B, and Appendix C. A geographic overview of all RDN Fire Protection Areas can be seen in Figure 2 below.



Fire Protection Areas - Regional District of Nanaimo (RDN 2006)

POLICE

Municipal policing is provided in the Regional District by three main detachments, located at the following addresses:

Nanaimo Detachment	Oceanside Detachment	Cedar Detachment
303 Prideaux St. Nanaimo, BC	727 West Island Highway Parksville, BC	Unit 10-A, 1830 Cedar Rd. Nanaimo, BC

Community Policing Offices (CPOs) also exist within the RDN, serving the communities of Bowser, Coombs, Errington, Nanoose Bay, Parksville, Qualicum Bay and Qualicum Beach. CPO offices are composed of volunteers, and are operated under RCMP Community Policing members of the Oceanside Detachment (OCP, 2000). CPO offices can be used as command centres in a disaster event or when special policing activities are needed. These offices are located at the following addresses: (OCP, 2000)

Parksville CPO	Qualicum Beach CPO	Mobile CPO
Parksville Community Hall 132 East Jensen Ave. Parksville, BC	**Qualicum Beach Town Hall** 201 – 660 Primrose Ave. Qualicum Beach, BC	**RV in Parksville Community Park** Next to Playground

In addition to the above, CrimeStoppers, Citizens on Patrol (COP), and Victim Services (among other organizations) exist within the Regional District of Nanaimo (Oceanside RCMP, 2006).

RCMP Corporal Kirby Brett Anderson, M.B., Nanaimo, British Columbia

PRE-HOSPITAL EMERGENCY MEDICAL

In the Regional District of Nanaimo, emergency medical service is provided by the British Columbia Ambulance Service (BCAS), which is dispatched by the regional 9-1-1 system. Locations and additional info regarding BCAS detachments within the Regional District are detailed in Table 7. The regional dispatch for the Regional District of Nanaimo is located in Victoria. In addition, there is a Provincial Air Ambulance Coordination Centre (PAACC) located just north of Victoria that will handle air-evacuations, transfers between regions, other provinces, and other countries (APBC, 2006).

Table 7 – British Columbia Ambulance Services (BCAS) stations in the RDN

BCAS Station	Address	Details
Nanaimo South (1-20)	231 Prideaux Street	3 vehicles
Nanaimo North (1-22)	4415 Boban Street	6 vehicles
Gabriola Island (1-53)	725 Church Street	1 vehicle
Parksville (1-30)	249 West Hirst Street	3 vehicles
Qualicum Beach (1-38)	787 Jones Street	1 vehicle
Qualicum Bay (1-73)	210 Lions Way	1 vehicle

SEARCH AND RESCUE

There are two main Search and Rescue (SAR) operations serving the Regional District of Nanaimo, the Arrowsmith SAR and the City of Nanaimo SAR. Arrowsmith SAR has developed over many years into a fully integrated member of District 69 services (ASAR, 2006). The volunteer organization attends to approximately 12 to 15 calls locally on average, and approximately 5 mutual aid calls from other SAR groups on Vancouver Island. Area coverage runs from the Nanoose Overhead to Deep Bay in its eastern extent. ASAR provides ground Search and Rescue, swift water rescue, tracking, avalanche rescue and rope rescue training.

An official Arrowsmith Search and Rescue Emergency Plan also exists, which states that all personnel should attempt to rendezvous at the ASAR Hall during a major emergency. The hall is located at 3241B Alberni Highway (ASAR Emergency Plan, 2005).

Nanaimo SAR Society is a volunteer organization that is responsible for ground and inland waters search and rescue activities within the jurisdiction of the Nanaimo RCMP detachment, including portions of the RDN (Nanaimo SARS, 2006). Nanaimo SAR consists of four search managers, two team leaders and between twenty-five to thirty members. Lost hikers in

Serving the regional district

high alpine areas are a common concern for the Nanaimo SAR team. In January of 2002, a fatality occurred due to hypothermia on Mount Benson, a 1019-metre mountain west of the City of Nanaimo. Severe weather conditions and ill preparedness by the hiking parties were the determined causes of the tragedy.

KEY SERVICE SYSTEMS

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 Regional District of Nanaimo 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)
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 this report four sectors of critical infrastructure for the Regional District of Nanaimo are highlighted: **Water**, **Energy,** [Tele]**Communications** and **Transportation**.

WATER

A major disaster may threaten the extent of coverage and quality of water supplied by the Regional District's main reservoirs, including both the loss of drinking water and the loss of water for fire fighting. To respond to water supply emergencies, the Regional District's Water Utilities Department has outlined an Emergency Response Plan (May 2005) which is discussed in a later section – Environmental Services. This report includes lists of water suppliers and emergency contacts. In addition to providing emergency water supply to all residents, the Regional District may face the challenge of organizing a water distribution system in the aftermath of a hazard event.

A general and geographic summary of water supply sources in Central Vancouver Island can be seen in Figure 2. Residents of central Vancouver Island rely on a variety of water supply systems. Major centres make use of surface water from managed watersheds – such as the Nanaimo and Englishman Rivers. Storage reservoirs have been constructed to ensure year-round supply. The South Fork Dam is a concrete arch dam that impounds approximately 2 billion litres, while the Jump Creek Dam was constructed to hold approximately 18 billion litres. The Arrowsmith Dam, completed in 1997, provides long term water supply to Parksville, French Creek, Nanoose Bay and Qualicum Beach (RDN, 2006a). Additional water is available for release from Arrowsmith Lake that Parksville will take advantage of during dry summer months (ibid).

Seven major water service areas (WSAs) exist within the Regional District of Nanaimo including: Nanoose Bay Peninsula, Decourcey, Englishman River, San Pareil, Surfside, French Creek and Melrose Terrace (RDN, 2006c). The Nanoose Bay Peninsular Water Surface Area was created in July of 2005 when seven systems were amalgamated into one. The previous sub-areas, which are still referred to in some context, are the following:

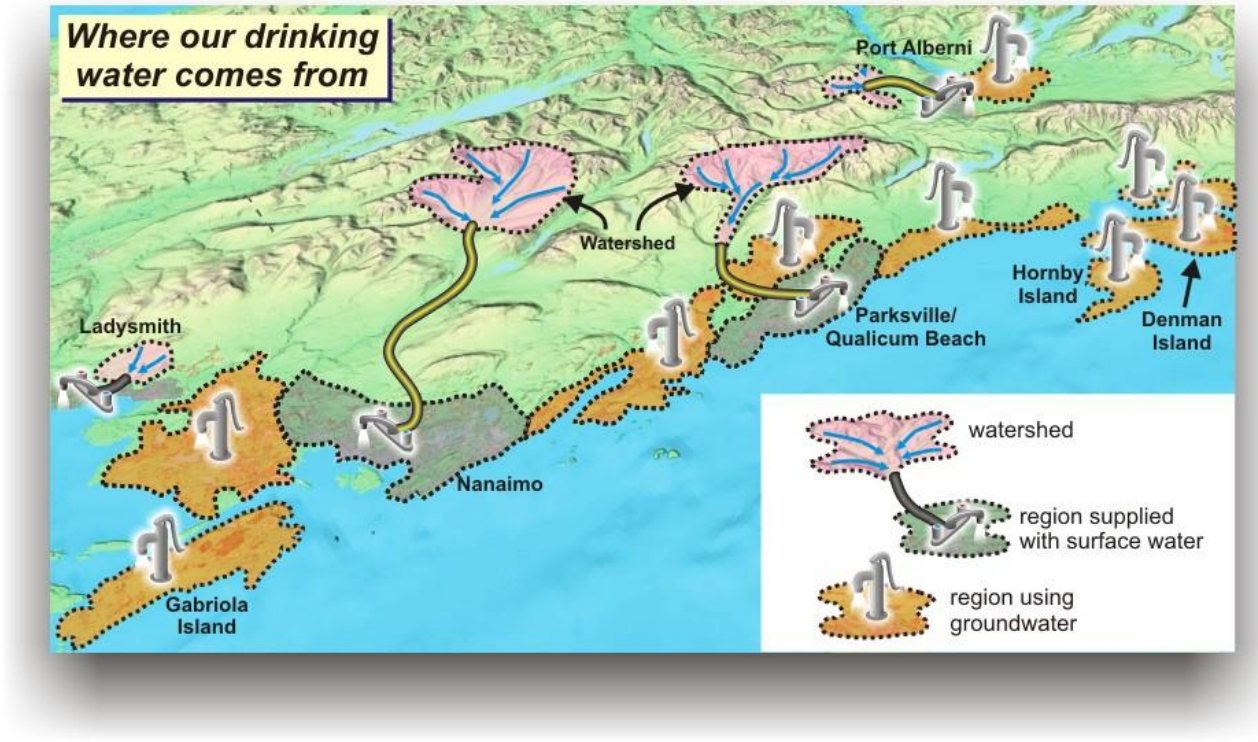
- Fairwinds
- Arbutus Park
- Madrona
- Wall Beach
- Driftwood
- Nanoose and
- West Bay

Most rural residents, including many people contained within the geographic scope of this HRVA depend on individual wells or individual surface water supplies for their supply.

RDN Water Utilities is invested in the maintenance of supply for health and security purposes. For example, in 2003 the RDN proposed the construction of a new reservoir with a capacity of 1,183,000 litres per minute (lpm) to meet domestic water needs and fire protection requirements at peak demand times within French Creek - Electoral Area H (RDN, 2003).

In addition to water infrastructure, critical waste infrastructure should be highlighted within the RDN. This includes:

- French Creek Wastewater Plant, 957 Lee Road
- Church Road Transfer Station (solid waste removal), 860 Church Road
- RDN Regional Landfill site, 1105 Cedar Road
- Greater Nanaimo Pollution Control Centre, 4600 Hammond Bay Road, which receives and treats wastewater from residential and commercial Nanaimo users (RDN, 2006)



Summary of Water Sources - Vancouver Island - Source: Geoscape.nrcan.gc.ca

An additional reservoir site in Extension is in the planning phase by the City of Nanaimo. This reservoir will be an above-ground reservoir, gravity fed and approximately one million gallons in storage capacity. This site will improve support for fire flow and emergency water intake in the area. **(Thomas, J., 2006)**

Additional information on the security and quality of water within the RDN (including the Water Utilities Emergency Response Plan) is presented in a later section – Water Contamination.

ENERGY

Energy related infrastructure within the Regional District includes a network of electricity and natural gas transmission lines and facilities. Gas is provided via a single pipeline between Powell River and Comox. The pipeline travels along the eastern coast of Vancouver Island with its terminus in Victoria.

BC Hydro is responsible for the distribution and restoration of electrical services in the Regional District, while Terasen Gas (formerly Centra Gas) operates facilities and gas lines in the Regional District of Nanaimo. Terasen Gas and BC Hydro both provide essential services and will support the Regional District during emergency response and recovery efforts.

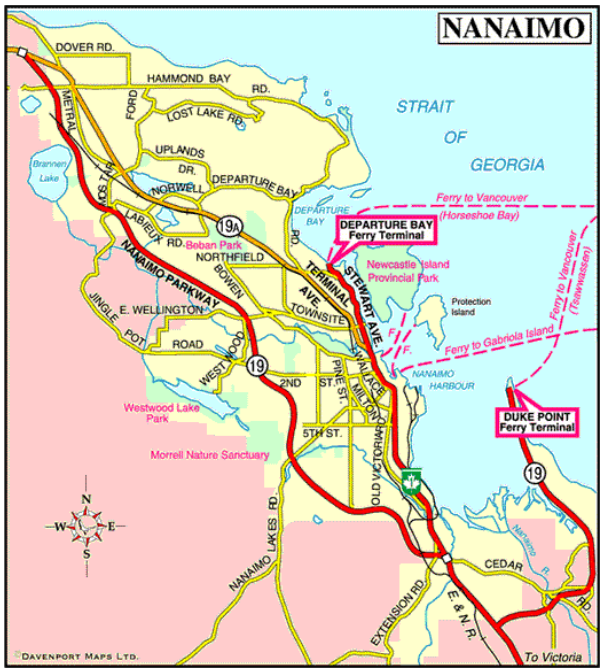
COMMUNICATIONS

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 coordination 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 Regional District of Nanaimo. Telus will strive to keep its equipment operational with primary emphasis on vital communications infrastructure needed by the Regional District into order to respond effectively to a major emergency. Amateur radio services are also available, which is discussed later in this report.

TRANSPORTATION

During and after an emergency or disaster, transportation is an essential component for effective emergency response and recovery. The Regional District of Nanaimo is accessible via water, surface, rail and air transport. A major airport exists approximately 15 minutes south of downtown Nanaimo.



Major thoroughfares for surface transportation include Highway 1, Highway 19, Highway 19A, Highway 4 and Highway 4A. Provincial Highway 19 (locally known as the Island Highway) is the main north-south route on Vancouver Island north of Nanaimo. Provincial Highway 4 (locally known as the Pacific Rim Highway) is the longest east-west major thoroughfare on the Island. Highway 1 (locally known *also* as the Island Highway) terminates in the downtown core of Nanaimo as it merges with Provincial Highway 19.

Many travellers into Nanaimo will arrive from Vancouver via BC Ferries – Tsawwassen to Duke Point and Horseshoe Bay to Departure Bay. The Departure Bay ferry terminal is served by Nanaimo Regional Transit System. Funding for this system is cost shared between the RDN and BC Transit. Conventional and HandyDART bus service is also offered by the Nanaimo Regional Transit System. Taxi service in the RDN is available through (but not limited to) AC Taxi, Alliance Taxi, Harbour City Taxi and Swiftsure Taxi (RDN, 2006b).

There are two major airports within the Regional District of Nanaimo, the Nanaimo Airport at Cassidy (YCD) and the Qualicum Beach Airport. Nanaimo Airport is located approximately 18 km south of downtown Nanaimo, and is serviced for passenger flights by Jazz Air (Air Canada). Its runway is approximately 1524 m long with a parallel taxiway system. It is equipped with a standalone Global Positioning System (GPS), Distance Measuring Equipment (DME) and a Non-Directional Beacon (NDB), as well as an Omni Directional Approach Lighting (ODAL) system. Air traffic advisory and weather services are provided by the NavCanada at the Nanaimo Flight Service Station (Nanaimo Airport, 2006).

EMERGENCY PREPAREDNESS

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

EMERGENCY COORDINATION CENTRE

The Regional District of Nanaimo Office, located at 6300 Hammond Bay Road will serve as the primary Emergency Coordination Centre. The secondary ECC has been designated as the Cranberry Fire Hall, located at 1555 Morden Road, in District 68. A tertiary ECC has also been established, designated as the Bow Horn Bay Fire Hall.

Site-specific backup power generation is in place at the primary, secondary and tertiary ECCs, which will streamline operations in the event of a power outage (Jani Thomas, electronic mail, April 6, 2006). The secondary ECC site has useful but limited supplies available such as emergency rations, forms, the Emergency Plan, as well as contact lists and a computer (*ibid*).

MUTUAL AID

The Regional District of Nanaimo has established an agreement with the City of Nanaimo, the City of Parksville, the Town of Qualicum Beach and the District of Lantzville to share *resources and facilities of the parties, their various departments and agencies, and all its other public agencies… to prevent and combat the effects of emergencies and disasters*. Included in the official mutual aid documentation is "ECC Operational Procedures," whereby the parties have mutually agreed to establish a Regional ECC when needed, to: *standardize ECC operational procedures between the participating jurisdictions, and to become most cost effective and efficient.*

In addition, as of February 2005, operational guidelines were developed for the use of transit buses by relevant personnel in the RDN (or by Emergency Management Agreement mutual aid partners) in the event of an emergency. Within this documentation, it is stated that *where transit operation requirements are unaffected the RDN Emergency Preparedness Coordinator (EPC) will contact the Manager of Transportation Services to obtain the use of buses on the request of the EMA partner EPCs* (RDN, 2005b).

EMERGENCY SOCIAL SERVICES

The Regional District'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 Regional District's ESS. The ESS is supported by several volunteer agencies including: Canadian Red Cross, Salvation Army, and St. John Ambulance.

There are total of 13 designated ESS reception centres within the Regional District of Nanaimo (including incorporated areas), which are detailed in Table 8.

Table 8 – ESS reception centres within the RDN (including municipalities)

Electoral Area or Municipality	Reception Centre	Address
Electoral Area A	Cranberry Hall	1555 Morden Road
	Cedar Community Hall	2388 Cedar Road
Electoral Area B	Agricultural Hall	476 South Road
	Gabriola Island Community Hall	2200 South Road
Electoral Area E	Nanoose Place	2925 North West Bay Road
Electoral Area H	Lighthouse Community Hall	240 Lions Way
Nanaimo (City	Beban Park	2300 Bowen Road
	Bowan Park	500 Bowen Road
	Church of Jesus Christ of the Latter Day Saints	2424 Glen Eagle Crescent
	Moose Lodge	1356 Cranberry Avenue
Parksville (City)	Parksville Community Hall	132 East Jensen Avenue
	Parksville Fellowship Baptist Church	550 Pym Street
Qualicum Beach (Town)	Qualicum Beach Civic Centre	747 Jones Street

ENVIRONMENTAL SERVICES

RDN Environmental Services is responsible for the coordination of sewage treatment, water utilities and waste management services throughout Electoral Areas within the Regional District of Nanaimo. The General Manager of Environmental Services will assume the role of ECC Operations Chief during events that require Environmental Services as the lead agency, such as during a flood or snowstorm event. Specific responsibilities may include: ECC staffing, road clearing, managing traffic, alleviating water disruption issues, firefighting water provision, sewage services, spill containment, building security, garbage/debris management and equipment and vehicle supply.

Supporting resources are also available from both provincial and private sources. This includes the Provincial Regional Emergency Operations Centre (PREOC) which is located in Victoria, and various private sources within the Regional District which include (but is not limited to) the following sources. The services included here are present in the RDN Water Utilities Department Emergency Response Plan (RDN, 2005c).

Excavation services and sand / gravel

Shoreline Equipment	2550 Powder Point Road, Nanoose Bay	Contact: Doug Penny (250-468-7759)
Lundine Backhoe Service	1361 Lundine Lane, Qualicum Beach	Contact: Jim Lundine (250-752-6808)
Ozero's Sand & Gravel	3880 Alberni Hwy., Qualicum Beach	Contact: 250-752-1482
Lussier and Sons Contracting	2365 Avondale Pl., Nanoose Bay	Contact: 250-468-9994

Electrical contractors

Canem Systems Ltd.	4386 Boban Dr. #9-B	Contact: 250-751-7760
East Isle Power		Contact: Harvey (250-951-9884)
TC Trades Affiliates, Ltd.	6016 Nelson Rd., Nanaimo	Contact: T. Frenette (250-756-0077)

Water related services

Land & Water BC		Contact: 250-741-5650
Nanaimo Service Centre	501 – 345 Wallace St.	
Water Pure & Simple (bottled supply)		Contact: 250-752-1373
Water storage tanks (Express Trailer)		Contact: 250-248-2218
Fyfe's Well Drilling, Ltd.	3331 Alberni Hwy., Qualicum Beach	Contact: 250-752-9358
Four Star Water Works Ltd.	587 Alberni Hwy., Parksville	Contact: Leon Cake (250-954-3546)
Iritex Pumps and Irrigation	#12 – 1009 Allsbrook Rd., Parksville	Contact: 250-248-7028

Building supplies & miscellaneous

Windsor Plywood	4441 Boban Dr., Nanaimo	Contact: 250-758-5122
Albertson's Home Centre	1187 Franklin's Gull Rd., Parksville	Contact: 250-248-6888

HEALTH AUTHORITIES

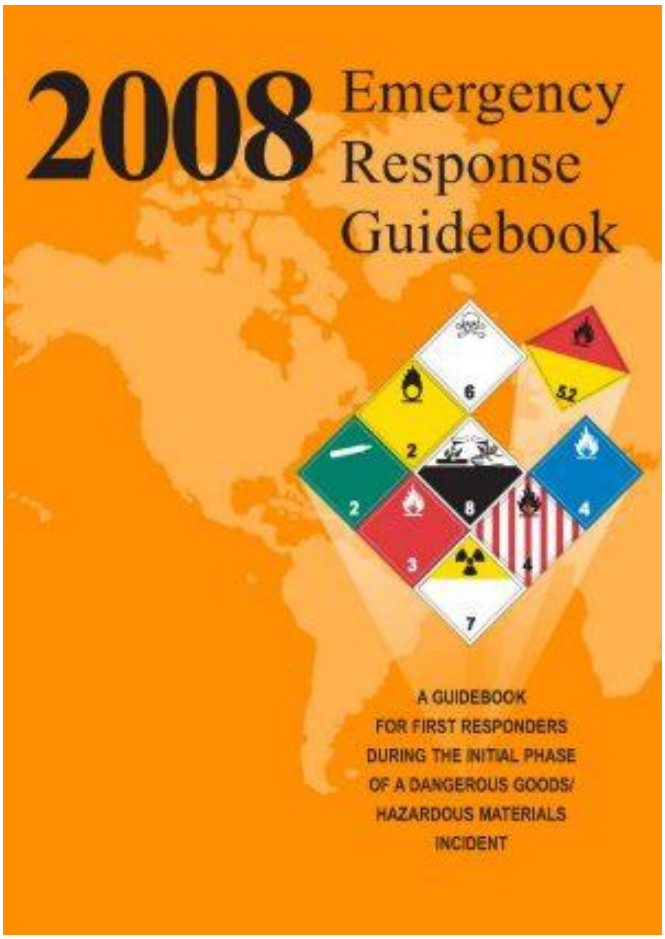
The Vancouver Island Health Authority (VIHA) provides health care to over 752,000 people on Vancouver Island, on the islands of the Georgia Strait, and in the mainland communities north of Powell River and south of Rivers Inlet, through a network of hospital, clinics, residential facilities, health units and centres (VIHA, 2009). These facilities primarily fall within the boundaries of the municipalities. The following hospital and care facilities are available for use by residents of the RDN, not including specific addiction centres:

Table 9 – RDN Care Facilities

RDN Care Facilities	
Nanaimo Regional District Hospital	**1200 Dufferin Crescent, Nanaimo**
Nanaimo & District Home Support	**528 Wentworth Street, Nanaimo**
Nanaimo Health Unit – CD Clinic - Adult	**8-1599 Dufferin Crescent, Nanaimo**
Nanaimo Health Unit – Public Health	**1665 Grant Avenue, Nanaimo**
Nanaimo - Princess Royal Family Centre (Public Health	**260 Irwin Street, Nanaimo**
Traveller's Lodge (Elder Care)	**1298 Nelson Street , Nanaimo**
Kiwanis Village Lodge (Elder Care)	**1233 Nelson Street , Nanaimo**
Nanaimo Senior's Village (Elder Care)	**6085 Uplands Drive, Nanaimo**
Parksville/Qualicum Health Unit & Mental Health	**249 Hirst Avenue, Parksville**
Eagle Park Health Care Facility (Elder Care)	**777 Jones Street , Nanaimo**
Trillium Lodge (Extended & Intermediate Care)	**401 Moilliet Street , Parksville**

The Emergency Disaster Planning & Response Department of the Vancouver Island Health Authority has prepared a Disaster Plan containing a series of All-Hazard Response Manuals to enable VIHA to respond efficiently and effectively to most emergency situations (VIHA, 2005b). This plan includes an outline of the duties and responsibilities for supporting departments, as well as immediate action checklists and communication protocols, along with other useful information.

CANUTEC



Hazardous materials are located at various locations within the Regional District of Nanaimo, and are transported by road and rail. 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.

There are various *in situ* fuel sites within the RDN that should be noted as a possible spill or explosion hazard, specified in Table 12, Section 6.7.1.

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).

AMATEUR RADIO OPERATORS

There are various amateur radio clubs that fall within Regional District of Nanaimo boundaries. These include (but are not limited to) the Nanaimo Amateur Radio Association (NARA), the Mid-Island Radio Association (MIRA) and the Oceanside Radio Association (ORCA). The latter two radio clubs are located in the vicinity of Qualicum Beach and Parksville respectively (MIRA & ORCA, 2006). ORCA is dedicated to emergency communications in the region and maintains focus on this, while MIRA exists for a wider range of purposes, including recreational. ORCA's primary VHF repeater is hard-linked to a UHF repeater, both located at the Parksville City Hall Emergency Coordination Centre to provide coverage to District 69 (ORCA, 2005).

The Nanaimo Amateur Radio Emergency Group (NAREG) is a volunteer public service composed of Amateur Radio operators in the Nanaimo area, including the Nanaimo Amateur Radio Association (NARA). In 2003, a communications plan was established in Nanaimo to unify operating procedures for the Nanaimo Amateur Radio Emergency Group (NAREG) in Nanaimo, BC. Frequency assignments, net operating procedures, definitions of emergency conditions, message handling procedures and prioritizing are all included within this plan (Merritt, 2003).

Within the City of Nanaimo, basic operations are intended to take place on VHF / UHF using a simplex channel of 146.52 MHz FM, VE7ISC Repeater on 146.64 MHz FM or either of two UHF repeaters.

Island Trunk System

http://www.ve7na.ca/gallery/v/ITS+Repeaters/

The Island Trunk System aims to provide a network of open Amateur radio repeaters, for general and emergency communications use, throughout Vancouver Island, surrounding waters and parts of the lower mainland on the West Coast of British Columbia Canada. NARA maintains 5 repeaters which link into the system.

HAZARDS

This HRVA is designed to provide an assessment of the hazards that may present risks to the Regional District of Nanaimo. These hazards may require site support through the Emergency Coordination Centre.

In selecting these events for consideration, ASC acknowledges the potential 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. Pearce's *British Columbia: Hazard, Risk and Vulnerability Analyses* (1993) offers an excellent overview of other hazards.

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.

ATMOSPHERIC

PRECIPITATION

SNOW

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.

Source: Randsco.com

According to Environment Canada historic records, the average monthly snowfall in the Nanaimo area has been 18.5 cm through the winter months (November through February). This average is skewed slightly by the mild month of

November, but Nanaimo receives a relatively low amount of snowfall in the winter months regardless. December and January are the coldest months, but the average monthly temperatures are consistently above zero, at 2.9°C and 2.7°C respectively.

As seen in Table 10, the RDN has received an average snowfall exceeding 27 cm every year in the month of January. Although an extreme snow depth of 74 cm was recorded in January of 1966, there is an average of only 17.6 days per year that Nanaimo has a minimum temperature of 0°C or less. Nonetheless, this historic data highlights the potential for major snow events to take place, which may cause direct or indirect problems to the region. In addition, some scientists point to the frequency of winter storms in Canada since the mid 70's as an indicator of an increasingly dangerous trend (David Suzuki Foundation, 2005).

Table 10 - Winter Climate Normals 1971-2000: Average Temperatures and Snowfall

Location	Monthly Average Winter Snowfall (cm)				Daily Average Winter Temperature (*C)			
	NOV	DEC	JAN	FEB	NOV	DEC	JAN	FEB
Nanaimo	**7.8**	**22.8**	**27.2**	**16.3**	**5.4**	**2.9**	**2.7**	**4.2**

(Environment Canada, 2009 – Canadian Climate Normals)

An important consideration for the Regional District of Nanaimo regarding snowstorms is the potential for this type of event to cripple transportation routes. Main access routes into the Regional District of Nanaimo from the south (Cowichan Valley Regional District) include Highway 1, which turns into Highway 19A (Oceanside Route) as one drives through the northern section of the City of Nanaimo.

Bridges within the Regional District of Nanaimo are also of importance, connecting the Regional District of Nanaimo. These include bridges constructed over the following watercourses on Highway 19 alone: Nile Creek, Big Qualicum River, Little Qualicum River and the Englishman River.

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 RDN's ability to deal with severe weather events the risk of a snowstorm to the Regional District of Nanaimo is moderate.

HAIL

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 (Natural Resources Canada 2005a). The impacts of hailstorms are often similar to those of blizzard conditions as agriculture and property can both be damaged due to hail. According to Natural Resources Canada, hailstorms are most common in the May to July period, usually with storms occurring in the afternoon, with the hail portion of a storm usually lasting from six to ten minutes (Natural Resources Canada 2005a).

Hailstorms are not uncommon in eastern Vancouver Island, but these storms are more common in elevated regions and do not normally last for extended periods of time. In addition, Vancouver Island hailstorms do not typically produce hailstones that are considered a threat to people or property. The majority of damaging hailstorms in Canadian history have taken place in Alberta and eastern provinces in Canada (NRCan, 2004), but are not a major concern in the Regional District of Nanaimo.

Due to the characteristics of hailstorms historically occurring in the RDN the risk of a hailstorm to the Regional District of Nanaimo is low.

RAIN AND WINDS (EXTREME)

The cause of most river floods is excessive rainfall and snowmelt, which causes significant elevations in river level and ultimately the inundation of low-lying floodplain areas. Rainstorms themselves cause damage by overwhelming drainage capacities, causing saturation-induced landslides, ground slumping, erosion and debris flows. In addition, severe rainstorms hamper various forms of transportation and introduce increased potential for accident occurrence.

Rainstorms are not uncommon in the Regional District of Nanaimo, and can last for several days. The wettest time of year is typically in the fall, though periods of heavy rain are often experienced in the winter and spring months. According to Environment Canada, there is an annual average of 7.5 days when there is 25 mm or more of rain falling in the Nanaimo area. In January of 1991, 97.3 mm of rain fell in a single day, setting an extreme daily rainfall record.

Source: Nanaimo River Cedar BC flood December 2007

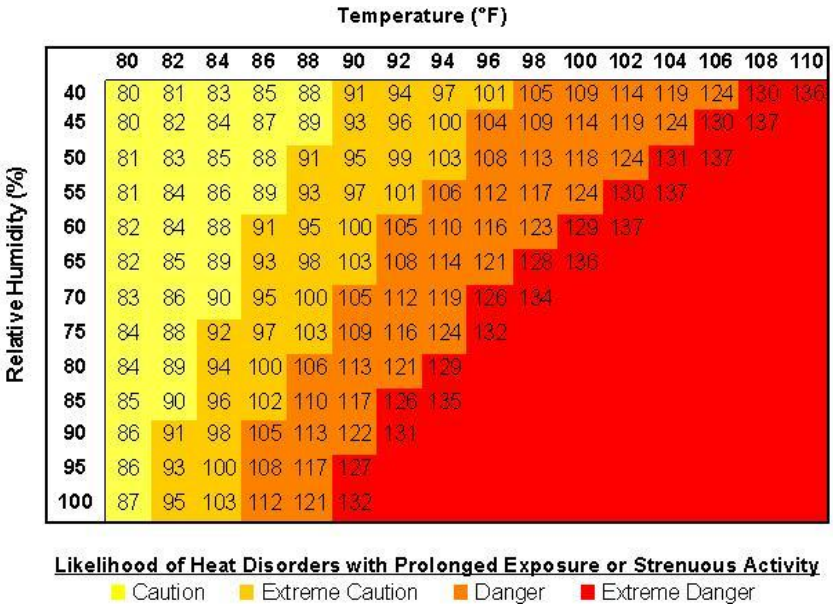
Windstorms can occur that may cause trees to topple or send debris airborne, which in turn may damage critical infrastructure within the RDN and cause harm to residents.

Windstorms are not uncommon throughout Vancouver Island, with significant high wind events occurring in the past. In January of 2003, ferocious winds with gusts reaching 150 km/h across Vancouver Island knocked out power affecting many residents. A total of 30,000 BC Hydro customers, including residents of the Regional District of Nanaimo were left without power for hours (Environment Canada, 2003). Another notable windstorm occurred in the spring of 1997, toppling hundreds of old growth trees in Cathedral Grove (McMillan Park). In 2001, discussion surrounding the removal of trees in the park centred on environmental protection as well as the potential for increased susceptibility to wind damage (Times Colonist, 2001).

Due to the relatively low impact of rainstorm and windstorm events in the RDN the risk of rainstorms and windstorms to the Regional District is low.

TEMPERATURE

EXTREME HEAT



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. Impacts of heat waves can range from crop losses to high mortality due to heat prostration or the aggravation of existing conditions such as high blood pressure or heart disease. The elderly and very young are particularly vulnerable to very hot and humid conditions. There is also the threat of water shortages and the danger of forest fires. From analyzing historic climate records in the Regional District of Nanaimo region (Nanaimo weather station), a noteworthy trend exists such that the daily average maximum temperatures in June, July and August have not exceeded 25°C in all recorded years. Instances of extreme hot weather are rare in the region, with the highest temperature set in August of 1960 when it reached 36.7°C. Nonetheless, extended periods of hot weather in the high 20's and low 30's have occurred in the recent past. The summer of 2003 in the Nanaimo area brought above average temperatures, with a heat wave occurring in late July. Fortunately, there was no influx of patients in Nanaimo General Hospital due to sun stroke or severe sunburns, even among the young and elderly (Nanaimo Daily News, 2003). It is important to note that there has been a tendency for both extreme and average monthly temperatures to increase over time in this region of British Columbia, suggesting that heat waves may become a more significant risk in the future.

With the above in mind, the risk of a heat wave to the Regional District of Nanaimo is moderate.

EXTREME COLD

www.cbc.ca

Blizzards combine low temperatures, high winds, and blowing snow. The effects of a blizzard are always intensified by the wind chill factor associated with the high winds, typically in the 90 to 130 km/h range. Blizzard conditions are often most severe in unforested, rural areas where there are no trees present to break the effects of the wind. Combining strong winds, low temperatures, and poor visibility, blizzards can wreak havoc on traffic, buildings, communications, crops, and livestock, and can pose a threat to people with exposed skin and insufficient clothing for the conditions. White-out conditions occur in extreme cases and reduce visibility to such a level that even pedestrians can easily become disoriented. 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 Regional District of Nanaimo. Although blizzards are rare in the Regional District of Nanaimo, the potential does exist for this type of extreme weather event. There are three main weather stations present in the Nanaimo area, with one meeting World Meteorological Organization (WMO) standards - "Nanaimo A," which is the basis of discussion here. By analyzing the weather station data at Nanaimo (A) one may notice that extreme temperatures and snowfall have reached significant levels in harsh winters of the past (see Table 10). On February 1st, 1991, a snowfall event occurred which produced more than 73 cm of snow. Temperatures in the Nanaimo area have also dipped to -20°C, although this has not occurred for many years – this extreme was recorded on December 30th, 1968. Given the position of the Regional District on eastern Vancouver Island off the Strait of Georgia, the potential for high winds accompanying a snowstorm and developing into blizzard conditions exists.

Table 11 – Winter Climate 2000-2008: Extreme Snowfall and Temperature

Year	Extreme Total Winter Snowfall (cm)				Extreme Minimum Winter Temperature (*C)			
	NOV	DEC	JAN	FEB	NOV	DEC	JAN	FEB
2000	0	58.0	43.0	0.4	1.1	-1.0	-0.9	0.1
2001	13.0	2.0	0	14.2	6.7	3.0	4.4	3.8
2002	0	8.0	45.6	0	3.1	1.4	0.6	-0.7
2003	4.0	15.2	0	0	-0.9	0	2.5	0.2
2004	0	3.4	37.9	2.0	3.2	1.5	0.5	1.0
2005	13.8	1.0	86.8	5.4	1.4	0.6	-1.2	-2.0
2006	98.9	4.0	0	2.8	1.0	0.2	1.7	-1.1

(Environment Canada, 2009 – National Climate Data and Information Archive)

With all factors taken into consideration, the risk of blizzards to the Regional District of Nanaimo is moderate.

ELECTRICAL (LIGHTNING)

Lightning is caused by the union of three contingent factors: moisture laden air, the instability of existing weather systems and a triggering agent which causes air near the ground to ascend. Lightning strikes carry up to 100 million volts of electricity and leap from cloud to cloud, or cloud to ground and vice versa. Lightning tends to strike higher ground and prominent objects, especially good conductors of electricity such as metal.

A lightning strike can damage transmission lines, affect aircraft, disrupt communication systems, damage or destroy structures, and cause structure and forest fires. Lightning strikes can also cause severe or fatal injuries to people. Lightning kills an average of seven people and injures 60 to 70 others in Canada every year. However, the number of deaths and injuries from lightning strikes has decreased in the past 35 years due to improved forecasts and warnings, better lightning awareness and improved medical care.

Lightning is one of the major causes of wildfires starting **about 50 percent** of all forest fires in BC. Lightning strikes generally ignite in remote areas, each burning an average of 560 ha compared to 50 ha for most human-caused fires.

The Ministry of Forests and Range (2005) report a number of major fires in British Columbia ignited by lightning strikes. These include the Okanagan Park Fire of 2003 and the Garnet/Penticton Fire of 2004. The Okanagan Park Fire was caused by a lightning strike near Squally Point across Okanagan Lake, and forced the evacuation of 33,050 people from the communities of Naramata and Kelowna with 4,050 evacuated for a second time. The fire destroyed or damaged 238 homes, destroyed 12 wooden trestles, and damaged two other steel trestles in the historic Myra Canyon. (This does not imply that lightning-initiated fires are any worse than human-caused fires. Fires started by people are usually in closer proximity to settlements, recreational areas, and forest-fire fighting resources and are therefore suppressed more readily. Remotely started fires are often left to burn in their natural course if they are not expected to negatively affect settlements, resources, or infrastructure.)

Picture: Flickr.com

The Regional District of Nanaimo is roughly divided into two biogeoclimatic zones. Along the eastern coast of Vancouver Island, a Coastal Douglas Fir (CDF) classification dominates, thriving within a “Mediterranean” type of climate. The understory primary consists of salal and / or Oregon grape (MOF, 2003). Western red cedar exists on wetter sites, and Garry oak and arbutus exists on the drier sites. The Coast Western Hemlock (CWH) Zone dominates much of the remaining stands throughout Vancouver Island, with Western hemlock and amabilis fir as the dominant species. Although the species makeup, understory and relatively mild climatic

conditions within the RDN are not strongly conducive to fire from lightning strikes, the threat does exist.

In the summer of 1997, more than 7000 lightning strikes flashed in southern Vancouver Island and Greater Vancouver during a thunderstorm in July in a span of 90 minutes (Environment Canada, 2002). The risk of lightning to recreational boaters, paddlers, fishermen or swimmers has also been highlighted in and around the Regional District of Nanaimo.

Planning and preventing by checking marine forecasts, buying a weather radio, and learning basic weather reading to supplement forecasts can help to prevent a dangerous incident. In addition, five general rules exist in order to stay safe during a thunderstorm, which include: (1) Getting off the water, (2) Seeking shelter, (3) Avoiding objects that conduct electricity (e.g. paddles), (4) Monitoring the storm and (5) Applying First Aid to victims in the event that something does occur (Kinnee, 2006).

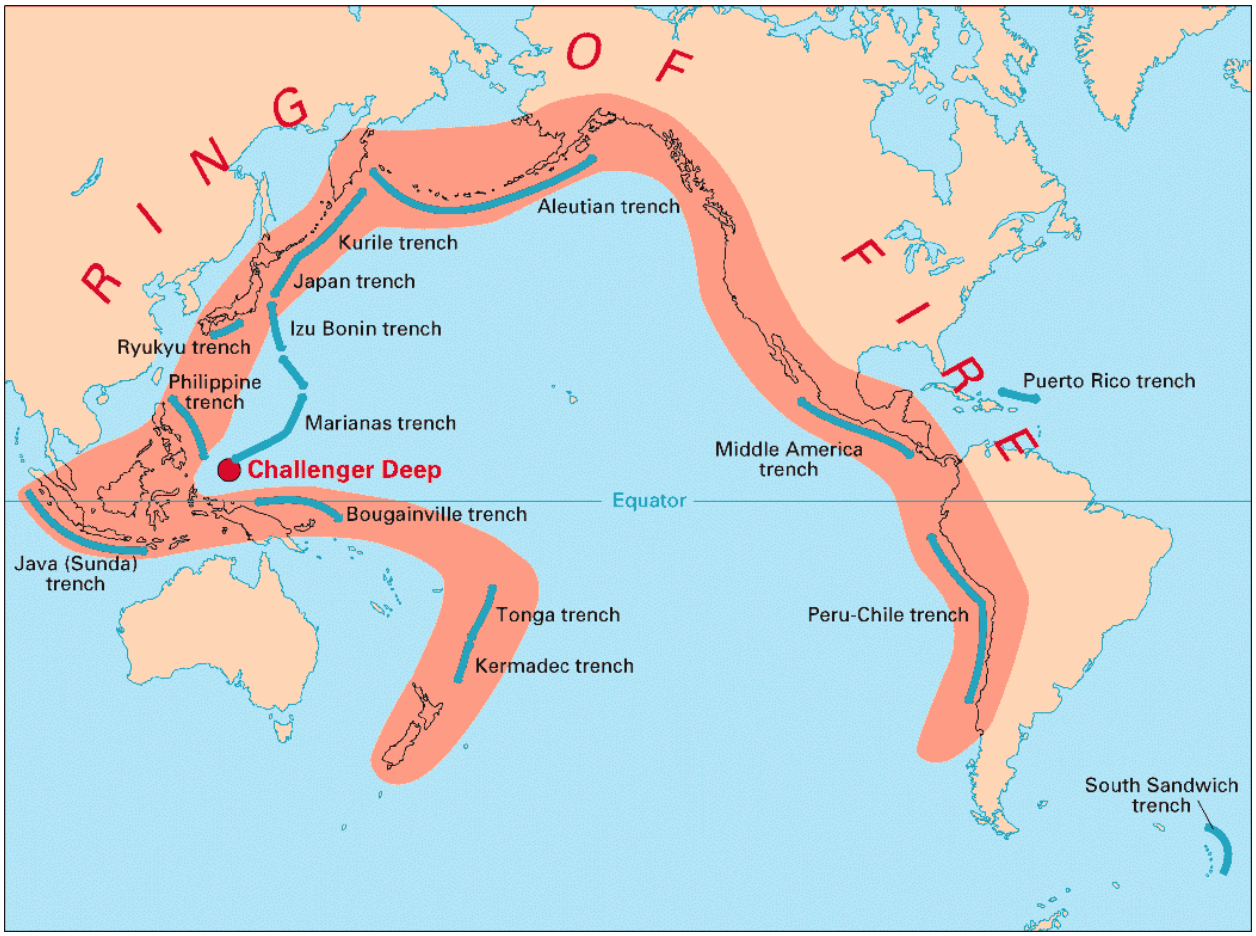
In consideration of the potential consequences of lightning strikes the risk of lightning in the Regional District of Nanaimo is low.

GEOLOGICAL

Geological hazards result from the adverse geological conditions capable of causing damage or loss of property or life. Geological hazards exist due to the location of development or construction within an impact zone of a natural hazard.

SEISMIC

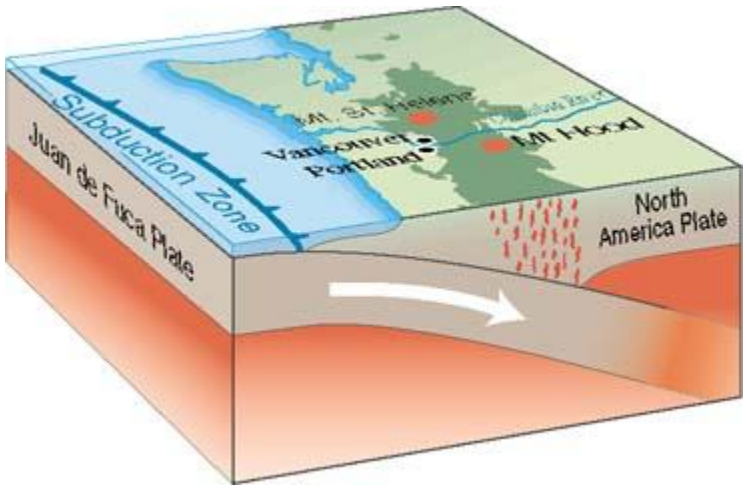
The Nanaimo Regional District is located within the 'Ring of Fire' that extends along the west coasts of South and North America, eastern Asia and the South Pacific. This entire zone has frequent earthquakes.



Ring of Fire (URL: pubs.usgs.gov/publications/text/fire.html)

The earthquake hazard is primarily due to the location of the RDN in the northern region of the Cascadia Subduction Zone where the Juan de Fuca tectonic plate is pushing under the North America plate. This plate against plate movement appears to be 'locked' at this time which results in deformity of the plates that stores energy that can be released as an earthquake when the 'locked' sections rupture. Geological evidence indicates that these earthquakes

exceeding magnitude 9.0 have occurred in a cycle of 300 – 600 years. The last known great earthquake was in January of 1700.



Cascadia Subduction Zone under British Columbia, Washington and Oregon (Source: USGS)

The ground motion of an earthquake, surface failures and liquefaction result in disruption and damage. The degree of damage is related to the magnitude of the seismic event and its' proximity to populated areas. Magnitude relates to the relative strength of the earthquake and damage to structures begins to happen near magnitude 6 on the Richter scale when the event is close to populated areas.

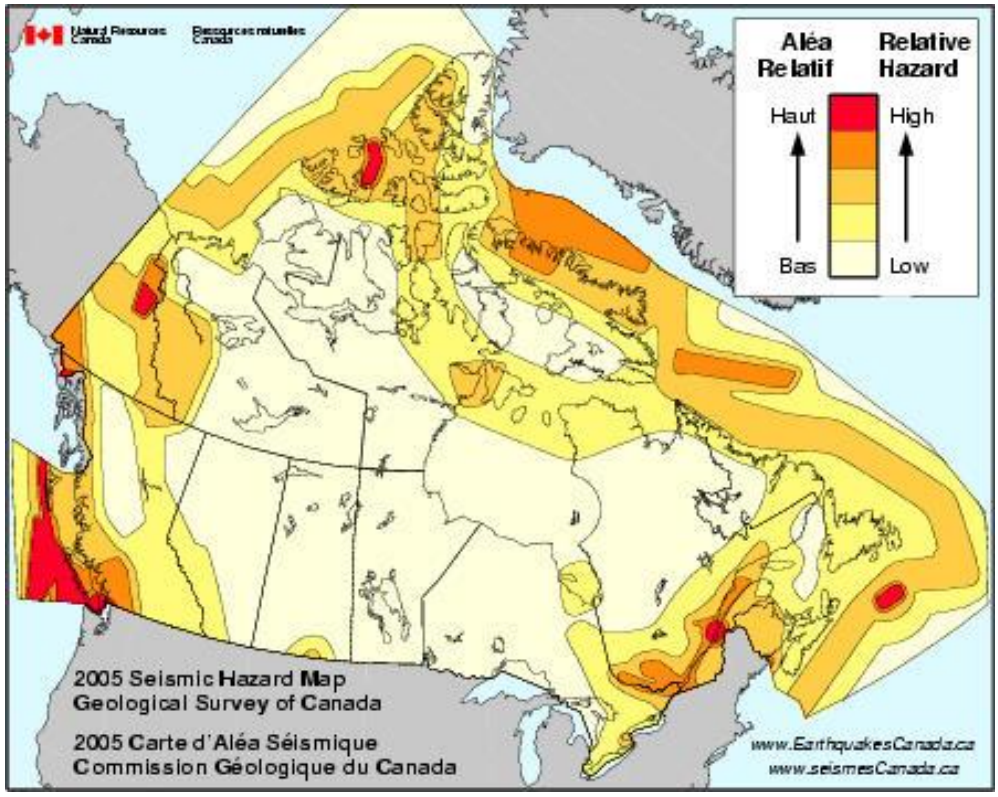
The National Building Code of Canada 2006 shows (illustration) the RDN to be within a high hazard area. Earthquake risk zones have been established by an analysis of past earthquake activity and tectonic structure. The relationship between earthquake occurrence frequency and relative magnitude are used to determine risk zones for the purposes of providing a building code intended to prevent structural collapse and protect human life.

The majority of buildings in the RDN are wood frame and low level which results in a reduced likelihood of collapse. Taller buildings have been built under more demanding building codes which are more earthquake resistant.

Earthquake response and recovery are further complicated by the likelihood of impact extending to surrounding communities and the lack of availability of mutual aid resources as each community will be struggling to deal with their own issues. A key aspect of earthquake preparedness lies with individuals and families. The resources of the local authorities will be consumed by high priority emergencies.

National building Code 2006 Seismic Hazard Map
Seismescanada.rncan.gc.ca

RDN in high risk zone



The location of the Regional District of Nanaimo in the high risk zone and the predicted timing and magnitude of the next seismic event result in a high risk to the Regional District

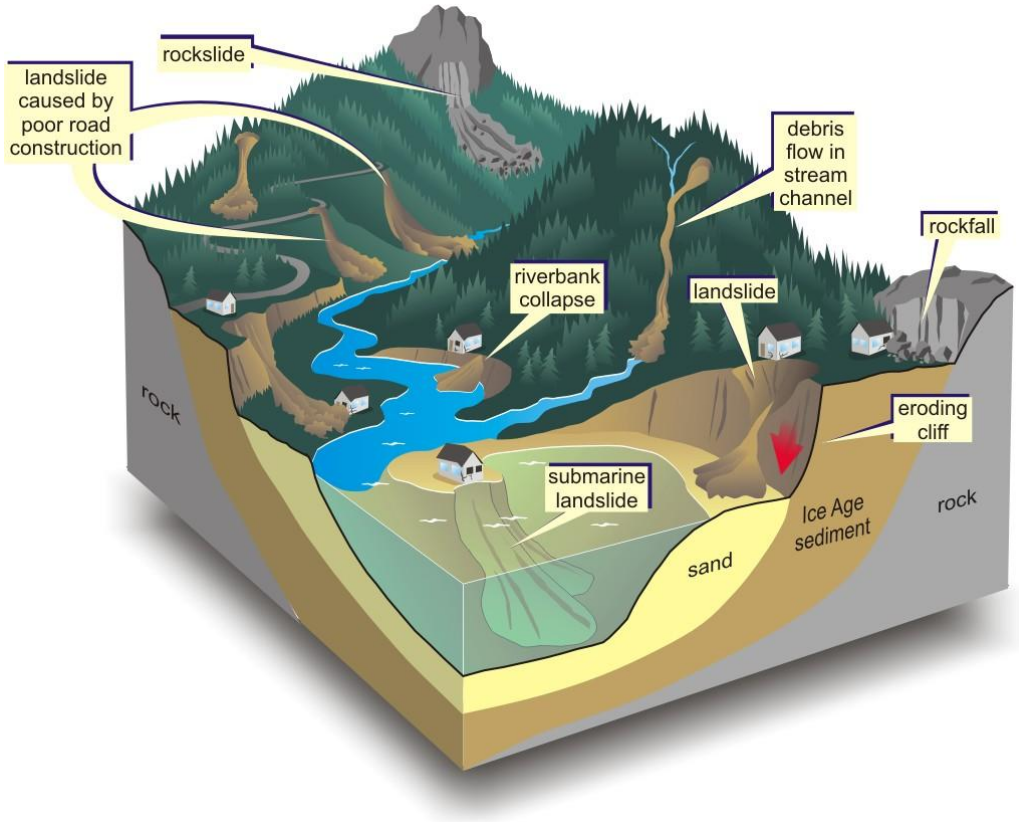
AVALANCHE

Avalanches are the abrupt and rapid flow of snow down a slope resulting from natural triggers or human activity. Aspects such as the type and mass of snow, the degree of slope, the sliding surface, the trigger nature, direction and elevation will all contribute to the eventual effect of the avalanche. While other materials such as rock, air, water, dirt, trees, etc., may become entrained into an avalanche, it always initiates in snow and is primarily composed of snow.

Due to the low levels of snowpack and the topography of the Regional District the risk of avalanche is low for the RDN.

SLIDES

Landslide includes a wide range of geological phenomena such as rock falls, debris flows and slope failures that can occur in coastal, offshore or onshore environments. While gravity is the primary driving force, there are many potential contributing factors that result in slope instability.



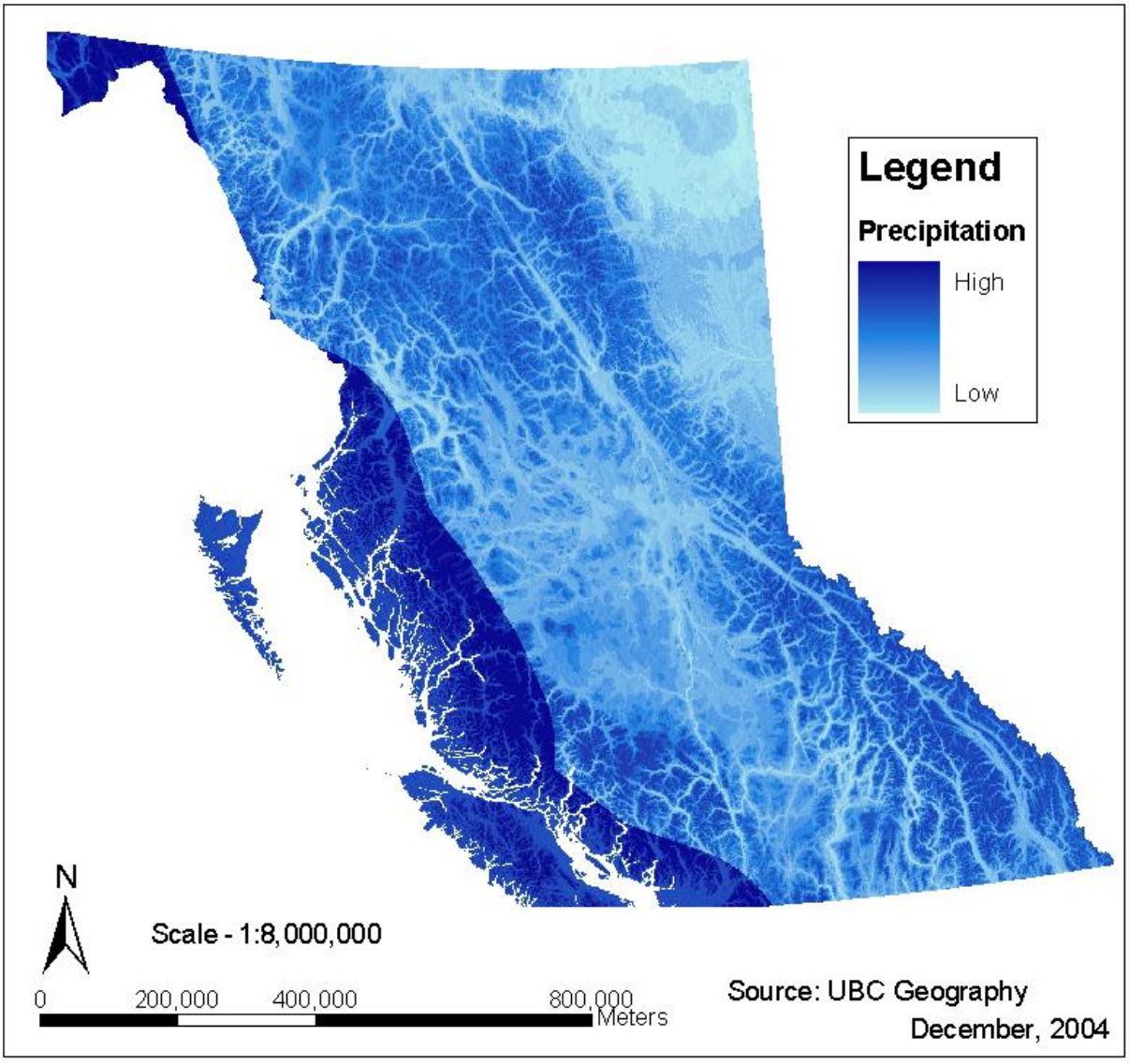
Potential Landslide Types - URL: geoscape.nrcan.gc.ca

Landslides occur when a slope exceeds its' limits of stability as a result of:

- Groundwater pressure reducing soil stability
- Absence of vegetation to stabilize soils such as might follow a wildfire
- Saturation of soils due to heavy rains, snowmelt, etc.
- Erosion from rivers or waves at the base of a slope reducing the foundation
- Earthquakes – possible combined with other factors

Landslides can damage or destroy structures, roads, power lines, pipelines, fuel storage sites or anything else that they encounter.

The topography of the RDN does not have significant amount of steep slopes, but there is a significant amount of rainfall and a number of waterways within the region that contribute to reduced soil stability. The silt, sand and clay soil types that are typical for the lowlands portion of the Region quickly become unstable during heavy rainfall and surface water flows and can flow as liquids down relatively gentle slopes. These types of landslides can significantly impact people and property.



Annual Precipitation in British Columbia

Due to the relatively high levels of ground water and precipitation impacting the plastic soil types, the Regional District has a moderate level of risk of Landslide.

SUBSIDENCE

Subsidence of land occurs when the surface has been undermined resulting in a downward motion or sinking. This can be as a result of human or natural activities. Human activities may include mining, excavation, or fluid extraction (water, oil, gas, etc). Natural actions may include subterranean water flows, limestone subsidence or faulting.

The Nanaimo Region has a history of mining operations as recent as the 1950s when fuel oils replaced coal for home heating. Disused and abandoned mine shafts and tunnels can present a significant risk for subsidence.

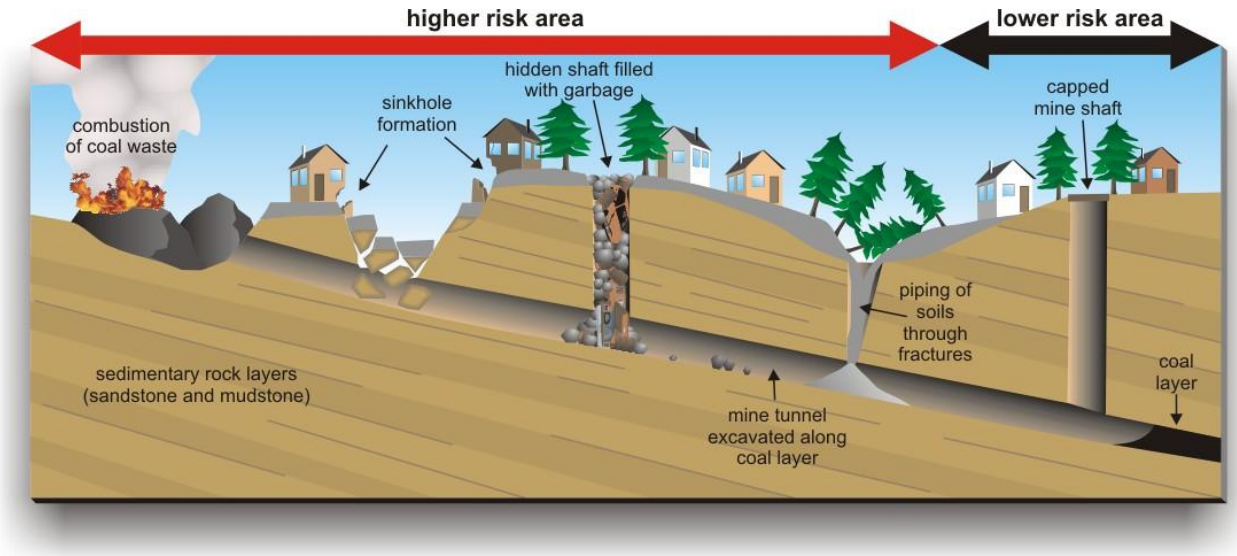
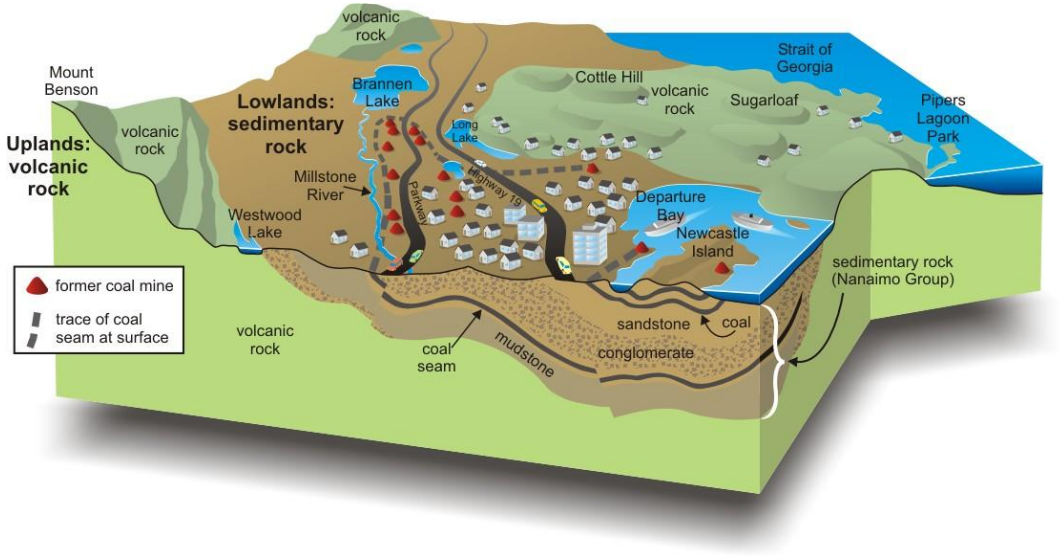


Illustration of mining related subsidence potentials (geoscape.nrcan.gc.ca)

According the Energy, Mines and Petroleum Resources (www.minfile.gov.bc.ca) there are a number of disused mine properties in the Region. When mines are deactivated, they are normally sealed and access is eliminated. While these shafts and tunnels are likely filled with ground water, they remain as subterranean voids that can lead to subsidence that impacts people and property.

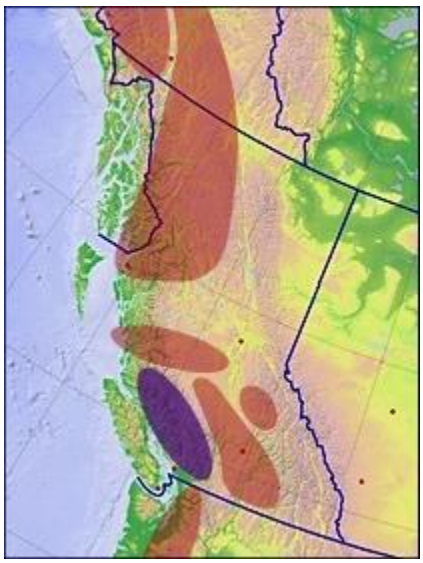
The following illustration shows a sampling of these disused coal mines.



Locations of former coal mines - red cones (geoscape.nrcan.gc.ca)

Given the existence of disused mining properties with subterranean voids the Regional District of Nanaimo has a moderate risk of subsidence that could affect people and property.

VOLCANIC



B.C. Volcanic Zones

Volcanoes are openings or ruptures in the crust of the planet that allow hot molten rock, ash and gases to escape onto the surface and into the atmosphere. The Regional District of Nanaimo is not contained within British Columbia's active volcanic zones. The closest is the Garibaldi Volcanic Zone along the southwest coast of BC as an extension of the Cascades Volcanic Zone spanning from northern California to the US/Canada border. The RDN does not have a significant threat of actual volcanic activity with lava or pyroclastic flows but could be impacted by a plume of volcanic ash that resulting from an eruption in the Garibaldi or Cascades Zones.

Major eruptions can eject volcanic ash into the atmosphere that can be carried thousands of kilometers. Volcanic ash consists of small 'tephra', or bits of pulverized rock and glass that result from volcanic eruptions. While this ash is not poisonous by itself it is irritating to eyes and skin and can cause health effects in people with compromised respiratory systems due to asthma, emphysema or other health issues. The very abrasive dust can compromise machinery and power systems.

The prevailing weather patterns are likely to move volcanic ash from eruptions in the near volcanic zones to the east, so combined with the limited volcanic activity in the Region, the RDN has low risk for volcanoes.

HYDROLOGICAL

DAM FAILURE

The dams located in the RDN are of varying sizes and capacity. The following dams are rated as *high consequence* according to Schedule 1 of the British Columbia Dam Safety Regulation pursuant to the Water Act of BC:

- Arrowsmith
- Jump Creek
- Middle Chase River
- Lower Chase River
- South Fork
- Fourth Nanaimo
- Reservoir #1
- Westwood Lake

High consequence is defined (in summary) as:

Life Risk	Economic & Social Risk	Environment & Cultural Risk
Some potential for loss of life involving residents and working, travelling and/or recreating public. Development within inundation area typically includes highways and railways, commercial and work areas, locations of concentrated recreational activity and scattered residences. Estimated fatalities less than 100.	Substantial economic losses affecting infrastructure, public and commercial facilities. Includes extensive damage to highways, railways, power lines, pipelines and other utilities. Scattered residences may be impacted. Estimated costs could exceed $1 million.	Loss or significant deterioration of nationally or provincially important fisheries habitat, wildlife habitat, rare and/or endangered species, unique landscapes or sites of cultural significance. Feasibility and practicality of restoration and/or compensation is high.

While the potential consequences of a dam failure are significant, this risk is offset by the stringent requirements for inspection and maintenance required of the dam authorities and by the fact that there is no record of a major failure or release of impounded water.

The risk of a dam failure in the Regional District of Nanaimo is low.

WATER SHORTAGE

A drought is an extended period of months or years when there is a shortfall of precipitation leading to hardship and negative impacts on people, agriculture and ecosystems. Drought conditions are relative to what is considered to be 'normal' for a particular region or location. A drought in Egypt would be significantly different from drought conditions in the Regional District. Cycles of variance in precipitation and ground water are a natural part of most ecosystems.

The Synthesis Report (2007) from the Intergovernmental Panel on Climate Change states:

> ***Climate change is expected to exacerbate current stresses on water resources from population growth and economic and land-use change, including urbanisation. On a regional scale, mountain snow pack, glaciers and small ice caps play a crucial role in freshwater availability. Widespread mass losses from glaciers and reductions in snow cover over recent decades are projected to accelerate throughout the 21st century, reducing water availability, hydropower potential, and changing seasonality of flows in regions supplied by meltwater from major mountain ranges***

While all of the predictions of future trends are stated as potentials, there is clear evidence that the climate is changing and that there will be changes in average temperatures and the weather and precipitation models for most regions. It is possible that while temperatures may increase, there may be a concurrent increase in precipitation events. The solutions to potential water shortages may lie in programs of water management and conservation.

There is some documentation showing that the levels of the wells, reservoirs and snow packs that provide water sources for the Regional District of Nanaimo fluctuate, but the data is not sufficiently conclusive to indicate a clear trend.

It is clear that water is a critical part of the lives and economy of the Regional District and that a serious shortage of water would result in a significant impact. Serious shortages of water for firefighting purposes may even place the safety of the Region in jeopardy given the existing risks of wildland and structural fires.

In recent decades, there has been little control on the consumption of water. Water usage limitations have been implemented when there is a near-future shortage anticipated. A strong program of water system controls, public education regarding effective water usage coupled with future projections of water supplies and demands from urbanization and industry would be valuable for offsetting the potential for water supply issues.

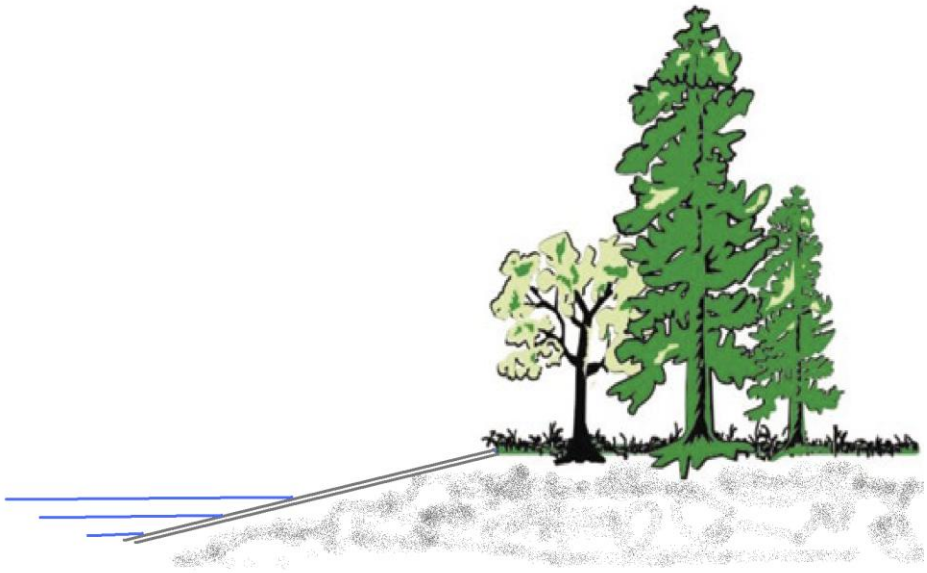
Given the potential for climate and precipitation changes affecting the water supply and the potential increases in demand resulting from urbanization and industrial growth it is important for the Regional District of Nanaimo to gather information to develop projections for water systems for the future. Currently, the risk of water shortage for the RDN is low.

EROSION AND SEDIMENTATION

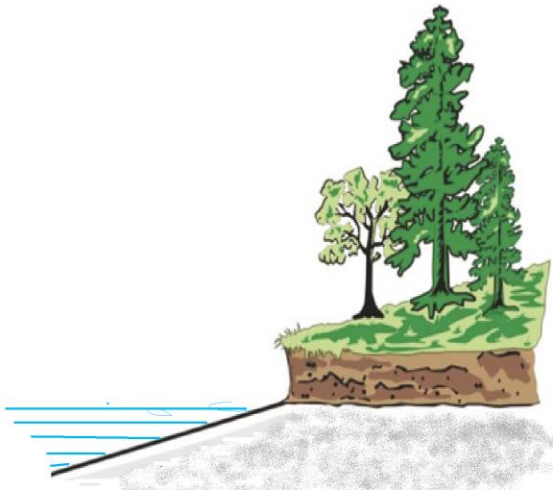
Erosion is the removal of solids (soil, sand, rock, etc.) from its' original location by natural forces such as wind, ice, snow or water. Sediment is the particulate matter that is being transported and eventually deposited elsewhere. This transport is usually fluvial (water transport). River sand deposits, river deltas and beach sands are examples of fluvial transport and deposition.

Given the extent of the shorelines involving ocean, lakes and watercourses, erosion is a fact of life in the Regional District. The watercourses of the Englishman, Nanaimo and Little Qualicum Rivers are continuously making changes in their beds and directions which often results in an impact on the riparian zone (the zone where the watercourse meets the land) bordering the watercourse. The natural shift of this interface is simply part of the cycle of the ecosystem, but riparian areas must be protected from the effects of residential, commercial and industrial development and construction. The Riparian Area Regulations (Fish Protection Act – Section 12) and a process requiring Watercourse Protection Development Permits are in place.

The degree of lakeshore erosion is determined by a combination of factors. Wind and wave action, soil composition, stability of slope and other factors contribute to the eventual impact of erosion. Low angle slopes with minimum exposure to wind and rocky materials are most stable and high angle slopes with wind and wave exposure and soft soil materials are least stable. Unstable lakeshores can benefit by the placement of armouring – the placement of materials (rocks, concrete blocks, etc) that will resist movement and protect the lakeshore.

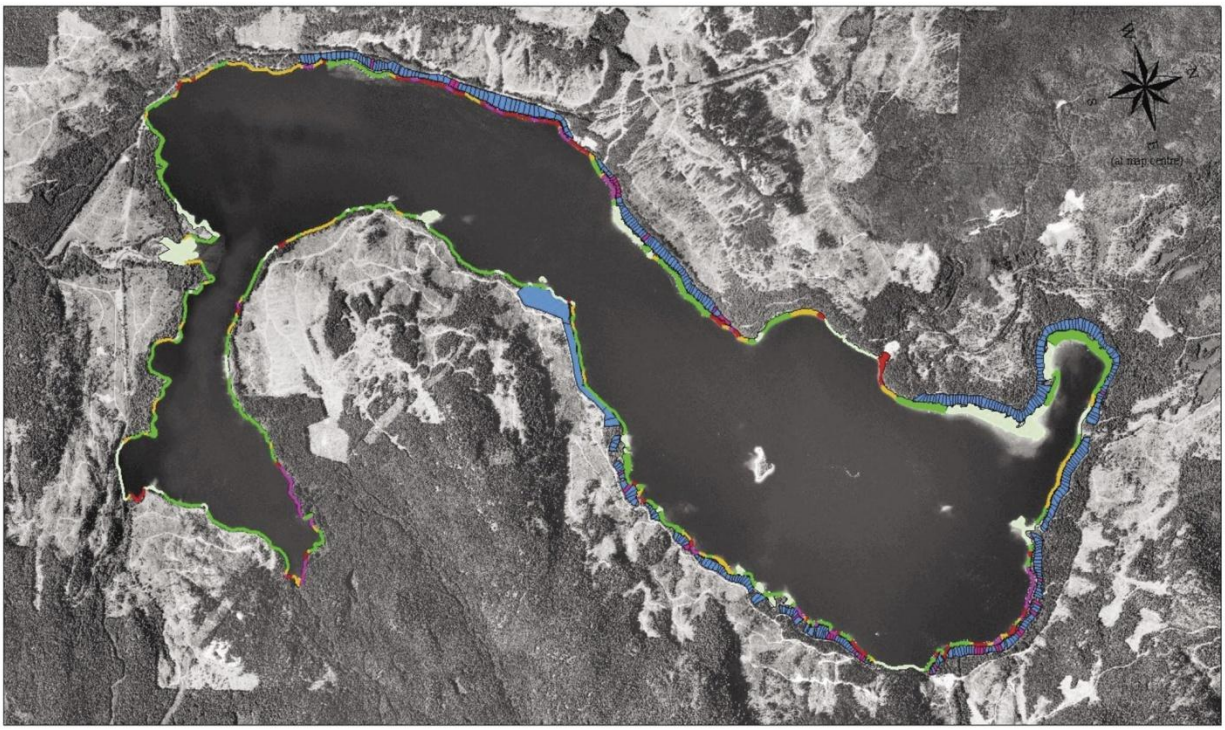


Low angle, stable slope, compact material - low erosion risk



High Angle, unstable, soft material - high erosion risk

The Lakeshore Erosion Hazard Mapping study (Technical handbook, 2005) completed by Guthrie and Law discusses the variations of lakeshore erosion in general and includes a detailed erosion assessment of Horne Lake.



Erosion Risks at Horne Lake - Orange, Red and Purple areas are classified as Moderate, High and Very High erosion risks (Source: Lakeshore Erosion Mapping – Guthrie and Law 2005 – BC Ministry of the Environment)

Sedimentation and Sand Waves at the Englishman River Delta (geoscape.nrcan.gc.ca)

Erosion resulting from ocean wind and wave action impacts the Region by removing material and transporting it to a new location. When material is transported from the toe of a slope and makes it unstable, a landslide event (previously discussed) may result. When the process is more gradual, it must be monitored to determine if this erosion is going to result in a negative impact of some sort and corrective measures implemented on a case by case basis.

The material transported from its source is deposited at a downstream location which may be another location within the watercourse or all the way to the ocean. If the sedimentation occurs within the waterway, there is the possibility that ecological features may be impacted or flow may be impeded to the point where a local flooding event may occur. Ocean sedimentation results in the formation of sand deposits from silt materials that are carried down water courses. These deposits shift according to wind and wave action and may form a hazard to marine navigation. The RDN has experienced a number of erosion events along the course of waterways such as the Little Qualicum that have resulted in the exposure of waterlines, waste water & sewage systems and the wastage of land.

Considering the level of impact of erosion and sedimentation events, the risk to the people and property of the Regional District of Nanaimo is Low.

FLOOD

Floods in the Regional District of Nanaimo result from inadequate drainage of water when the flow capacity in regular waterways and drainage systems are surpassed by the amount of water from heavy precipitation and/or snowmelt. The RDN is well aware of the areas at risk and flows and water levels are monitored during heavy precipitation and runoff periods. Some flooding results from inadequate drainage pump capacity and storm drains, ditches, and natural watercourses that become blocked or partially blocked by sediment, debris, ice or snow. Regular programs of inspection and maintenance mitigate this possibility.

There are flood plain areas within the Regional District that correspond to the watercourses of the Nanaimo River, the Englishman River and the Little Qualicum River. Each of these flood plains has residences within the anticipated limits of a flood. The homes at risk are maintained on notification lists and advance warnings are provided to residents whenever potential floods are anticipated.

These risks will increase as time passes with the anticipated climate changes and global warming of 1-4 degrees centigrade. Scott Weston *et al*., (Vulnerability of the Lower Englishman River, 2003) predicts flow increases of up to 40 within the next 100 years. The increase in

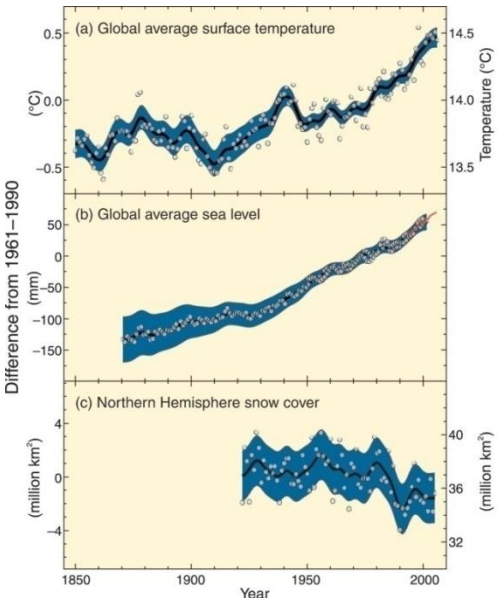
incidence and severity of flooding will result in more homes being placed at risk. These anticipated flow changes must be taken into account in all aspects of planning and development in potential flood impacted areas.

The Regional District has substantial experience and expertise in managing and coordinating flood responses. Flood Information Packages are distributed to at-risk areas to assist residents to prepare for potential floods, and limited evacuations have been undertaken as recently as 2007. January 2009 experienced near flood conditions due to heavy rains and runoff. Some of the potential impacts of flooding include evacuation, relocation, disruption of critical infrastructure, travel issues, fresh water shortages, hazardous materials spills, etc.

Considering the people and property at risk in flood potential areas, the frequency of flooding events and the predicted increases in river flows, the risk of flood in the Regional District of Nanaimo is high.

STORM SURGE

Storm surges are the increases in high water levels above the normally anticipated tide conditions usually associated with storm and high wind conditions pushing waters onshore. Low lying coastal features are most at risk. If storm surges coincide with high tides and heavy precipitation events, it can increase the incident and impact of flooding coupled with the increased runoff from the RDN waterways.



Source: IPCC Synthesis Report 2007

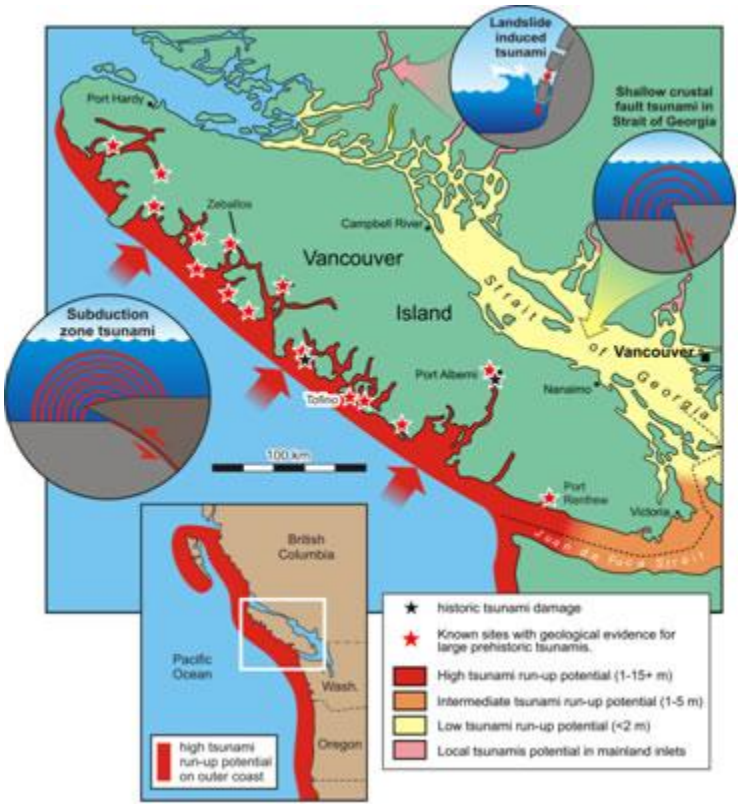
Given the predictions of climate change, the Intergovernmental Panel on Climate Change IPCC Synthesis Report of 2007 states that the sea level has increased at a rate of 1.8 mm per year from 1961 to 2003 and 3.1 mm (average) per year from 1993 to 2003. Given the gaps in understanding the drivers of sea level rises the IPCC does not provide specific predictions, but models based on existing data indicate the potential of a 180 to 590 mm rise in seal levels before the year 2100.

Given the vulnerability of this coastal location and the potential of a compounding effect of surge coupled with high watercourse flows and heavy precipitation, the storm surge risk in the Regional District of Nanaimo is moderate.

TSUNAMI

A Tsunami is a series of waves created when large volumes of water are displaced due to earthquake, landslide, volcanic eruption or other event. With immense amounts of energy travelling at substantial speeds, the effects of a Tsunami can be devastating. They can be telegenic (generated from a distance) or terrestrial (generated by local land shifts). The Regional District of Nanaimo's location on the east coast of Vancouver Island protects it from the impact of telegenic tsunamis from offshore earthquake zones. The west coast has a substantial risk.

The risk of a terrestrial tsunami exists on the east coast and in any body of fresh water such as the larger lakes of the Region. A wave could be generated if an unstable slope released into a landslide above or within a body of water. No records of such event exist, but the potential remains.



Source: Atlas of Canada - www.atlas.nrcan.gc.ca

Due to the protected geography of the Regional District and the low frequency of a land shift event the Regional District of Nanaimo has a low risk of tsunami.

FIRE

WILDLAND AND INTERFACE

Wildland fires are part of the normal cycle of a forest. Periodic fires would burn off the accumulation of plant debris/fuel on the forest floor while old growth trees would survive and plants and trees would re-establish in burned off areas where the ash may even provide nutrients for the new growth. Fires have always been a natural component of the planet's ecosystem.

When areas became populated and people found themselves at risk from forest fires, they protected themselves and their property by implementing fire prevention measures and extinguishing the fires when they did ignite. This artificial suppression of the fire cycle has resulted in a serious accumulation of 'ladder' fuels in the lower levels of forested areas and the risk of an extremely intense fire is now higher.

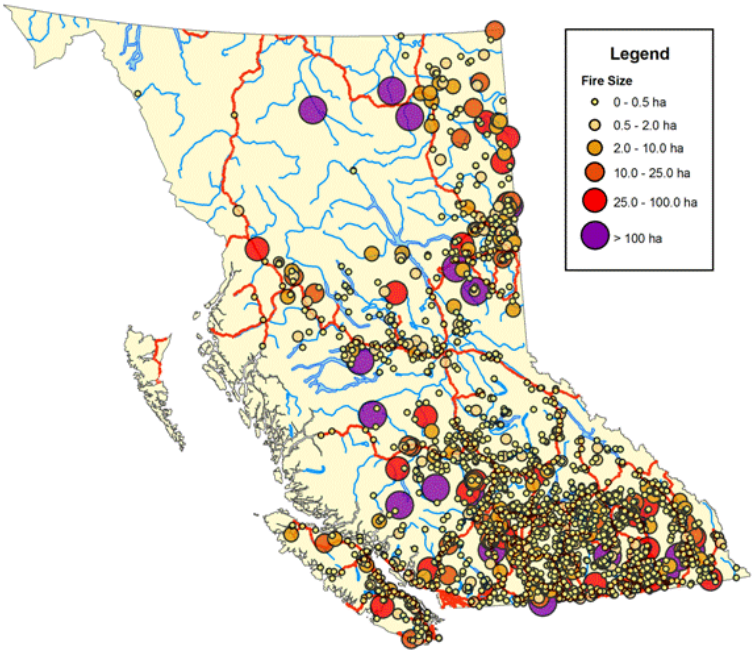
Accumulated ladder fuels

During dry, windy periods these intense fires are very difficult to extinguish once ignited by natural causes like lightning or by human act or omission. They are devastating to forests and sensitive environments and are a serious threat to people when the fires impinge on human developments and infrastructure. These are considered to be Wildland Urban Interface (WUI) fires.

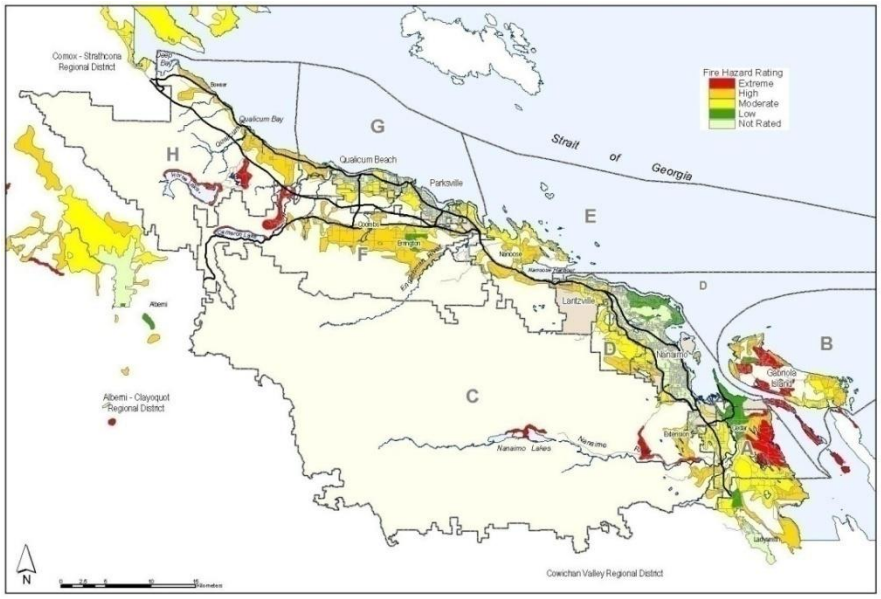
The table below shows the 10 year history of wildland fires in British Columbia. 2003 stands out as the year of the Firestorm when over 300 homes and businesses were lost and 45,000 people were evacuated due to the risk of fire encroachment. (www.bcwildfire.ca)

Year	Total Fires	Total Hectares	Total Cost (millions)	Average Hectares per Fire	People-Caused		Lightning-Caused	
2008	1975	12,703	$76.1	6.4	802	(40.6%)	1173	(59.4%)
2007	1606	29,440	$98.8	18.3	687	(42.8%)	919	(57.2%)
2006	2570	139,265	$158.7	54.2	1034	(40.2%)	1536	(59.8%)
2005	976	34,588	$47.2	35.4	591	(60.6%)	385	(39.4%)
2004	2394	220,518	$164.6	92.1	681	(28.4%)	1713	(71.6%)
2003	2473	265,053	$371.9	107.2	959	(38.8%)	1514	(61.2%)
2002	1783	8,539	$37.5	4.8	911	(51.1%)	872	(48.9%)
2001	1266	9,677	$53.8	7.6	787	(62.2%)	479	(37.8%)
2000	1539	17,673	$52.7	11.5	697	(45.3%)	842	(54.7%)
1999	1208	11,581	$21.1	9.6	609	(50.4%)	599	(49.6%)
1998	2665	76,574	$153.9	28.7	910	(34.1%)	1755	(65.9%)

The following map shows the incidence of wildland fires in BC in 2008.



The Regional District of Nanaimo has mapped fire risks throughout the jurisdiction as red/extreme, tan/high and yellow moderate:



Development Services - Regional District of Nanaimo

The risks of forest fire and wildland urban interface fires are substantial throughout and adjacent to the populated areas of the Region. Given the high fuel load in the forests and the likelihood of fires igniting, the risk of forest and wildland urban interface fires is high.

COMMUNITY WILDFIRE PROTECTION PLANS

Community Wildfire Protection Program was developed under following the recommendations of the Filmon Report – Firestorm 2003 Provincial Review. The program is funded by the Ministry of Forests and Range and is administered by the Union of BC Municipalities. Funding is available for communities to develop these plans. They detail the risks to individual communities and provide plans for wildfire protection including prevention and suppression. Forest professionals with a sound understanding of fire behavior and forestry are critical to creating a plan with fuel management components and response programs.

Community Wildfire Protection Plans are critical to reducing the risks in a community and an important component of an effective response system.

The following communities have completed wildfire protection plans:

- Bow Horn Bay
- Parksville
- Cranberry
- Deep Bay
- Errington
- Extension
- Gabriola Island
- Horne Lake
- Qualicum Beach

STRUCTURE FIRE

Structure fires are a fact of life in any populated area. Fires can be ignited by any number of acts or omissions. They are most often accidental, but can be started intentionally. Fires in structures with persons of limited mobility, the very young or the elderly, hospitals, care homes, nursing facilities, etc can be catastrophic.

Structure fires occur throughout the Regional District although most occur in areas where Fire Departments provide services. In the event that a structure fire occurs outside of a fire protection area, the response to the fire may be delayed and the fire could spread to other structures or forested areas.

While structure fires occur on a regular basis, there is an effective system of emergency response in place. The risk of structure fires in the Regional District of Nanaimo is moderate.

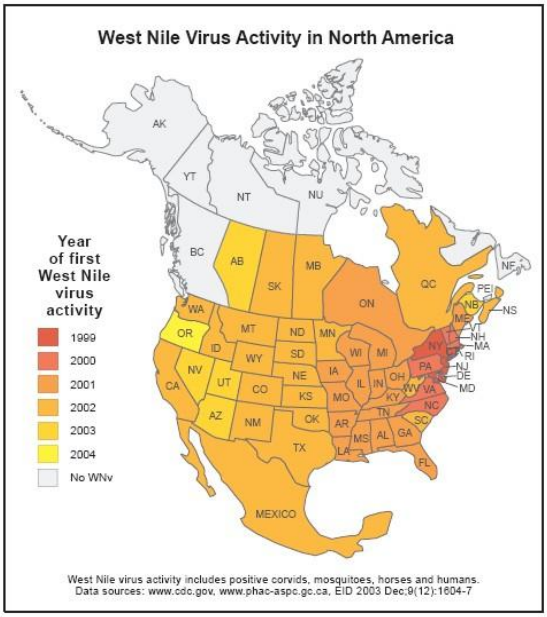
BIOLOGICS

ANIMAL DISEASE

While animal disease is primarily a concern for farmers who may suffer economic impacts, animal diseases can also be transmitted from animals to humans. The potential for transmission of diseases to humans results in a health concerns for human populations.

Examples include: Avian influenza (Bird Flu) H5N1, West Nile Encephalitis and Bovine Spongiform Encephalopathy (Mad Cow Disease).

The Canadian Food Inspection Agency has detected avian influenza in 2004, 2005 and 2009 in the Fraser Valley of BC resulting in significant quarantines and euthanasia of commercially raised bird flocks. While there have been no human cases of avian flu to date in Canada, the World Health Organization (WHO) reports 252 human deaths worldwide since 2003. The WHO reports that avian flu H5N1 has a strong potential to mutate to an extremely contagious human virus and could result in a global pandemic.



West Nile Virus can cause flu-like symptoms that can progress to encephalitis or meningitis. Persons over the age of 50 are most at risk. West Nile has been detected throughout North America and deaths have been recorded in Canada, but have not yet been detected in animals or humans in BC according to the BC Center for Disease Control surveillance report of October 2008. Mosquitoes transfer West Nile virus by feeding from an infected bird and then biting a human. West Nile Virus surveillance is continued throughout BC.

BSE (Bovine Spongiform Encephalopathy) also known as 'Mad Cow Disease' has been detected in isolated cases in 13 cases in Canada, one in BC. Humans who eat beef from infected livestock run the risk of developing Creutzfeldt-Jacob Disease which has resulted in 150 deaths worldwide.

Given the risks and incidences of animal diseases impact human populations the risk of animal disease is moderate.

HUMAN DISEASE AND PANDEMIC

An epidemic occurs when the incidence of a particular disease is above the expected frequency. A pandemic occurs when a disease spreads across a large region and may have global impacts. According to the World Health Organization (WHO), a pandemic may result from three factors:

1. Emergence of a disease new to a population
2. Disease agents infect humans causing serious illness
3. Agents spread easily and sustainably among humans

Influenza (flu) is a common infection and impacts many annually. It is an unpleasant, but somewhat benign illness. This virus can mutate into a variety that is much more virulent and contagious than the original. A human population may not have an inherent immunity to the new virus. Influenza has been the root of global pandemics in 1732, 1775, 1847, 1857, 1889, 1918, 1957 and 1968. In 1918 the Spanish Flu reportedly caused between 20 to 100 million deaths worldwide (WHO). Given the numbers of people travelling intercontinentally by air, a pandemic would spread very quickly today.

The BC Center for Disease Control estimates that pandemics occur every 20-40 years. In an influenza pandemic, the BCCDC estimates that between 20% and 50% of the population may become infected, and that 15% to 35% of the population would become clinically ill such that they would be unable to attend work or other activities for at least one and a half a days. The rate of outpatient visits is estimated at 40 to 400 per 1,000 people, the rate of hospitalizations is estimated at 0.2 to 13 per 1,000 people, and the rate of death is estimated at 0.014 to 7.65 per 1,000 people.

Local health authorities will likely be overwhelmed with patients requiring treatment and hospitalization. Reduced workforces will result due to large numbers of absences. Neighboring communities who would normally provide assistance will be similarly impacted and mutual aid will not be available. The Regional District of Nanaimo is working in concert with the Vancouver Island Health Authority (VIHA) who has developed the VIHA Pandemic Influenza Plan to which is consistent with the plans developed at the provincial and national levels to coordinate a global response to a global pandemic.

Vaccines are often very effective for flu epidemics, particularly for vulnerable populations like the young and elderly, but it takes months to develop a vaccine to a new strain of virus. A pandemic could be in full bloom by the time a vaccine is developed.

Current pandemic predictions indicate that the likelihood of a pandemic increases with time and the risk of human disease and pandemic in the Regional District of Nanaimo is high.

PLANT DISEASES AND PESTS

Plant diseases and pests do not generally result in direct risks to humans. However, they can cause significant risk to crops, extensive damage to local plant species and in worst case scenarios, cause extensive damage to the ecosystem.

Plant diseases affect plants in the same way that human diseases affect humans. Plant pathogens invade the plant and cause a negative effect on the plant that may be irritation, injury (damage) or death. The pathogen may cause genetic damage that affects the offspring of the plant. Significant outbreaks of plant diseases are dealt with by the Department of Agriculture Plant Health Unit. This agency will coordinate responses from other agencies as required. The Plant Health Unit should be notified of any unusual observations regarding plant diseases and pests.

The gypsy moth is native to other continents but a North American variant has become established in eastern Canada and the U.S. Infestations naturally spread slowly but can be accelerated by moving infested goods to new locations. The gypsy moth has a broad range of host trees but prefers domestic shade trees including the fragile Garry Oak and expensive ornamentals. The BC department of Agriculture states that if the gypsy moth becomes established here, they could strip these trees of their foliage in midsummer causing substantial damage to the wildlife habitat values and undermine the health of the local ecosystem.

It is a direct threat to agriculture as it thrives on the leaves of berry plants and fruit & nut trees. A Vancouver Island infestation could damage our economy if trading partners placed trade restrictions on lumber and agricultural products.

The Nanaimo area has had a number of gypsy moth inhabitations, but an assertive program of pest control has controlled the levels and avoided infestations.

The Mountain Pine Beetle has infected Lodgepole pines throughout BC and has currently affected more than 13.5 million hectares of forest as of January 2008. This infestation is being managed through the Ministry of Forests and Range by the Mountain Pine Beetle Emergency Response Team.

Considering the potential for economic, ecological and other losses, the risk of plant diseases and pest infestations in the Regional District of Nanaimo is moderate.

ACCIDENTS

AIRCRAFT

Aircraft crashes have the potential for multiple types of emergencies at the same time. Depending on the type & size of aircraft, the occupancy, cargo and location a crash can result in fire (vehicle, structural, or wildland), explosion, injuries, deaths, hazardous materials release and more. Specialized response equipment, training and strategies are required for crashes.

Nanaimo Airport provides regularly scheduled flights with Air Canada and a number of charter airlines. Flights may have more than 30 passengers which provide the potential for a multi-casualty incident requiring additional critical incident support responses for survivors, families, local residents and emergency responders.

Nanaimo Airport - Source: farm1.static.flickr.com

The Nanaimo Airport is a operating within its capacity but substantial growth is anticipated. Jacobs Consultancy predicts that the daily passenger traffic will increase from 42 passengers per hour in 2006 to more than 180 passengers per hour in 2025. Plans for runway lengthening and terminal expansion are in place and Phase 1 of this project is anticipated to be completed before 2010 (Times Colonist, December 16, 2008).

The Nanaimo Airport has an emergency plan which includes emergency procedures for structure fire, crash, multiple casualties, hazardous materials and more.

The Qualicum Beach Airport serves local aircraft and KD Air providing scheduled links to Gillies Bay, Vancouver and Port Alberni for up to 8 passengers. Emergency response services are provided by the Qualicum Beach Fire Department.

Both facilities maintain excellent safety records, but the potential exists for an airplane crash that may result in a variety of emergency situations.

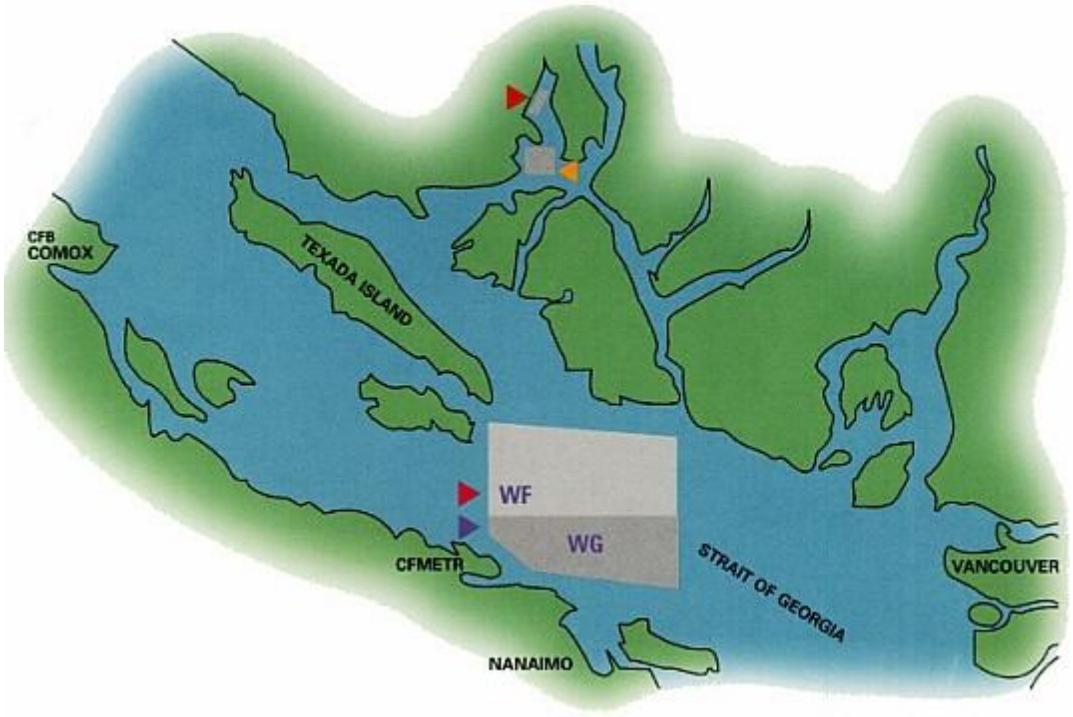
Considering the passenger traffic and the potential for a variety of emergency conditions that may result from a crash the risk of aircraft accident to the Regional District is moderate.

MARINE

The main marine facility in the Regional District is the Port of Nanaimo which is responsible for providing high levels of safety and environmental protection. The Port Authority works closely with the City of Nanaimo on issues of policing and emergency planning and response.

Deep Bay and Gabriola Island have substantial marine traffic of small vessels for recreation, fishing and small commercial operations. Marine incidents are dealt with by local authorities and by the Canadian Coast Guard as the authority having jurisdiction in navigable waters.

Nanoose Harbor is home to the Canadian Forces Maritime Experimental Test Range, or CFMETR which testing for submarine, surface and aircraft weapons systems is conducted. The testing range is clearly designated on marine charts as areas 'WG' (Whisky-Golf) and marine traffic is restricted. No explosives are used on this range, but vessels in the restricted area could be impacted by an unarmed torpedo or other weapon or vessel.



Area 'Whisky-Golf, CFMETR (Source: MARPAC Maritime Forces Pacific)

CFMETR has a strong program of environmental and emergency planning & response as part of the Canadian Military.

Considering the volume of the marine traffic, CFMETR and the potential for a marine spill the risk of a marine accident in the Regional District of Nanaimo is moderate.

MOTOR VEHICLE INCIDENT

Given road network and the number of vehicles travelling in and through the Regional District, motor vehicle incidents are inevitable and occur regularly. Detailed statistics up to 2006 are available from the Insurance Corporation of BC at:

http://www.icbc.com/Library/research_papers/Traffic/index.asp

The magnitude of a motor vehicle incident will be determined by many potential factors including number of persons involved, type and size of vehicles, materials carried, structures impacted or weather. Specialized response such as victim extrication and hazardous materials may be required for accidents.

Effective response systems from local and provincial jurisdictions are in place for motor vehicle accidents to deal with the potential emergencies.

Considering the frequency of motor vehicle accidents and the effectiveness of the response systems the risk of motor vehicle accidents in the Regional District is low.

RAIL INCIDENT

Southern Railway of Vancouver Island operates a limited cargo service and operates a passenger service on behalf of VIA Rail through the Regional District of Nanaimo. Rail traffic is limited, but there are ongoing discussions regarding upgrading the rail bed to support a commuter rail service (CBC News, November 28, 2008). If a commuter service was implemented, it would substantially increase the traffic (and the risks) along the rail corridor.

The rail corridor is currently owned by the Island Corridor Foundation, a registered non-profit foundation created by local municipalities and First Nations to preserve the rail corridor.

Considering the frequency and volume of rail traffic, the risk to the Regional District is low.

HAZARDOUS MATERIALS

A hazardous material is any solid, liquid or gas that can cause harm to living organisms, property or the environment. The term dangerous goods is used interchangeably. The Canadian Transportation of Dangerous Goods Regulations classify hazardous materials as follows:

- **Class 1 – Explosives**
- **Class 2 – Gases**
- **Class 3 – Flammable Liquids**
- **Class 4 – Flammable Solids**
- **Class 5 – Oxidizers and Organic Peroxides**
- **Class 6 – Toxic and Infectious**
- **Class 7 – Radioactive**
- **Class 8 – Corrosive**
- **Class 9 – Miscellaneous**

EXPLOSIONS

An explosion is a very sudden increase in volume and energy release in an extreme manner. This is usually accompanied by high temperatures, gas release and a shock wave. Explosions may be natural (volcanic), chemical, nuclear, electrical, BLEVE or mechanical.

- A volcanic explosion is unlikely due to the minimal volcanic activity in the area.
- Chemical explosions occur when a material designed to explode, such as dynamite, is detonated. Explosives used in industry, construction and exploration are regulated by stringent controls and are only available to trained personnel and are stored in specially designed containers and structures.
- Nuclear explosions result from the failure of a reactor vessel or from the detonation of a nuclear weapon. Vessels powered by nuclear energy and potentially carrying nuclear weapons operate in the vicinity of Canadian Forces Maritime Experimental Testing Range (CFMETR) at Nanoose Bay. Nuclear propulsion systems and weapons are maintained with strict controls and tight security.
- Electrical explosions occur when a strong electric arc rapidly vaporizes metals and insulators.
- BLEVEs (boiling liquid expanding vapour explosion) result from the rupture of a vessel containing boiling flammable liquids. The resulting rapid expansion and evaporation mixing with air contribute to a 'fireball' type of explosion.
- Mechanical explosions occur when any pressurized vessel fails explosively. The contents may not be flammable. A can of beans in a campfire is an example of a mechanical explosion.

Explosion risks in the Regional District include pipelines, liquid petroleum gas (propane) storage tanks, fuel storage tanks and others. System failures involving flammable or pressurized materials may result in explosions.

Natural gas and propane are transported in pipelines and used for fuel transport throughout the region. Any damage to these systems may result in an explosion.

Flammable vapours trapped in underground or confined spaces may become explosive.

Considering the low frequency of this type of event and the local nature of the incident the risk to the Regional District of Nanaimo is low.

LEAKS AND SPILLS

Hazardous materials stored in containers and facilities are subject to failure of their containers from various means including mechanical failure, physical damage or misuse of a system containing hazardous materials. A hazardous materials accident is when there is an uncontrolled release that requires emergency action to prevent or limit harm to organisms, property or the environment.

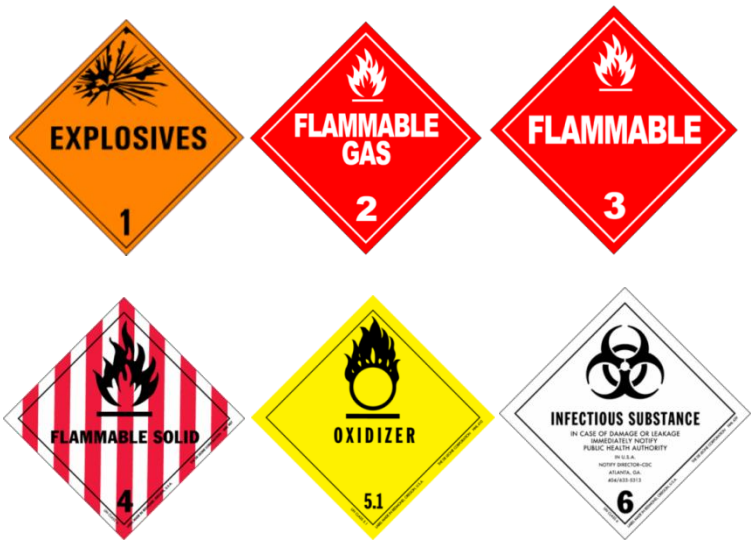
Some facilities that have substantial amounts of hazardous materials have installed systems to detect a release and provide an early warning. This is the case at the several water processing facilities where chlorine is used extensively. A current example is the City of Nanaimo Water System Emergency Response Plan – October 2008. Specific procedures and guidelines are detailed in the plan to minimize the potential of harm from a chlorine release.

Fuels of various types such as gasoline, diesel, aviation fuel, marine bunker fuel and more are stored at various locations throughout the region. These storage facilities are constructed and managed with the purpose of handling hazardous materials and consequently have safeguards and protection systems in place.

Any facility that stores, uses or processes hazardous materials should have a site specific hazardous materials response plan that is available to any agency that may have emergency responsibilities during an accident.

DANGEROUS GOODS IN TRANSPORT

Dangerous Goods in transport are regulated by the Canadian Transportation of Dangerous Goods Regulations. When significant amounts of dangerous goods are being transported, they are required to be marked with visible placards that indicate the classification of the material. The following are examples of classification placards:



Each of these classifications of material has a general response protocol and response assistance is available from various agencies. Transport Canada provides assistance through CANUTEC which is the **Canadian Transport Emergency Centre** operated by Transport Canada to assist emergency response personnel in handling dangerous goods emergencies. This national bilingual advisory centre was established in 1979 and is part of the Transportation of Dangerous Goods Directorate. It has the mandate to regulate the handling, offering for transport and the transport of dangerous goods by all modes in order to ensure public safety. CANUTEC is one of the major programs instituted by Transport Canada to promote public safety during movement of people and goods in Canada

CANUTEC has set up a scientific data bank on chemicals manufactured, stored and transported in Canada and is staffed by professional scientists specialized in emergency response and experienced in interpreting technical information and providing advice.

CANUTEC deals with some 30,000 telephone calls per year with approximately 1,000 of these that require an emergency report.

An accident involving dangerous goods in transport may result in extreme risk to people, livestock, property or the environment as a result of the material being released in an environment that does not have established controls and safety measures. Emergency responders from local fire departments, industrial services and mutual aid must prioritize their actions. High priorities may include evacuations or shelter-in-place protocols. Substantial amounts of hazardous materials are in transport on a regular basis within the Regional District.

Given the amount of hazardous material balanced against the existing response systems the risk faced by the Regional District is moderate.

ADDITIONAL HAZARDS

CANADIAN FORCES MARITIME EXPERIMENTAL TEST RANGE (CFMETR)

Source: npa.ca

CFMETR is a joint Canadian-United States Navy 3 dimensional tracking range located at Nanoose Harbour and used for testing underwater, surface and air targets including torpedoes, submarines, sonobuoys, sonar systems, surface vessels and aircraft. CFMETR is operated under the jurisdiction of the Department of National Defense (DND) and has developed

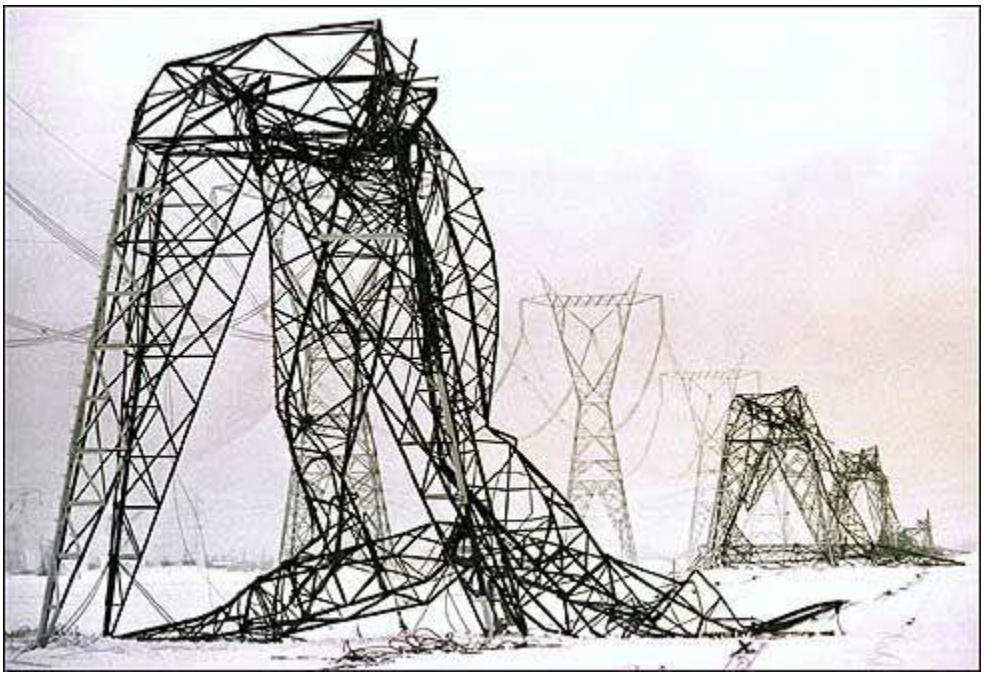
CFMETR operations entail multiple hazards that have the potential of impacting the people and property of the Regional District of Nanaimo. Nuclear powered military vessels are regularly deployed to this site. Many of these vessels may carry nuclear weapons. CFMETR maintains a Nuclear Emergency Response Plan to guide the response to nuclear emergencies involving nuclear powered vessels and nuclear capable vessels. In the event of an emergency covered by this plan, CFMETR will establish a specially team from CFMETR And other Canadian Forces Bases to deal with the emergency.

The probability of a fission product release into the environment has been stated as lower than 1 in 10 million years (CFMETR). If such an emergency occurs, a programmed response from all levels of government would be initiated. The CFMETR and Canadian Forces Base Esquimalt maintain designated Nuclear Emergency Commanders for this contingency.

The risk to the Regional District of Nanaimo of a nuclear accident at CFMETR is low

POWER OUTAGE

Most of the residents and businesses of the Regional District are dependent on electricity for heating, cooking and the provision of water services. Minor power outages occur on a regular basis and are usually localized and have minor consequences. While major, widespread power outages are rare, the potential exists during periods of extreme weather and low temperatures. During these periods residents become even more vulnerable without power.



Power line damage - Eastern Canada – 1998 (www.hamiltonspectator.com)

Changes in climate, temperature and precipitation predicted by the Intergovernmental Panel on Climate Change (IPCC) show that weather patterns are likely to change over the next 100 years and that Vancouver Island may be more susceptible to the types of ice storms that have impacted eastern North America. Ice storms in 1998 and 2008 damaged the power delivery infrastructure to the extent that hundreds of thousands of people were without power for days or weeks. In 1998 Ontario, Quebec, New Brunswick, Novas Scotia and parts of New England and New York experienced freezing rain that coated buildings, power lines, towers and tress with up to 4 inches of ice causing extensive collapse damage. That storm was considered to be the most expensive disaster to date in Canada.

In order to stay safe and healthy during these events alternatives for heating, lighting and cooking should be in readiness. Some homes in the Regional District maintain primary and secondary sources of heating and cooking (wood-burning, propane, etc) that are independent of the power grid. Generators for providing electrical power may also be used.

A Personal Emergency Preparedness Guidebook is available from the Regional District at http://www.rdn.bc.ca/cms/wpattachments/wpID141atID47.pdf, or by contacting your local emergency planning coordinator, or the Provincial Emergency Program (PEP).

Considering the current potentials for the type of extreme weather that typically causes an extensive power outage, the risk to the Regional District is low.

WATER CONTAMINATION

Water supply contamination has occurred in various locations in North America, usually as a result of a water-borne pathogen. The Regional District of Nanaimo has not had any incidents involving contamination of water supplies. The Region maintains an assertive testing, inspection and maintenance program for the water supply systems. The Regional District maintains Emergency Response Plans to protect drinking water supplies and to respond effectively to water related emergencies.

Water supplies in the Regional District meet the Ministry of Health and Canadian Drinking Water Standards.

Considering the occurrence rate, testing regimes and existing emergency plans the risk of water supply contamination is low.

APPENDIX A – HAZARDS TABLE

RDN HRVA – HAZARDS TABLE (Prioritized)	
RISK	**SCORE**
EARTHQUAKE	16
FIRE - INTERFACE & WILDFIRE, FLOOD	15
EPIDEMIC – HUMAN	12
DANGEROUS GOODS SPILL, FIRE – INDUSTRIAL	12
SEVERE WEATHER	10
EPIDEMIC - ANIMAL, LANDSLIDE or SUBSIDENCE, STORM SURGE, ACCIDENT - MARINE, ACCIDENT – RAIL	8
INFRASTRUCTURE FAILURE	6
TRANSPORT ACCIDENT – ROAD, EROSION	6
EXPLOSION OR EMISSIONS, TRANSPORT ACCIDENT – AIR, WATER SHORTAGE	4
TSUNAMI	3
DAM FAILURE, VOLCANO ERUPTIONS	2

APPENDIX B – RDN FIRE HALLS AND ASSOCIATED FIRE PROTECTION AREAS

Electoral Area	Fire Hall	Address	Fire Protection Area
A	Cranberry	1555 Morden Road	Cranberry FP District
	North Cedar	2100 Yellow Point Road	North Cedar FP Area
	North Oyster No. 1	4821 Yellow Point Road	Outside RDN boundaries
	North Oyster No. 2	3500 Hallberg Road	Yellowpoint-Waterloo FP Area
B	Gabriola No. 1	760 North Road	Gabriola FP District
	Gabriola No. 2	2400 South Road	
C	East Wellington	2331 East Wellington Road	Mountain FP District
	Extension	2201 Bramley Road	Extension FP Area
E	Nanoose Bay	2471 Nanoose Road	Nanoose FP Area
F	Errington No. 1	960 Errington Road	Errington FP Area
	Errington No. 2	1930 Errington Road	
	Coombs-Hilliers No. 1	992 Ford Road	Coombs-Hilliers FP Area
	Coombs-Hilliers No. 2	3241 Alberni Highway	
G	Dashwood	230 Hobbs Road	Dashwood FP Area
H	Bow Horn Bay	220 Lions Way	Bow Horn FP Area
	Deep Bay	5031 Mountain View Road	Deep Bay FP Area

APPENDIX C – FIRE RESPONSE IN RDN NEIGHBOURING MUNICIPALITIES

Municipality	Fire Hall	Address	Fire Protection Area
District of Lantzville	Lantzville	7580 Lantzville Road	Lantzville FP Area
City of Nanaimo	Nanaimo Fire Hall No. 1	666 Fitzwilliam Street	Nanaimo (Municipality)
	Nanaimo Fire Hall No. 2	2499 Dorman Road	
	Nanaimo Fire Hall No. 3	6230 Hammond Bay Road	Wellington FP Area
	Harewood	191 Fourth Street	Nanaimo FP Area
	Protection Island	26 Pirates Lane	
	Chase River	1400 Cranberry Avenue	
City of Parksville	Parksville Fire Hall	160 Jensen Avenue	Parksville (Municipality)
			Parksville Local FP District 69
Town of Qualicum Beach	Qualicum Beach Fire Hall	124 Harlech Road	Qualicum Beach FP Area
			French Creek FP Area