

CITY OF NANAIMO

THE HARBOUR CITY



Nanaimo British Columbia Canada

"A Perfect Place to Call Home"

"A Perfect Place to Call Home"

Hazard, Risk & Vulnerability Analysis

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DISCLAIMER

This information is the property of the city of Nanaimo (the Client) and may be used by the Client or those consulted by the Client, including Emergency Response Management Consulting (ERMC), for the purposes outlined in the scope of work.

Information and data utilized in this document have been gathered from various sources including:

- ❖ Reg District of Nanaimo HRVA 2009 Update
- ❖ MOE HM HRVA Final
- ❖ Nanaimo Emergency Program – Local Hazards
- ❖ City of Nanaimo – Emergency Response & Recovery Plan
- ❖ GVRD – Electoral Area HRVA
- ❖ HRVA BC – Toolkit 2004
- ❖ Nanaimo Emergency Program Guide Appendices
- ❖ City of Nanaimo website – Economic Development

The information contained in this document is the application of ERMC's professional expertise and professional opinion, subject to the accuracy and content of available information and the scope of work. The user of this information accepts full responsibility for any errors or omissions contained therein.

1. EXECUTIVE SUMMARY

The City of Nanaimo) contracted the services of Emergency Response Management Consulting (ERMC) to provide a Hazard Risk & Vulnerability Analysis (herein referred to as “HRVA”) for the City. A HRVA is a subjective qualitative assessment of the hazards that could impact the City of Nanaimo.

There are 22 hazards presented in this report, all with varying degrees of potential and consequence. The methodology of rating the hazards for potential and consequence was approved by the project team, and can be found in Section 3. With the hazards identified and listed in this report, it is now necessary for the city to prioritize them and amend and update current Emergency Response Plan. In addition, an action plan is required to make changes as necessary within the capabilities of the City.

Vulnerabilities identified in the process include (in no particular order): residents/businesses in immediate vicinity of railway, highway 19, ferry terminal etc due to multiple vehicle/human interface, proximity of transportation of Hazardous Materials/Fuels Transport through the central portion of the city and the danger of fires. See **Appendix C** for vulnerabilities reference map which indicates the abundance of facilities and activities along this transportation corridor and hub.

This HRVA indicates that the hazards with the highest potential to impact the city are natural hazards such as seismic activity and manmade hazards such as rail incidents, marine incidents, motor vehicle collisions, hazardous materials incidents and fires resulting from these incidents. Severe weather, security/mental health issues, localized flooding, utility service outages, communications outages and mine shaft failure also have high probability of occurrence; however, they would not have the same impact on the City.

Of special interest for the HRVA team during this review was the increase in events/activities that appear to be as a result of Mental Health issues. This has been identified as a special hazard of interest and the analysis has been applied for documentation and further assessment purposes.

Detailed hazard analysis assessments for each identified hazard can be found in **Appendix A** of this report.

Stakeholders (see **Appendix B**) participating in the analysis process indicated a strong willingness to work towards the continuing improvement and development of the city’s emergency response preparedness. This is a positive foundation from which to consider the hazards presented in this report and establish prioritized mitigation strategies.

While this report addresses hazards as they currently apply to Nanaimo, any planning towards addressing these hazards must be tempered with the future in mind.

2. INTRODUCTION

This Hazard, Risk, and Vulnerability Assessment update (herein referred to as HRVA) was conducted by a stakeholder group selected for their experience in Health, City works, community development, fire/rescue, policing, emergency management and industry.

The purpose of the analysis was to update the identification of possible hazards, their likelihood for occurrence (probability), and their possible impact (consequence). In turn, this information can then be used by the City of Nanaimo to determine what steps can be taken to effectively plan and prepare for identified hazards.

3. METHODOLOGY

The first step in the Hazard Analysis process was to identify and agree on the matrix criteria for probability and consequence. This criterion is used to assess all the possible hazards that could affect the City of Nanaimo. It was agreed to begin with a review of any developed matrixes and revise them for development of the specific matrix for municipal hazard analysis.

a) *Qualitative Measure of Likelihood (Probability of Occurrence)*

This was primarily judged by referencing past experience and events. The influence of changes made by humans and changes in nature (weather patterns, climate changes) were also used in assessing the future probability of occurrence.

In the Probability block, there is a Probability score which contains a numerical assessment. The following criteria were used:

Scoring	Qualitative Measures of Likelihood (Probability) of Occurrence
4	Frequent or Almost Certain , <i>exposure to hazard will occur if not attended to and will result in repeated incidents</i>
3	Moderate or Likely to occur , <i>exposure to hazard is common to this region and has happened infrequently in municipalities</i>
2	Unlikely or improbable , <i>exposure to hazard is conceivable but unusual, unlikely in the region but heard of similar incidents</i>
1	Highly Unlikely or rare , <i>exposure to hazard is rare for this region</i>

b) Qualitative Measure of Consequence/Impact

Once the likelihood of a specific hazard occurring was determined, the severity of the hazard was evaluated. In the Consequence block, there is a score block that will receive a numerical assessment. The criteria used were as follows:

Scoring	Consequence/Impact on People, Property, and Environment
4	Catastrophic , Multiple fatalities, municipal evacuation, widespread long term environmental impact, no or minimal stakeholder confidence
3	Severe , Multiple serious injuries or one fatality or adverse long term health impact, severe - medium term environmental impact, release requiring significant clean up, widespread reduction in stakeholder confidence
2	Moderate , Serious injury (First Aid, Illness), minimal property damage, release with minimal short term adverse effects on the environment, moderate reduction in stakeholder confidence
1	Minor , Minor injuries, minimal impact if any on public, equipment or property damage, environmental impacts confined locally, minimal or no reduction in stakeholder confidence

c) Hazard Identification and Analysis

The next step in the Hazard Analysis process was to identify the possible hazards that could affect the City of Nanaimo. The hazards listed in this report are categorized into Natural and Man-Made hazards. These hazards were identified by reviewing recent assessments, interviewing key municipal personnel, considering historical data, and comparing data with surrounding communities.

In the Hazard Analysis, each hazard is given an overall score. This score is comprised through assessments of both Probability & Consequence while taking into consideration any mitigative measures in place.

d) Total Scoring and Prioritization

Once the scores for Probability and Consequence are determined, their scores are added. For example, a hazard with a Probability score of 3 added with the Consequence of 2 is a Score of 5. This Initial Score is then assessed for consideration of mitigative measures that are in place to reduce the consequence. Reference Figure 1 and 2

Note that assigning the Total Score is not the same as assigning priority to hazards. The prioritization of hazards is completed using the scores as a guide. A hazard with a higher score does not necessarily mean that it is a higher priority. An incident that

has a 'higher' probability and/or consequence should be evaluated to determine how the effects of that particular hazard can be mitigated.

4. CONSIDERATIONS

The Hazard Analysis was completed with the following taken into consideration:

4.1 General Information (reference Nanaimo Emergency Program Guide)

Nanaimo is located on the East Side of Vancouver Island, 110 kilometres north of Victoria. Nanaimo covers an area of 88.19 square kilometres.

Nanaimo has five fire stations within the city. Current staffing levels limit response capability to major emergencies. Nanaimo may rely on limited mutual aid from surrounding volunteer departments in the event of a major emergency. Policing is provided by a substantial detachment of the RCMP located in a central station adjacent to the main fire station.

There are two basic life support ambulance stations in Nanaimo operated by the provincial ambulance service. Current staffing levels limit response capability to major emergencies. A regional 409 bed hospital is located centrally in Nanaimo.

A water collection and distribution system operated by the City of Nanaimo provides water to Nanaimo and to Extension. The water is transported to Extension and the City of Nanaimo via two parallel pipelines that start out as 750 mm and 1200 mm and travel approximately 20 kilometres to the city boundary. These mains have the ability to supply peak day flows of 240 megalitres (50 million gallons) per day. The water is then distributed through approximately 30 kilometres of secondary supply systems to 8 balancing reservoirs located throughout the city.

These reservoirs collectively contain approximately 100 million litres and act to maintain system pressures during peak hour flows. The city is currently using up to 80 million litres per day during peak summer flows. Peak hour flows can exceed the daily average flows by two and half times. Peak hour flows for the summer of 1998 were 1600 litres per second. The water is disinfected by chlorine at treatment plants located in Extension and the City of Nanaimo. Approximately 75% of the water reaches the customer by gravity.

The City of Nanaimo also operates several pump stations that are used to supply water to higher elevations in the city or boost pressures during peak flows. The pump stations and reservoirs also act to give the system a safety factor for fighting fires and a back up for possible system failures.

Electricity is supplied by seven generating stations on Vancouver Island as well as by submarine cables from the mainland. Vancouver Island is experiencing the most growth in usage in the province. To meet this demand, several cogeneration projects are underway or being planned.

Natural gas is supplied through an extensive system operated by Centra Gas.

Nanaimo is well served by transportation routes. Indeed, the city was once known as the “Hub City”. BC Ferries provides access to Nanaimo via their Duke Point and Departure Bay and downtown terminals. Nanaimo is also accessed directly by private boat or floatplane. Two major scheduled air carrier currently serves Nanaimo airport, located south of the city which is WestJet and Air Canada . In addition, smaller airlines fly out of the facility including Kenmore Air as well as private planes. Highways number 1 and number 19 transect Nanaimo as well as the E&N railroad.

The harbour is an active place with floatplane service connecting to the mainland year round. In addition a working harbour boasts a cruise ship facility that see 2-10 vessels visiting per year in addition to a busy harbour full of personal vessels.

A group of investors are close to launching a new high-speed passenger-only ferry service from Downtown Vancouver to Nanaimo, bridging the two cities directly with a relatively short 68-minute trip each way using high-speed passenger ferry vessels.

The catamaran ferry vessels will be of similar size to the Harbour Lynx vessel with capacity for approximately 300 seated passengers. Such vessels can typically reach speeds of 60 km/h.

The new private high-speed passenger ferry service will provide BC Ferries with some modest competition for its West Vancouver Horseshoe Bay to Nanaimo Departure Bay route.

5. HAZARD ANALYSIS REFERENCE SHEET

The chart below summarizes the Probability and Consequence scoring determined for each hazard. This information is intended for quick reference, and precedes the details provided for each individual hazard. The hazard scoring is also plotted in the Hazard Analysis Grid, which follows on the next page. Note that the total score is **not** intended to identify prioritization.

Hazard	Probability	Consequence	Total Score
Natural			
Seismic	3	4	7
Severe Weather	3	3	6
Epidemic	2	4	6
Fire – Municipality/Rural (Structural)	4	3	7
Flooding	3	2	5
Landslide / Debris Flows	3	2	5
Drought	3	2	5
Wildfire	3	2	5
Man Made - Technological			
Prolonged Power Outage	3	3	6
Structural Collapse	2	3	5
Dam Failures	2	4	6
Mine Shaft Failure	3	2	5
Tele-Communications Failure	3	3	6
Man Made – Human Interface			
Rail	3	4	7
Marine	4	3	7
MVA	4	3	7
Aircraft	3	3	6
Security - Terrorism	3	3	6
Explosions	3	3	6

Hazard	Probability	Consequence	Total Score
Social Disturbances	3	2	5
Man Made - HAZMAT			
Hazardous Material (Loss of Containment)	3	4	7
Man Made – (Of Local Interest)			
Mental Health	4	2	6

6. HAZARD ANALYSIS GRID

Once the scoring for each hazard was completed, they were plotted on the Hazard Analysis Grid.

As noted previously, Probability and Consequence are each assigned numerical values from one to four. The adding together of the Probability and Consequence scores provides a Total Score. This grid provides a snapshot of the overall risk severity for each hazard. The grid is categorized into Low, Medium, and High groupings to assist in gauging the severity of each hazard.

Legend	Low	Medium	High
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(n) – Natural Hazard	(m) – Man Made Hazard
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PROBABILITY	4		(m) – Mental Health Issues	(m) – Marine (m) – MVA (n) - Fire	
	3		(n) – Drought (n) – Flooding (n) – Landslide/Debris Flow (n) - Wildfire (m) – Social Disturbances (m) – Mine Shaft Failures	(n) – Severe Weather (m) – Power Outage (m) – Aircraft (m) – Security – Terrorism (m) – Explosions (m) – Telecommunications Failure	(m) – Rail (n) – Seismic (m) – Hazmat
	2			(m) – Structural Collapse	(n) – Epidemic (m) – Dam Failures
	1				
	-	1	2	3	4
	CONSEQUENCE				

7. INDIVIDUAL HAZARD ANALYSIS

(see **Appendix A**)

8. PRIORITY

The preceding figures have identified the potential risks for the city of Nanaimo in categories from low to high. The city of Nanaimo must now review the risks and decide upon which they need to focus. The higher the risk does not necessarily indicate the priority upon which must be placed the focus for reduction of impact. See below for interpretation of risk ratings.

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 if possible and within capabilities of City.

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9. PUBLIC SAFETY RISK MANAGEMENT FRAMEWORK (Nanaimo Fire Rescue Department)

The following table indicates risk reduction measures identified for the City of Nanaimo to-date:

RISK	RISK ASSESSMENT	ADVANCE MITIGATION	RESPONSE PREPAREDNESS	RECOVERY PREPAREDNESS	RESPONSE	RECOVERY
MEDICAL EMS	-HRVCA -Response History -Cardiac, Trauma Data	-Pub Ed on Web -BP Screening -Fall&Injury Prev.	-Medical Delivery Plan -FR/EMR/PCP Training -MCI Plan -Std. Resp. Coverage		-Fire assignment -DOC (for MCI) -ECC (for MCI) -EMBC	
Epidemic	-WHO, Provincial Health Officer/ EMBC	-infection Control Plan	-infection Control Plan -Support Vaccination Clinics -Response & Recovery Plan	-infection Control Plan	-Com Asst. Prog -DOC -ECC -EMBC	-infection Control Plan -Info Centre
STRUCTURAL Buildings	-HRVCA -RHAVE: Number L/M/H Risk -Response History	-Code Enforce BCBC/BCFC -Building Bylaw -Sprinkler Bylaw - Fire Safety Plans - <i>GetSet</i> Pub Ed	-Target Hazard ID Pre-Incident Plans -Std. Resp. Coverage -OG's -Response & Recovery Plan	-Community Asst. Program Design - <i>ReBuild</i> Program - <i>GetSet</i> Pub Ed	-Fire assignment - Mutual Aid -Com Asst. Prog -DOC -ECC -EMBC	-Investigation Public info -PI Neighbor Meeting - <i>ReBuild</i> Process -
Critical Infrastructure	-HRVCA -Critical Infr. Plan	Consult NFPA & Post Disaster Engineering Standards	-Critical Infr. Plan -Response & Recovery Plan	-Critical Infr. Plan Secondary sites	-Fire assignment -Public Works -Com Asst. Prog -DOC -ECC -EMBC	
WILDLAND /	-HRVCA -Hazard Map	CWPP -FireSmart	-Resourcing -Structural Prot. Unit	CWPP -Community Asst.	-Fire assignment -MoF	-Investigation -Public info

INTERFACE	-GIS Mapping -Response History	Fuel Mgmt. -Dev. Plans -GetSet Pub Ed	-FireSmart GIS Risk Mapping - Inter-Agency Plans -Std. Resp. Coverage -Resp & Recovery Plan	Program Design -ReBuild Program - GetSet Pub Ed	-Mutual Aid -Com Asst. Prog -DOC -ECC -EMBC	-PI Neighbor Meeting -ReBuild Process -
RISK	RISK ASSESSMENT	ADVANCE MITIGATION	RESPONSE PREPAREDNESS	RECOVERY PREPAREDNESS	RESPONSE	RECOVERY
MARINE Ships/Vessels/Marinas	-HRVCA -Incident History -Port Inventory	-Port/CoN Agrmnt (NFPA Stds/Code Enforcement) -Port Strategic Plan	-Pre-Incident Plans -Port/CoN Agreement -Fire Boat Agreement -Industry Partnering -Std. Resp. Coverage	-Port/CoN Agreement	-Fire assignment -Port Authority -Coast Guard -Marine Rescue -DOC -ECC -EMBC	-Investigation -Info Centre
Critical Infrastructure	-HRVCA -Port Critical Infrastructure Inventory	-Port/CoN Agrmnt (NFPA Stds/Code Enforcement) -Port Strategic Plan	-Marine Commerce Resumption Plan -Pre-Incident Plans -Port/CoN Agreement	-Marine Commerce Resumption Plan (MCRP)	-Port Authority -Fire assignment -DOC -ECC -EMBC	-MCRP
HAZMAT	-HRVCA -Incident History -Movements	-Hazmat Industry Group	-Hazmat Industry Group -Industry Partnering -Joint Exercising -Std. Resp. Coverage -Response & Recovery Plan	-Hazmat Industry Group	-Fire assignment -Industry -Ind. Contractor -MOE -DOC -ECC -EMBC	-Investigation -Recovery Plan -Info Centre
TRANSPORTATION Air	-HRVCA -Port Movements -Nanaimo Airport Movements	-Port Aviation Grp/Regulation -Airport Regulation	-Port Aviation Group -Port/City Agreement -Airport Aid Agreement -Std. Resp. Coverage	-Port Aviation Group	-Port Authority -Airport Authority -Fire assignment	-Support for Port/Airline -Info Centre

	-Incident History		-Mutual Aid Agreement -Response & Recovery Plan		-RCMP -BCAS -Airline -DOC -ECC -EMBC -Transport Can.	
RISK	RISK ASSESSMENT	ADVANCE MITIGATION	RESPONSE PREPAREDNESS	RECOVERY PREPAREDNESS	RESPONSE	RECOVERY
TRANSPORTATION Cont. Rail	-HRVCA -SVI Movements -Response History	-Pub Ed GetSet Rail Crossing Safety -Support I.C.F. Goals/Upgrade Plan	- Hazmat Industry Group -Std. Resp. Coverage		-Fire assignment -Industry -Ind. Contractor -MOE -DOC -ECC -EMBC	-Info Centre
Road	-HRVCA -Response History -ICBC/RCMP Stats	-Pub Ed GetSet CPSPprogram	-MVI Response Protocol -Std. Resp. Coverage	-MVI Response Protocol	-Fire Rescue Assignment -EMBC Road Rescue Prog. -Public Works/ Emcon -RCMP / BCAS	-Traffic Mgmt. -Debris Removal Assistance -Info Centre
CRITICAL INFRASTRUCTURE Dams/Water Resources	-HRVCA -Dam Safety Assessments	-Dam Upgrade Plans -Removal Remediation Plans	-Dam Safety Plan Inundation Mapping -Evacuation Plan -Refine Response & Recovery Plan -Est. Recovery Plan -Public Education Plan	-Dam Safety Plan -Temporary Housing -Re-Build	-Public Works -Fire assignment -Dam Insp. -RCMP -ECC -EMBC	-Info Centre

Hydro	-HRVCA -History of Storm & Responses		-BC Hydro Contact No. -OG Electrical Emerg.			
Natural Gas	-HRVCA					
Telecommunications	-HRVCA					
	-HRVCA					
ENVIRONMENTAL Drought	-HRVCA		-Response & Recovery Plan			-Info Centre
Storm	-HRVCA		-Response & Recovery Plan			-Info Centre
Vol. Ash	-HRVCA		-Response & Recovery Plan			-Info Centre
GEOLOGICAL Flood	-HRVCA		-River Inundation Maps -Tsunami Inundation Maps -Response & Recovery Plan			-Info Centre
Landslide	-HRVCA		-North Slope Geological Map -Response & Recovery Plan			-Info Centre
Seismic	-HRVCA		-Structure Age GIS Map -Mine Location Map -Response & Recovery			-Info Centre

			Plan			
SOCIAL Disturbance	-HRVCA		-Response & Recovery Plan			-Info Centre
Terror	-HRVCA					-Info Centre
Lost Persons	-HRVCA					

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Some specific areas of focus are identified below:

9.1 Mitigation

1.	Update and maintain municipal emergency response plan
2.	Maintain vigilance (mapping/notification) in monitoring mine shaft issues, industrial incidents, fuel storage and movement, social disturbances, traffic patterns (land, sea, air), tourism
3.	Land use permitting, shifting of industrial, truck routing

9.2 Preparedness

1.	Continue with emergency response training for city emergency services
2.	Communicate with city industrial businesses to identify opportunities for mutual assistance, training and enhancement of response capabilities
3.	Enhance public information program (hazard awareness) to encourage emergency preparedness (Information Centre)
4.	Identify specific response training required for existing and/or new hazards
5.	Review vulnerable Reception Centres and identify alternate potential locations
6.	Consider enhanced Public Notification System for citizens/businesses near high impact areas (Rail/fuel depots/ferry terminal) where immediate changes are not feasible
7.	Utilizing existing response agencies for Public Education and Prevention on all hazards.
8.	Amending bylaws, regulations, enforcement and inspections.
9.	GIS Mapping enhancement

9.3 Response

1.	Continue to train responders in the Principles of BCERMS and Incident Command System (ICS) as well as Managing Emerging Operations (EOC).
2.	Enhance response capabilities by nurturing mutual aid agreements with available response partners in the city (industrial) and in the region (municipal), provincial and federal.
3.	Train, and develop Response capacity and further develop pre planning on Hazard Specific Response. Eg. Hazmat Consortium

9.4 Recovery

1.	Increase public awareness on the hazards impacting their community, especially the identified vulnerable population (demographic and locale).
2.	Enhance the city's municipal business continuity plan and the community recovery plan to reflect the recently identified and prioritized hazard assessment.
3.	Develop Recovery plan that includes waste and debris management, traffic and transportation management, municipal service continuity and engage private sector in developing business continuity plans.

10. SUMMARY

Through a subjective analysis, this report captures the existing hazards to the City of Nanaimo. The next phase will be to consider these hazards and determine how they should be prioritized. It is recommended that this process involve representation from, as a minimum, management and city emergency management. Once prioritization is complete, decisions will have to be made regarding allocation of resources towards mitigating the effects of these hazards.

