Regional District of Bulkley-Nechako

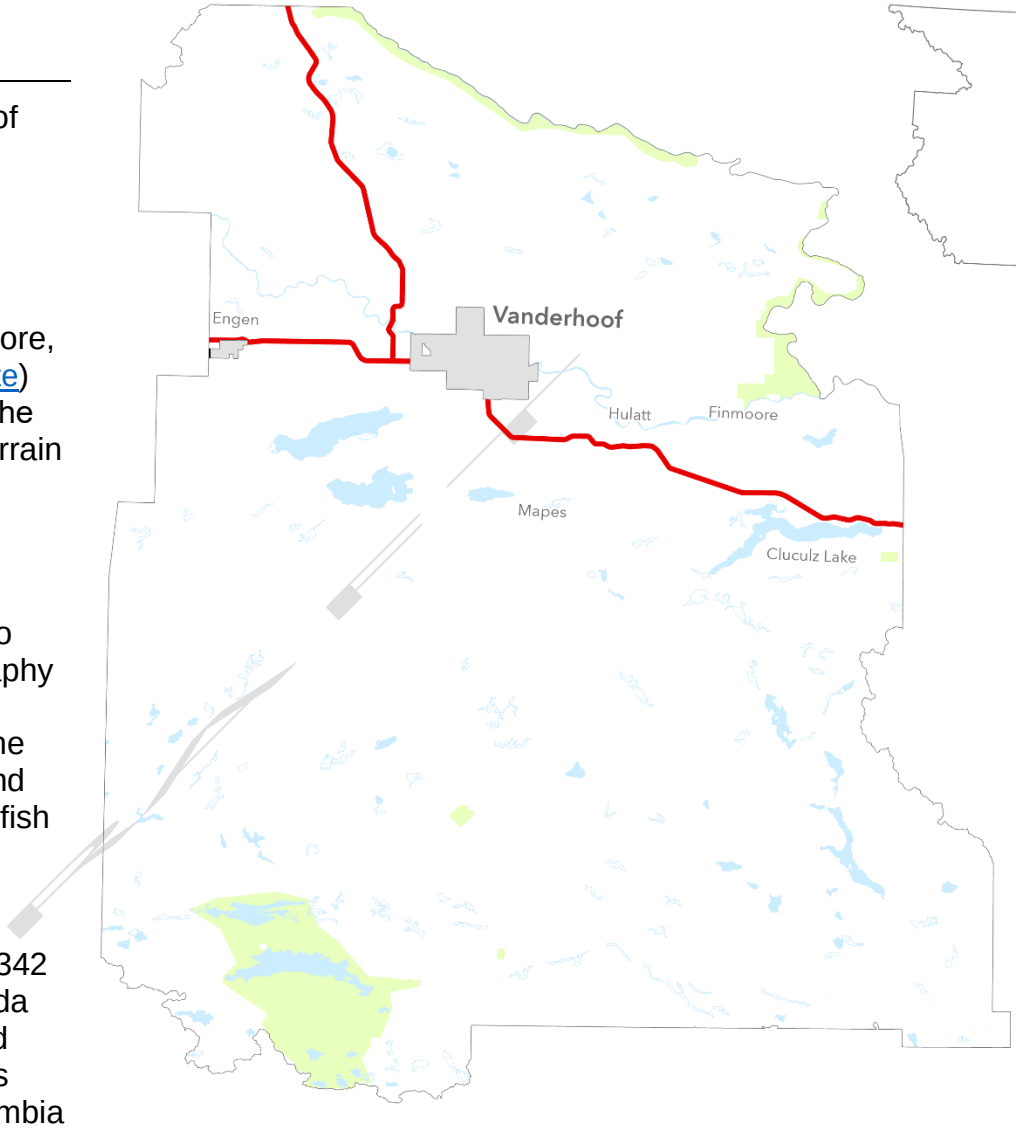
HRVA Electoral Area 'F' Committee Backgrounder

ELECTORAL AREA ‘F’ HAZARD IDENTIFICATION

“Know the Risks, Make a Plan, Be Prepared”

CHAPTER 2: ELECTORAL AREA ‘F’ HAZARD IDENTIFICATION

Electoral Area ‘F’ Geographic Setting



Electoral Area ‘F’ (Vanderhoof Rural) is the rural area surrounding the District of Vanderhoof and Saik'uz First Nation. The unincorporated communities within the area include Engen, Hulatt, Finmoore, Cluculz Lake, Mapes. (website) Electoral Area ‘F’ lies within the interior plateau of BC. The terrain is dominated by gently rolling hills, covered with pine and spruce forests and fertile agricultural lands. Although considered 'flat', the area also has some interesting topography including steep rocky bluffs, waterfalls, and mountains. The area is also rich with lakes and rivers that abound with sport fish and other wildlife.

Saik'uz First Nation is a community of approximately 342 with an additional 645 (Canada G. o., Indigenour peoples and communities, 2021) members living throughout British Columbia and Canada. Its traditional territory is located near the geographical centre of BC, with the leading community situated on the east end of Nulki Lake, 14 kilometres south of the town of Vanderhoof. There are 10 reserves with a total area of 3,235 ha. A member of the greater Dakelh (Carrier) Nation, Saik'uz derives its name from the Dakelh word meaning "on the sand", which refers to the sandy soil on which the main community is settled. Saik'uz has a rich tradition of trapping, hunting, fishing, and medicine, and is currently working to revitalize its language in-community and to develop sustainable economic and cultural growth. (Nation, 2022)

The Nazko First Nation has two unpopulated reserves, Ulkah IR No. 3 (59.6 ha in size) and Umliisle Indian Reserve No. 4 (47.7 ha in size) within Electoral Area F.

The Nadleh Whut'en includes 7 reserves with a total of 969 hectares between Fort Fraser and Fraser Lake in Electoral Area D. One reserve, Fondeur 9, which is 64.8 ha in size, lies within the boundaries of Electoral Area F.

Located in Electoral Area “F” is the District of Vanderhoof, the geographic center of B.C. and 674 metres (2,211 ft) above sea level. The Vanderhoof District by highway is 97 Km west of Prince George and 129 Km east of Burns Lake. Nestled in the beautiful Nechako Valley, Vanderhoof is surrounded by fertile farmlands and miles of forests. The presence of various levels of government agencies such as Canada Employment, Forestry, Agriculture and Conservation play significant roles in the stimulation of the Vanderhoof economy. A regional hospital, health care unit, dental clinics, physiotherapy clinic, financial institutions, seniors housing, numerous service organizations and affordable, although currently limited, housing opportunities are available.

Selecting Hazards for Electoral Area 'F'

The first step in the HRVA process is to identify the possible hazards that will need to be analyzed in the study area. It will be important that the committee determine the best approach and decide if there is value in completing a preliminary or high-level review of all the hazards identified in this section before assessing the frequency, severity, and consequence of specific hazards.

The list below is an adaptation of hazards identified in the BC Emergency Management Regulation. Climate change is recognized as having impacts on the frequency and intensity of many hazards and may also cause new hazards to emerge. This list will guide the HRVA analysis moving forward. The objective is to identify the mostly likely hazards and look for historic experience data to be analyzed when scoring the frequency, severity, and consequence of specific hazards.

Atmospheric

- ☐ 1. Air Quality ↗
- ☐ 2. Extreme Heat ↗
- ☐ 3. Extreme Cold ↗
- ☐ 4. Fog ↗
- ☐ 5. Freezing Rain or Drizzle ↗
- ☐ 6. Space Weather ↗
- ☐ 7. Hail ↗
- ☐ 8. Hurricane/Typhoon/High Wind Event ↗
- ☐ 9. Lightning ↗
- ☐ 10. Snowstorms and Blizzards ↗
- ☐ 11. Tornado ↗

Disease & Epidemic

- ☐ 12. Animal Disease ↗
- ☐ 13. Human Disease (Includes Pandemic/Epidemic) ↗
- ☐ 14. Plant Disease and Pest Infestation ↗
- ☐ 15. Public Health Crisis

Fire

- ☐ 16. Structure Fire
- ☐ 17. Wildfire ↗

Geological

- ☐ 18. Avalanche ↗
- ☐ 19. Landslide/Debris Flow ↗
- ☐ 20. Land Subsidence (and Sinkholes) ↗
- ☐ 21. Submarine Slides

Seismic

- ☐ 22. Earthquake
- ☐ 23. Liquefaction
- ☐ 24. Tsunami (Telegenic and Terrestrial)

Volcanic

- ☐ 25. Ash Fall
- ☐ 26. Volcanic Flow (Pyroclastic, Lava, Lahars)

Hazardous Materials and Explosions

- ☐ 27. Explosions
- ☐ 28. Hazardous Materials Spill
- ☐ 29. Mine Incident
- ☐ 30. Nuclear Incident
- ☐ 31. Oil or Gas Pipeline Spill
- ☐ 32. Space Debris

Hydrological

- ☐ 33. Drought ↗
- ☐ 34. Seiche ↗
- ☐ 35. Storm Surge ↗

Flooding

- ☐ 36. Lake, River, and Stream Flooding ↗
- ☐ 37. Coastal Flooding ↗
- ☐ 38. Storm Water Flooding (urban, local, pluvial) ↗
- ☐ 39. Flash Flooding ↗

Infrastructure Failure

- ☐ 40. Dam and Spillways Failure ↗
- ☐ 41. Dike Failure ↗
- ☐ 42. Structure Failure ↗

Interruptions to Critical Services

- ☐ 43. Electrical Outage ↗
- ☐ 44. Food Source Interruption (supply chain, or community food stores) ↗
- ☐ 45. Telecommunications Interruption ↗
- ☐ 46. Transportation Route Interruption ↗
- ☐ 47. Wastewater Interruption ↗
- ☐ 48. Water Service Interruption (Includes shortage and contamination) ↗
- ☐ 49. Fuel Source Interruption ↗

Security

- ☐ 50. Cyber Security Threat
- ☐ 51. National Security Threat
- ☐ 52. Public Disturbance
- ☐ 53. Major Planned Event

Transportation

- ☐ 54. Aircraft Incident
- ☐ 55. Marine Vehicle Incident
- ☐ 56. Motor Vehicle Incident
- ☐ 57. Rail Incident

Note: Climate change is recognized as having impacts on the frequency and intensity of many hazards and may also cause new hazards to emerge. Those hazards identified as being impacted by changing climatic conditions are indicated with a "↗".

Unique Local Hazards

Are there additional hazards that are unique to this region that are not covered by the list above?

Please note these hazards below, including any information sources, historical stories or maps that might help to define these unique local hazards:

Electoral Area 'F' Hazard History

Electoral Area 'F' has experienced several events that have impacted residents of the region since the early 1900's. The regularity of the event happening determines the risk factor which will be used in the Hazard, Risk, and Vulnerability Analysis.

There are several well-known hazards in Electoral Area 'F' including flooding, wildfires, ice jams, severe weather and interruptions to critical services. Many of these hazards are high risk and are a priority to all communities within the Regional District of Bulkley-Nechako.

Appendix 1, Historic Hazard Data, provides the details on recorded events in Electoral Area 'F'.

The Regional District HRVA 2003 Hazard, Risk, and Vulnerability Analysis Priority Matrix identifies the following hazards:

FREQUENCY	Very Low	Low	High	Very High	
6			Fire – industrial (18)	Fire- interface & Wildfire, Flood (24)	**Frequent or very likely**
5	Avalanche (5)		Dangerous goods spill, Epidemic- human, Explosion transportation accident – Road (15)	Severe Weather (20)	**Moderate or likely**
4		Critical Facility Failure, Infrastructure Failure (8)	Transportation accident – Air, Rail (12)	Earthquake (16)	**Occasional, slight chance**
3		Epidemic – Animal (6)	Landslide, debris flow (9)		**Unlikely, Improbable**
2			Terrorism (6)		**Highly unlikely (rare event)**
1		Dam Failure, Mine Accident (2)		Volcano Eruption (4)	**Very Rare event**
	1	**2**	**3**	**4**	

SEVERITY

Risk index # is the Frequency x Severity.

The District of Vanderhoof has an evacuation plan from 2008 that identifies 9 evacuation sectors in the municipality. Several risks have been identified specific to each sector and include flooding, highway and train accidents, grassfire risk and brush fires.

Saik'uz First Nations Emergency Pan was updated in 2018. The Emergency Plan contains a list of all hazard probabilities, lists forest fire, power outage, heavy snow fall and pandemic as the highest priority hazards for the community. In addition, the plan contains several hazard response action plans for the identified highest risk priorities and also includes plans for dangerous good spills on land or water and earthquakes. (Nation S. F., November 8, 2019)

Defining Hazard Considerations for Electoral Area ‘F’

This section provides definitions from the HRVA Hazard Reference Guide 2021 Province of British Columbia, the District of Vanderhoof and Saik'uz First Nation emergency management plans. These definitions and related information can help to inform the HRVA advisory committee in determining what hazards will be analyzed in this HRVA process.

The hazards are grouped in to three categories: Natural Hazards; Human-Caused Hazards; and Diseases, Pest Infestations & Epidemics. Hazards defined in this section are based on historical event types in Area F as well as following the Hazard, Risk, and Vulnerability Analysis Priority Matrix’s from the Regional District HRVA 2003, District of Vanderhoof and Saik'uz First Nation emergency management plans. The top four priority hazards identified by RDBN staff include:




Flooding **Severe Weather** **Wildfire** **Rail Incidents**

Known hazards are also identified on a map of electoral area ‘F’ and can be found in Appendix 3 of this chapter. Additional hazard definitions and information can be found in the provinces HRVA Companion Guide 2021.

If you have information on known hazards, resources or details on resiliency strategies related to the hazards listed below, please include these as notes and pass them on to the Regional District HRVA Coordinator for inclusion in the analysis.

Indigenous Traditional Knowledge

Long before European explorers and traders arrived in the late 1700s, Indigenous people in BC told stories and practiced traditions to share important knowledge about natural hazards. By repeating these stories, Indigenous people passed on valuable information about how to prepare for and survive disasters across time and across generations. (Prepare BC Emergency Management BC, 2019)

Those holding traditional knowledge can assist in understanding the nature of local hazards, suggest appropriate risk reduction and response mechanisms, and even give options for recovery based on past experiences. They can also help us recognize and respect the long history and rich traditions of First Nations communities on this land. (Munsaka, 2018) The Regional District recognizes the importance of learning from traditional knowledge and is looking to continually strengthen and develop relationships in the hopes that this knowledge can assist and inform future emergency planning and preparedness planning.

Summary of Climate Patterns

The information below has been summarized from the *Climate Patterns, Trends, and Projections for the Omineca, Skeena, and Northeast Natural Resource Regions, British Columbia - Technical Report 097,* 2016. (Foord, 2016)

Baseline climate of the Vanderhoof Resource District

Seasonal/Annual	Precipitation (mm)	Mean temperature (°C)	Maximum temperature (°C)	Minimum temperature (°C)
Vanderhoof District				
Winter	121.4	-8.9	9.6	-37.1
Spring	79.5	3.9	25.8	-22.4
Summer	144.8	14.0	31.5	-1.0
Fall	130.7	3.8	25.2	-20.4
Annual	475.6	3.2	31.8	-39.5

Omineca Natural Resource Region Trends (1895 – 2008)

The Omineca Natural Resource Region has become wetter and warmer over approximately the last century. Precipitation has increased by approximately 20% in spring, summer, and fall. Precipitation has increased the most in the Vanderhoof District (e.g., up to approximately 40% in summer) while winters have been getting increasingly drier in the Vanderhoof District. The annual extreme minimum temperature has increased by 2.9−5.7°C across the region, likely because Arctic air movements through the region have become less frequent because the jet stream has been moving northward. Increases in spring extreme minimum temperatures have been large and seem to follow an east-to-west trend across the Omineca. Summer minimum temperatures have increased by slightly more than 1°C in most districts. Mean annual temperature has increased in the region by 0.8°C.

Omineca Natural Resource Region Climate Projections

Mean annual temperature in the Omineca Natural Resource Region is projected to increase by 3.5°C with minimum temperatures increasing more than maximum temperatures. Summers are predicted to warm more than other seasons, by 3.8°C, with minimum temperatures increasing the most. Mean annual precipitation is projected to increase by 7%. Any increases will likely be as rainfall because precipitation as snow is projected to decrease by about 30% (ranging from –10% in Mackenzie District to –40% in the Robson Valley). The number of growing degree-days will increase, and the number of frost-free days will increase. The greatest increase in the number of frost-free days is projected to occur in the fall. Evaporation and climate moisture deficit will increase despite moderate increases in growing-season precipitation.

A Note about Climate Change:

Climate change impacts both the frequency and intensity of many hazards. It may also cause new hazards to emerge. In this HRVA methodology, climate change is not indicated as a separate hazard; however, those hazards identified as being impacted by climate change are indicated with a special symbol. e.g. Drought (BC E. M., 2021)

Natural Hazards

Flooding: Lakes, Rivers, and Stream

Flooding is the overflow of natural drainage channels, natural shorelines and/or human-made facsimiles leading to partial or complete inundation from the overflow of inland or tidal waters, and/or the accumulation or runoff of surface waters from any source. **(BC E. M., 2021)**

- Floods in Electoral Area 'F' are caused by natural conditions and geography. The area experiences a variety of flooding due to:
  - Heavy Rains or rain-on-snow events in spring, fall, and winter months;
  - Spring freshet flooding from rapid snow melt;
  - Intense precipitation at any time of year;
  - Ice jams in spring, fall, and winter months; and
  - Failure of dams or flood protection works on the Nechako River.
- The Nechako River is of the highest concern in the area.
  - The District of Vanderhoof has a Flood Plain Management Bylaw No. 1174, 2017 that referenced a "Vanderhoof Flood Mitigation Study, 2009".
- 447 addresses are in the floodplain.
- The Regional District Floodplain Management Bylaw No. 1878, 2020 was established to reduce or prevent injury or the loss of life, and to minimize property damage, during flood events.
- The Province of BC has invested in Flood Plain mapping along the Nechako River. With the BC River Forecast Centre continual monitoring and forecasting river flows.
- See Appendix 2 for hydrometric data reporting annual maximum daily discharge rates (m3/s) for one Ministry of Environment monitoring station.

Notable floods in Electoral Area 'F' include:

- Additional flood accounts can be found in Appendix 1.

Related Hazards: Hurricane/Typhoon/High Wind Event / Landslide/Debris Flow / Storm Water Flooding / Flash Flooding / Dam and Spillways Failure / Dike Failure.

Wildfire

An unplanned fire - including unauthorized human-caused fires - occurring on forest or range lands, burning forest vegetation, grass, brush, scrub, peat lands, or a prescribed fire set under regulation which spreads beyond the area authorized for burning.

The wildland urban interface (WUI) is any area where combustible forest fuel is found adjacent to homes, farm structures or other outbuildings. This may occur at the interface, where development and forest fuel (vegetation) meet at a well-defined boundary, or in the intermix, where development and forest fuel intermingle with no clearly defined boundary. **(Service B. W., 2021)**

- There are 833 (Cluculz Lake) + 173 (Stoney Creek Res) + 50 (Naltesby Lake) = 1056 addresses in electoral area 'F' in a high Wildfire Urban Interface risk area.[1] In addition, there are 2596 addresses in electoral area 'F' in a medium Wildfire Urban Interface risk area.

[1] This data was collected on October 8, 2021 from the RDBN GIS system

- Vanderhoof community forest has a Wildfire Risk Management Plan developed in 2018. This area is North of the District Boundary and within Area F.
- Saik'us First Nation has a Community Wildfire Protection Plan.
- In British Columbia, structure density (i.e., the number of buildings located within a given area) is used to define the boundaries of the wildland-urban interface (WUI) for wildfire and risk management planning purposes. The spatial WUI attributes were combined with the Provincial Strategic Threat Analysis (PSTA) wildfire threat layer (for Crown land) to identify at-risk areas at a strategic scale. The province updated data in June 2021. These threat ratings did not consider local physical attributes that can be used to analyze wildfire threats more thoroughly on a local scale.[2]

Notable Wildfires in Electoral Area 'F' in 2010 and 2015 and 2021. Please see Appendix 1 for details on these notable wildfires.

Notable fires outside Electoral Area 'F'

In the summer of 2018, the RDBN mobilized its emergency management structure for over 72 days in response to 15 major fires which resulted in 64 evacuation orders and alerts with 1,544 dwellings under evacuation order, affecting approximately 3,475 people and requiring the relocation of over 3,000 livestock. Eight dwellings and over 45 other structures were lost and a declaration of state of local emergency was in place from August 1 to September 20. (Inc., 2019)

Related Hazards: Air Quality / Extreme Heat / Lightning / Structure Fire / Explosions / Drought / Structure Failure / Electrical Outage / Telecommunications Interruption / Transportation Route Interruption / Water Service Interruption.

[2] This data was retrieved from the wildland urban interface risk class maps found here: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/vegetation-and-fuel-management/fire-fuel-management/wui-risk-class-maps, Retrieved on Nov 1, 2021.

Area 'F' Weather Hazards

Climate Norm's 1981-2010[3]

Annual Rainfall 332 mm
Annual Snowfall 157.2 mm
Average Temperature, January -9.0 C
Average Temperature, July 16.3 C
Frost-free Days 129 days
Maximum Temperature 36 C (May 29, 1983)
Minimum Temperature -47 C (Dec. 30, 1984)

- In Area F, one Environment Canada station monitors Climate Normal from 1981 – 2010 in Vanderhoof.
- According to Environment Canada, in the Vanderhoof area, the minimum extreme temperature recorded was -47 degrees Celsius and occurred in December of 1984. On average, there are less than 2.4 days in January where the temperature reaches below -30 degrees Celsius. (Canada E. , Climate Normal 1981-2010 - Fraer Lake North Shore, Climate ID 109C0LF, 2021)
- Atmospheric River effects can be seen throughout the region. An **atmospheric river, or AR**, is a large, narrow stream of water vapour that travels through the sky. It can stretch to 1,000 miles (1,600 kilometres) long and more than 400 miles (640 km) wide, and on average, carries an amount of water equivalent to 25 Mississippi Rivers. As the rivers cross from the ocean to the land — particularly to mountainous regions like the B.C. coast — the vapour condenses into precipitation, sometimes dumping a month's worth of rain or snow in a matter of days. Less-intense ARs are essential to many continents' water supply by bringing a whole lot of it from the warmer tropical oceans. But the bigger and more intense they get, the more dangerous they can be, triggering landslides and flooding resulting in tens to hundreds of millions of dollars in damage or more. The warmer the air is, the more water vapour an AR can carry. As the atmosphere's average temperature rises, then, an atmospheric river can grow — and when it makes landfall, it can release more rain or snow than in years past. (Linch, 2021) Environment and Climate Change Canada is working to create a new warning system that would act as a Canadian version of AR warnings. This system is predicted to be publicly ready in the fall of 2022. (Linch, 2021)

Snowstorms and Blizzards

Meteorological disturbance giving rise to a heavy fall of snow, often accompanied by strong winds. Snowstorm and blizzards impact upon transportation, powerlines and communications infrastructure, and agriculture. **(BC E. M., 2021)**

- Snowfall is a common occurrence in the winter months, although it is rarely heavy enough to pose a significant risk.

Related Hazards: Extreme Cold / Freezing Rain or Drizzle / Avalanche / Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Fuel Source Interruption / Aircraft Incident / Motor Vehicle Incident.

[3] (Canada E. , Climate Normal 1981-2010 - Vanderhoof, Climate ID 1098D90, 2021)

Extreme Heat ↗

Heat waves can be characterized by temperatures significantly above the mean for an extended period, or by a combination of high temperatures with high humidity and a lack of air motion. Heat waves impact upon the very young, the elderly and those with cardiovascular conditions. Heat waves also impact upon agriculture. **(BC E. M., 2021)**

Notable Heatwaves in the Electoral Area 'F' include:

- The last week in June 2021 brought about unprecedent heat in British Columbia and across western Canada. With forecasts stating it was the warmest stretch since records have been kept (In many instances 100+ years) ((MSC), 2021). With CBC reporting 486 sudden deaths over a five-day period from June 25th – 30th, 2021 195% increase over the approximately 165 deaths that would normally occur in the province over a five-day period. (News C. , 2021)
- Temperatures reaching 35'C on June 26, 2021. (NAVCAN, 2021)[4]

Related Hazards: Lightning / Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Structure Fire / Wildfire / Drought / Food Source Interruption / Water Service Interruption.

Lightning ↗

Generally, all the various forms of visible electrical discharge that are produced by thunderstorms; often seen as a bright flash of light in the sky. Lightning impacts air transportation, powerlines and communications infrastructure and causes forest fires. (BC E. M., 2021)

- Lightning occurs virtually year-round in the Pacific coastal region. The average date of the beginning of lightning season in Western Canada (1999-2018) for British Columbia - Interior – North and high mountain ranges is June 1st. The average date of the end of the lightning season in Western Canada (1999-2018) is between October 1st and November 1st. (Canada G. o., Lightning Statistics, 2016)
- The Canadian Lightning Detection Network (CLDN) was established in 1998 and consists of over 80 lightning sensors distributed across Canada. (Canada G. o., Lightning, 2016)
- Some quick facts regarding forest fires from Natural Resources Canada, Forest fires started by lightning, represent 45 per cent of all fires and 81 per cent of the total area burned in Canada, and occur in remote locations and often in multiple clusters. (Canada G. o., Lightning Statistics, 2016)
- Total ground to cloud lighting strikes from 1999-2018 in Prince George was 9,499 and the average number of lightening days (within 25km) is 32.9. (Canada G. o., Lightning Statistics, 2016)

Related Hazards: Hail / Wildfire / Storm Water Flooding / Flash Flooding / Electrical Outage / Telecommunications Interruption.

[4] There were no recorded temperatures on June 27 – 29th Error.

Hurricane / Typhoon / High Wind Event

Hurricanes are tropical cyclones with maximum sustained surface winds of at least 64 knots (118 km/h). Hurricanes are known as typhoons in the western Pacific, very severe cyclonic storms in the North Indian Ocean, and severe tropical cyclones in Australia. There are five classes of hurricane intensity as outlined by the Saffir-Simpson Scale. (BC E. M., 2021)

Related Hazards: Hail / Lightning / Snowstorms and Blizzards / Tornado / Landslide/Debris Flow / Explosions / Hazardous Materials Spill / Seiche / Storm Surge / Lake, River, and Stream Flooding / Coastal Flooding / Storm Water Flooding / Flash Flooding / Dam and Spillways Failure / Dike Failure / Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Wastewater Interruption / Water Service Interruption / Fuel Source Interruption / Aircraft Incident / Marine Vehicle Incident / Motor Vehicle Incident / Rail Incident.

Space Weather

A disturbance or fluctuation in the earth's magnetic field, associated with solar flares. The impact may include disruption of electrical grids, communications systems, navigation equipment, and satellite operations. Resource operations including surveying, drilling, and pipelines may also be negatively affected. (BC E. M., 2021)

- The source of space weather is the Sun. The Sun is a million times larger than Earth and so distant that its light takes eight minutes to reach us. When violent solar phenomena occur, they create space weather effects on Earth, which can pose a hazard for human activities. (Government of Canada, 2021)
- Effects from solar activity include (but are not limited to) geomagnetically induced currents in power systems and pipelines, azimuthal errors in directional drilling, disruptions to HF radio communication and GPS navigation, and failure or mis operation of satellites:
  - Magnetic disturbances induce electric currents in long conductors such as power lines and pipelines causing power system outages or interfere with pipeline corrosion systems.
  - Magnetic disturbances directly affect operations that use the magnetic field, such as magnetic surveys, directional drilling, or compass use.
  - Radio waves used for satellite communications or GPS navigation are affected.
  - Effects on satellites including radiation damage, memory upsets, phantom commands, surface charging and internal charging. (Government of Canada, 2021)

Related Hazards: Cyber Security Threat / Telecommunications Interruption / Electrical Outage / Transportation Route Interruption.

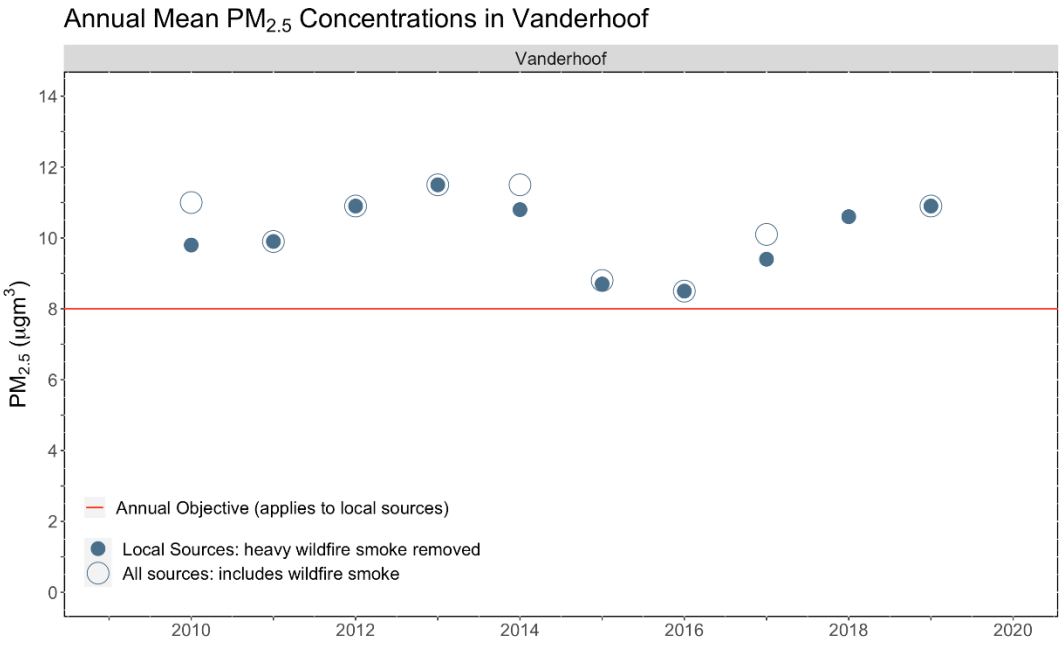
Air Quality ↗

Solids, liquids, or gases which, if discharged into the air, may result in statutory air pollution. (BC E. M., 2021)

- Communities in this region experience air quality episodes due to elevated particulate concentrations at various times throughout the year. Particulate matter is a concern for human health and from an aesthetic point of view. Vanderhoof has an air quality monitoring station that provides an Air Quality Health Index (AQHI), hourly air quality readings, and related health messages. The AQHI reports on the health risks posed by a mixture of pollutants, including particulate matter ($PM_{2.5}$[5]), ground-level ozone (O^3), and nitrogen dioxide (NO^2). (BC A. Q., 2021) These readings illustrate the level of health risks with a number and advice on minimizing health risks from air pollutants.
- The most significant air pollutant in the Vanderhoof area is fine particulate matter, $PM_{2.5}$, from open burning, industrial sources, wood burning appliances, backyard burning, transportation road dust and vehicle emissions. A study conducted by Elliot and Copes (2011) has estimated that between 16 to 74 deaths each year are attributable to fine particulate matter concentrations in Northern and Interior Health Regions alone. (Zirnhelt, June 21, 2021)
- In Canada, wildfires can significantly increase air pollution levels of fine particulate matter ($PM_{2.5}$) posing the greatest human health risk (Canada H. , 2021).
- Elevated $PM_{2.5}$ typically occur in the autumn and winter months when dispersion is poor and many different emission sources (industry, space heating, open burning) are active. (Zirnhelt, June 21, 2021)

Notable Air quality data in Electoral Area 'A' includes:

- The Province of BC has one active Air Quality Monitoring station located in this region at the Vanderhoof Courthouse. (Columbia P. o., Air Quality Data BC, 2021)
- Since 2010 Vanderhoof air quality, annual mean $PM_{2.5}$ concentrations, have exceeded the provincial air quality objectives (8 or 25 ug/m3) consistently
- A day is considered an advisory level day if the daily (24-hour) concentration is greater than the provincial objective of 25 ug/m3 for PM2.5. The



[5] $PM_{2.5}$ Particulate matter with a diameter of less than 2.5 micrometers (µm). One micrometer is one millionth of a metre. PM2.5 is included in fine particulate and is a subset of PM10 (when measuring PM10, it includes PM2.5). PM2.5 is typically associated with combustion sources (smoke) and is more closely related to adverse health effects than larger particles.

following chart provides the number of air quality advisory days in Vanderhoof issued by the Ministry of Environment since 2014[6]:

Year	# of days under advisory for fine $PM^{2.5}$
2014	13
2015	9
2016	9
2017	16
2018	16
2019	15
2020	3
2021	3

- The ministry of Environment further issues Smokey Sky Bulletins and in 2017 there were 47 days of bulletins issued and in 2018 there were 51 days issued.
- There are three Purple Air Quality Monitoring stations in Area F, Two in Vanderhoof and one in the Saik'uz community.

Related Hazards: Human Disease / Public Health Crisis / Structure Fire / Wildfire / Ash Fall / Explosions / Hazardous Materials Spill / Oil or Gas Pipeline Spill.

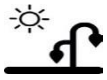
Hail

Precipitation in the form of lumps of ice mainly associated with thunderstorms. Hail ranges in size from that of a small pea to the size of cherries but has been observed as large as grapefruit. Hail in Canada occurs most frequently during the summer when thunderstorm activity is at its peak. (BC E. M., 2021)

- Hail event around Saik'uz that caused $35,000 worth of damage to one property.

Related Hazards: Lightning / Food Source Interruption.

Drought



Drought is a recurrent feature of climate involving a deficiency of precipitation over an extended period, resulting in a water shortage for activities, communities, or aquatic ecosystems. In BC, combinations of insufficient snow accumulation, hot and dry weather, or a delay in rainfall may cause drought. (BC E. M., 2021)

- Drought can lead to reduced water availability for household and business use. Lower stream flows may cause warmer river temperatures, affecting fish and other aquatic life. Low stream flows can also affect the growth of agricultural crops and limit the water available for irrigation. Low flows and extended periods of low precipitation can also have impacts on groundwater levels. Aquifers – particularly those at shallow depths - may develop a lower water table due to drought in any given year and from previous drought seasons, as there may not be enough water to recharge the aquifer. If natural water sources or adequate storage are not available in a community, it may also lead to insufficient supplies for firefighting. (Econics, May 2021)

[6] Data received from Ben Weinstein Sr Air Quality Meteorologist Monitoring, Assessment and Stewardship Environmental Protection on August 12, 2021

Notable regional incidents involving drought:

- Due to relatively normal to high snowpacks in the spring, early forecasts did not flag a drought risk for 2018. However, a heat wave in late spring rapidly depleted snowpacks and caused freshet flooding earlier than normal. That, and the lack of precipitation from July to November, created extensive dry conditions across lots of the province.
- In 2018, the Northwest, Upper Fraser West, Upper Fraser East, and Nechako regions reached Level 2 to Level 3 drought ratings, meaning these areas were very dry. (BC Agriculture & Food Climate Action Initiative, 2019) With the Skeena – Nass (including Witset, Smithers and Telkwa) reaching level 4 from August 23 to November 8th, being extremely dry. (Columbia P. o., British Columbia Drought Information Portal, 2021)

Related Hazards: Extreme Heat / Lightning / Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Wildfire / Food Source Interruption / Water Service Interruption.

Landslide/Debris Flow 

Debris avalanches and debris flows.
Debris avalanches are extremely rapid debris flows of mud, rock, brush, trees, and other debris propelled by torrential rains.
Debris flows are a form of rapid mass down-slope movement of a slurry of loose soils, rocks, and organic matter. (BC E. M., 2021)

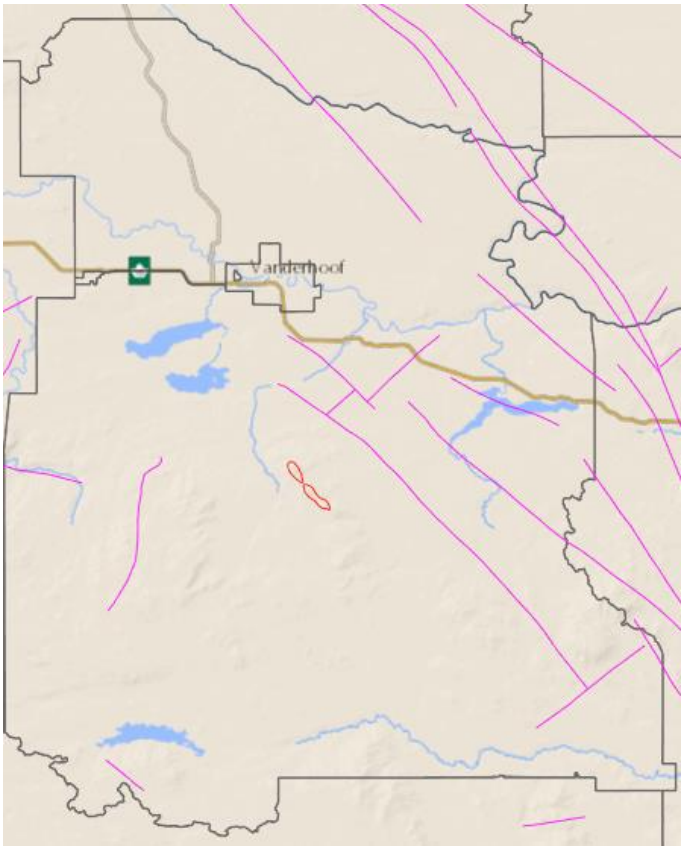
- The District of Vanderhoof has identified steep slopes as part of the Hazard Development Permit Areas the OCP and Schedule 4 Map. The OCP further defines steep slopes as a risk to land slide or erosion if over 20% (Engineering, 2020).

Related Hazards: Avalanche / Land Subsidence / Submarine Slides / Tsunami / Seiche / Lake, River, and Stream Flooding / Flash Flooding / Structure Failure / Electrical Outage / Telecommunications Interruption / Transportation Route Interruption.

Earthquake

An earthquake is defined as the shaking of the ground due to movement along a fault rupture. When a large magnitude earthquake occurs, energy traveling in seismic waves may cause damage to structures, trigger landslides, liquefaction, or other geologic hazards and, in certain circumstances, generate tsunamis. Impacts from earthquakes can be widespread and severe. (BC E. M., 2021)

- The Regional District's risk for seismic activity is considered medium to low (Canada G. S., 2015).
- In electoral area 'F,' there are no records of earthquakes. (Natural Resources Canada, 2021)
- Regional District residents would experience minimal physical impact; however, there could be a significant event that could impact the delivery of goods and services, depending on the location of the epicentre and the impact on major transportation routes from the east and the south.
- A map showing faults lines within Electoral Area 'F' reveals that few faults do exist. Faults in this area are of the Strike-Slip (pink) variety. *See map – source: Imap BC, retrieve Nov 2nd, 2021.*
- The five most significant earthquakes in BC occurred in 1700, 1946, 1949, 1970 and 2012. They ranged in magnitude from 7.3 (1946) to 9.0 (1700).



Related Hazards: Structure Fire / Avalanche / Landslide/Debris Flow / Land Subsidence / Submarine Slides / Liquefaction / Tsunami / Explosions / Hazardous Materials Spill / Mine Incident / Oil or Gas Pipeline Spill / Seiche / Dam and Spillways Failure / Dike Failure / Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Wastewater Interruption / Water Service Interruption / Fuel Source Interruption / Marine Vehicle Incident / Motor Vehicle Incident / Rail Incident.

Human Caused Hazards

Dam and Spillways Failure

A breach in the foundations, abutments, or spillways of a dam, which results in a sudden, rapid, and uncontrolled release of the impounded water. (BC E. M., 2021)

Nechako Reservoir

The Nechako River was dammed at its source on the eastern edge of the Kitimat Ranges in the early 1950s to provide power to the Alcan aluminum smelter in Kitimat that Australian company Rio Tinto now owns. The hydroelectric reservoir was formed by constructing the Kenney Dam on the Nechako River and nine smaller dams that inundated a chain of lakes and rivers. The Nechako Reservoir finished filling in 1957 and is 233 km long, with a water surface of 910 km². (Rio Tinto, 2021)

Three emergency scenarios are associated with the Nechako reservoir that could threaten downstream communities, these include:

- **A breach of Kenney Dam** consists of a failure of the dam, or its foundations or abutments accompanied by a large or rapidly increasing uncontrolled flow of water from the reservoir. This is the most severe emergency involving the Nechako Reservoir and will result in extensive downstream flooding. (Rio Tinto, November 2020) The Kenney Dam is located in the southern area of Electoral Area D. The Rio Tinto Kenney dam has a dam failure consequence of extreme and a failure probability rating being small. (Staff, 2009)
- **A Saddle Dam breach** consists of a failure of one of the nine saddle dams, the Skins Lake spillway, or their foundations or abutments accompanied by a large or rapidly increasing uncontrolled flow of water from the reservoir. This is the second most serious emergency involving the Nechako Reservoir. A saddle dam breach may result in extensive downstream flooding. (Rio Tinto, November 2020) The Skins Lake spillway is located in Electoral Area E adjacent to Oosta Lake. The Rio Tinto Cut off Creek Saddle #1, #2, and #3 dams have a dams failure consequence of high and a failure probability rating being small. Dam failure probability of small means that the risk level is of no concern and includes regular audit programs to identify any changes to the operation. (Staff, 2009)
- **"An extreme flood release** is defined as a Skins Lake Spillway discharge at or near the Probable Maximum Flood (PMF) of 1653 m3/s. The PMF results from the combination of a severe hydrometeorological event followed – or preceded - by a second extreme event. The PMF flood is estimated to produce a peak daily inflow to the Nechako Reservoir between 3566 m3/s. The Nechako Reservoir is capable of temporarily storing the major portion of these inflows. However, the PMF would require very large releases from Skins Lake Spillway of up to a maximum of approximately 1653 m3/s. These releases would be necessary to prevent excessively high-water levels, which could cause breaching of the dams. The PMF would also be accompanied by a substantial rise in reservoir level, which would cause flooding around the shoreline. It is anticipated that snowpack and/or weather conditions, together with monitoring of reservoir levels, would provide a minimum of several days warning of the need to make very large releases." (Rio Tinto, November 2020)

Rio Tinto provides inundation maps that provide information about possible flood arrival times and water levels for threatened downstream communities. The maps are based on

computer model simulations. The inundation maps concerning Electoral Area F include Vanderhoof Maps 13 through 18.

Maps 13 -18 illustrate the extent of flooding of the worst-case scenario of Kenney Dam Breach and Skins Lake Spillway Breach under two scenarios Probable Maximum Flood Breach Scenario and Fair-Weather Breach Scenario. The table below illustrates the inundation levels at Fort Fraser based on the different breach scenarios.

Distance from Skins Lake Spillway: Km 165				
Information *(all water levels are in m)*	**PMF Breach Scenario**		**Fair Breach Scenario**	
	Skins Lake Dam #3	Kenney Dam	Skins Lake Dam #3	Kenney Dam
Initial Water Level (m)	641.06	641.06	634.70	634.69
Maximum Water Level (m)	656.40	690.10	651.64	687.53
Depth above Initial Water Level (m)	15.34	49.04	16.94	52.84
Flood Arrival Time (hr)	22.77	8.03	30.65	9.30
Time for Maximum Elevation (hr)	73.27	47.90	92.70	48.47
Maximum Discharge (m^3/s)	17228	104162	10719	96234
Maximum Water Velocity (m/s)	0.70	0.98	0.56	0.99

Rio Tinto BC Works inundation maps and Emergency plan found on the Get Involved Nechako website

Other Types of Dams

- The Dam Safety Regulation under the Water Sustainability Act, objective is to mitigate loss of life and damage to property and the environment from a dam breach by requiring dam owners to inspect their own dams, undertake proper maintenance on them, and ensure that these dams meet ongoing engineering standards. The dams administered under this regulation are associated with dams that store or divert fresh water from a stream or aquifer or both. These dams are inspected annually and assigned a failure consequence and risk rating according to the Dam Safety Regulations of BC. [7]
- In Area F there are 25 dams regulated under the Dam Safety Regulations, two of which have a failure consequence of significant and a failure probability rating being 'very small'. Meaning that the risk level is effectual and included regular audit programs to monitor failure consequence only /normal operation and indicates very low probability of failure. (Staff, 2009)
- If a dam has a failure consequence of significant or higher than the owner is required to provide a record containing information for the use of the local emergency authorities for the dam for the purpose of preparing local emergency plans under the *Emergency Program Act.*
- Tailing Storage Facilities, including mining dams, in British Columbia are regulated under Part 10 of the Health, Safety and Reclamation Code for Mines in British Columbia (the Code), as established under the Mines Act. There are no mine tailing ponds[8] in Area F.

Related Hazards: Hurricane/Typhoon/High Wind Event / Landslide/Debris Flow / Earthquake / Mine Incident / Storm Water Flooding / Flash Flooding / Dike Failure / Structure Failure / Electrical Outage / Water Service Interruption.

[7] Michael Trudell, Senior Dam Safety Officer.
[8] BC Mine information website: https://www.mines.nrs.gov.bc.ca/map

Structural Fire

Urban fires are fires that occur in a residential, commercial, or industrial community. Rural and urban fires occur on a frequent basis in many parts of the province, and of provincial concern are the fires that cause many deaths and injuries, those that are beyond the ability of the local resources to respond or those that cause severe economic losses. For interface fires, see wildfires. (BC E. M., 2021)

Related Hazards: Air Quality / Lightning / Wildfire / Explosions / Structure Failure / Electrical Outage / Telecommunications Interruption / Water Service Interruption.

Rail Incident

An incident involving a passenger, cargo or light-rail train that results in damage, bodily injury, or death. (BC E. M., 2021)

- The CN Rail northern main line crosses the area from east to west roughly paralleling the Highway # 16 corridor traveling through the community of Vanderhoof. Along this part of its route, the rail line is adjacent to water courses and lakes as it travels east to west. A major rail accident in the area could seriously impact residents, the environment, and cut off large areas to emergency services, particularly if hazardous materials were involved.
- To have rail service interrupted for any length of time would seriously impact the transport of goods to and from the area.
- Rail traffic will increase substantially over the next few years as the Prince Rupert container port construction continues and this will further increase the risk of, and the effects of a CN Rail transportation route failure.
- There are volumes of hazardous materials transported by CN rail along this route to Prince Rupert including:

Substance PIN # [9] and Recommended Evacuation Radius[10]	
LP Gas UN1978	Initial downwind evacuation for at least 800m
Gasoline UN1203	Initial evacuation for 800 meters in all directions
MTBE (Methyl-tert-butylether) UN2398	Initial evacuation for 800 meters in all directions
Methanol UN1230	Initial evacuation for 800 meters in all directions
Fuel Oil Diesel Fuel UN1202	Initial evacuation for 800 meters in all directions
Caustic Soda UN1823	Initial evacuation for 800 meters in all directions
Sulphuric Acid UN1830	Initial evacuation for 800 meters in all directions
Anhydrous Ammonia UN1005	Initial evacuation for 1600 meters in all directions
Hydrogen Peroxide UN2014	Initial evacuation for 800 meters in all directions
Chlorine UN1017	Initial evacuation for 800 meters in all directions
Sulphur Dioxide UN1079	Initial evacuation for 1600 meters in all directions

- In March of 2020, a CN train derailed east of Prince George BC, forcing a school evacuation. This derailment included seven cars carrying liquefied petroleum gas (LPG), an extremely flammable product. Twenty-eight cars went off the tracks. (Trumpener, 2020)

[9] PIN means product identification number as designated by Transportation Canada for the transportation of dangerous goods.
[10] Distances for evacuation zones can be references in the North American 2016 Emergency Response Guidebook available at https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/ERG2016.pdf

Notable Rail Incidents in Electoral Area F:

- December 10th,2011 Vanderhoof - Mile 69.5 Nechako Subdivision Person was seriously injured when they walked into the side of the train, RCMP and ambulance attended.
- December 21st, 2011East of Vanderhoof - Mile 58.9 Nechako Subdivision the derailment occurred when the fractured L4 wheel on car No. CN 196g33 experienced a wheel fall-in event on the gauge side of the south rail. In this occurrence, once the fractured and derailed wheel entered the spiked section of track, the track fastening system was overcome by the lateral force of the derailed wheel, resulting in the rail rolling over and the subsequent derailment of the 1g trailing.(Haggerstone, 2013)
- September 6th, 2019, a pedestrian was stuck and fatally injured at a crossing at MPP 69.27 near Vanderhoof, BC. (Canada T. S., 2021)

Related Hazards: Avalanche / Landslide/Debris Flow / Explosions / Hazardous Materials Spill / Transportation Route Interruption / Fuel Source Interruption.

Aircraft Incident

An incident involving one or more aircraft that results in damage, bodily injury, or death. (BC E. M., 2021)

- The Vanderhoof Airport is located 6.5 km north of Vanderhoof by road and serves the community's aviation needs including charter flights, corporate flights, medivac airlifts and recreational flying opportunities. The airport is not equipped with a terminal, however, there is a "Club House". The Airport has a 5,018-foot-long paved runway and two grass runways, one 5,200 feet and the other 3,200 feet in length. Fuel is available, both 100 LL and Jet A from a self-serve (credit card required) facility run by the Vanderhoof Flying Club. The airport is equipped with an Automatic Weather Observing System (AWOS) which can be contacted for current conditions. (District of Vanderhoof, 2021)

Related Hazards: Fog / Snowstorms and Blizzards / Ash Fall / Explosions / Hazardous Materials Spill / Structure Failure / Transportation Route Interruption.

Motor Vehicle Incident

An incident involving a truck, car, bus, farm vehicle, or any other motor- or person-powered vehicle that results in damage, bodily injury, or death. (BC E. M., 2021)

- Highway 16 runs through the region, transecting Engen and Vanderhoof. This route contributes to the risk of motor vehicle crashes in the area, with the majority being reported along Highway 16. The chance of a hazardous materials spill is also high due to the growing volume of truck traffic. In addition, there are the communities of Saik'uz and Clucuz Lake.
- According to the Insurance Corporation of British Columbia North Central Crashes 2016 to 2020, there were 236 reported casualty crashes[11] in Vanderhoof, 4 in Clucuz Lake, and 5 in Engen. (ICBC, 2020)

[11] "Casualty Crash" (ICBC collision data) motor vehicle crashes resulting in an injury or fatality.

Related Hazards: Fog / Freezing Rain or Drizzle / Snowstorms and Blizzards / Explosions / Hazardous Materials Spill / Transportation Route Interruption.

Mine Incident

Mines in BC range from open pit coal and metal mines, underground coal and metal mines, placer operations or gravel pits and quarries. Each mining operation presents unique hazards with incidents ranging from structure failure, tailings dam failure, sediment pond or other containment failure, hazardous materials spill, or explosion. These incidents may be generated by other hazards such as flood or seismic activity. (BC E. M., 2021)

- Newgold Blackwater is a gold and silver mine proposed outside the RDBN Boundary, however road access would be accessed from Vanderhoof off the Kluskus-Oostsa Forest Service Road running through electoral area 'F'. The Project is a proposal to conduct gold and silver extraction from the Blackwater deposit situated along the northern foothills of Mt. Davidson in the Nechako Plateau, approximately 110 kilometres southwest of Vanderhoof, B.C. or approximately 160 kilometres southwest of Prince George, B.C.

Oil or Gas Pipeline Spill

Pipeline and gas well leaks and explosions occur when natural gas or gasoline pipelines, valves, or components rupture, by accident, by mechanical failure or corrosion. Gas leaks can also be caused by natural hazards such as earthquakes or landslides. (BC E. M., 2021)

- PNG owns and operates natural gas distribution facilities (gas utility), delivering gas from its transmission system to homes and businesses in the various communities served. The PNG Northwest Transmission Pipeline System connects with the Enbridge pipeline system near Summit Lake, British Columbia, and extends 587 km to the west coast at Prince Rupert. The pipeline follows the Hwy 16 corridor. PNG also owns and operates over 300 km of lateral transmission pipelines, extending into various communities in the Northwest, including Vanderhoof residents in Area 'F'.
- Pacific Northern Gas (PNG) Core Emergency Response Plan (ERP) is an operational guide designed to be used by staff to prepare effectively, respond to, and recover from both emergencies and disasters. (Pacific Norther Gas, 2020)
- This Plan identifies the following events that may activate response:
  - Natural disasters;
  - Human-caused: equipment failure and severe damage; environmental incidents security threats and acts of violence; and,
  - Information technology incidents.
- TransCanada Coastal GasLink Project is almost complete in Electoral Area 'F':
  - Approximately 670 kilometres (416 miles), the Coastal GasLink pipeline project will safely deliver natural gas across northern B.C. After Coastal GasLink delivers the natural gas from northeastern B.C. to the LNG Canada facility in Kitimat, B.C., LNG Canada will prepare it for export to global markets by converting the gas to a liquefied state – also known as LNG. (Coastal GasLink, 2021)
  - A portion of section 4 of the Coastal GasLink pipeline runs along the north end of Electoral Area 'F' North of Vanderhoof. This section of the pipeline route is 100% cleared, 100% graded, and 99.6% installed. Currently, there are no workers at the Vanderhoof Lodge. (Coastal GasLink, 2021)

- The proposed pipeline will be underground except at valve sites and compressor stations. The pipeline proposed to be monitored 24 hours a day, 365 days a year. With satellite technology, sensors within the pipeline send data every five seconds to our state-of-the-art control centre. If low gas pressure is detected, the valves on the affected section close automatically and are evaluated by our team of highly trained professionals, assessing the next steps. (Coastal GasLink, 2021)
- Coastal GasLink has prepared a comprehensive Emergency Response Plan that outlines procedures to protect the public, emergency responders, property, and the environment in the unlikely event of an emergency.

Related Hazards: Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Explosions / Hazardous Materials Spill / Fuel Source Interruption.

Electrical Outage

A deficit, interruption or failure of electricity or power systems, services, supplies, or resources. Power outages occur on a regular basis, however, they become a concern when the power outage is for a significant amount of time, when the temperatures are very low, or critical infrastructure, persons, livestock, or businesses are affected. (BC E. M., 2021)

- Power outages occur regularly, however, they become a concern when the power outage is for a significant amount of time when the temperatures are very low, or critical infrastructure, persons, livestock, or businesses are affected.

Related Hazards: Space Weather / Lightning / Telecommunications Interruption.

Water Service Interruptions

A deficit, interruption, or failure of water systems, services, supplies, or resources. (BC E. M., 2021)

Related Hazards: Animal Disease / Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Structure Fire / Wildfire / Drought / Wastewater Interruption.

Food Source Interruption

Food shortages occur when the population of a community undergoes a severe shortage of food. A severe shortage of food can lead to starvation, illness and, in extreme cases, death. (BC E. M., 2021)

- Statistics Canada provides data on the primary types of locations where BC residents buy their food. If residents in the region are representative of BC, they would be expected to buy 87% of their grocery shopping from supermarkets and other grocery stores. The remaining 13% is purchased from convenience and specialty stores. (Strategies, March 2021) Much of the food in the stores is shipped in through the major highway transportation corridors that are susceptible to external hazards and emergencies that can lead to food source interruptions in this region.
- Agriculture in Electoral Area F is predominantly Beef cattle ranching, hay production, multiple animal production and forage country. (Strategies, March 2021). Vanderhoof supports one abattoir for cattle, hogs, bison and sheep, and a farmers' market. Vanderhoof has the highest revenue per farm in the RDBN.
- The cost of locally grown and produced food remains high within the region.
- The average family in the Northern Health region spends $1038 a month on groceries (BC Centre for Disease Control Provincial Health Services Authority, 2018).
- Canada's Food Price Report 2021 forecasts an overall food price increase of between 3% and 5% this year. (Dalhousie University | University of Guelph | University of Saskatchewan | University of British Columbia, 2021)
- The main grocery stores across the region are supplied 50% from the lower mainland and the remainder coming from Edmonton/Alberta. In response to the 2021 November floods in the lower mainland the large chain stores were quick to develop continuity plans to reroute trucking through the US, into Alberta and back over to the North.

Notable Incidents involving food source interruptions:

- COVID-19 Pandemic (Started 2020) exasperated food insecurity for Canadian's who already had food security and affordability issues. Locally, the 2020 COVID-19 Pandemic prompted transportation delays and a crisis in the availability of food at the grocery stores following the March 2020 provincial lockdowns. The grocery stores implemented purchase limits, and store shelves were empty. "Foodbank numbers in the local area increased by 22% at the start of COVID-19 and again increased now that government COVID subsidies have stopped." (Salvation Army Food Bank Coordinator, 2021)
- Big Bar Landslide, BC (2019) caused a decline in salmon fisheries affecting FN food supplies.
- The 2016 ice storms in the Lower Mainland prompted an inevitable crisis — highways were closed, and food trucks couldn't make it up here. Store shelves started emptying.

Related Hazards: Extreme Heat / Extreme Cold / Snowstorms and Blizzards / Animal Disease / Landslide/Debris Flow / Plant Disease and Pest Infestation / Public Health Crisis / Drought.

Transportation Route Interruptions

An interruption or failure of transportation infrastructure or systems. This can include road, rail, or waterway damage, transportation delays due to weather and/or infrastructure failure. Transportation Route Interruptions are probable during disaster events. (BC E. M., 2021)

Related Hazards: Snowstorms and Blizzards / Wildfire / Avalanche / Landslide/Debris Flow / Earthquake / Liquefaction / Tsunami / Lake, River, and Stream Flooding / Aircraft Incident / Marine Vehicle Incident / Motor Vehicle Incident / Rail Incident.

Telecommunications Interruptions

The unavailability of services provided by the communications infrastructure resulting in significant inconvenience or an emergency event caused by human error, equipment malfunction or breakdown. (BC E. M., 2021)

- In the 2020 rain fall and subsequent slides and again in 2021 November floods in the lower mainland the local cell service was disrupted for long periods of time.

Related Hazards: Freezing Rain or Drizzle / Space Weather / Hurricane/Typhoon/High Wind Event / Lightning / Snowstorms and Blizzards / Tornado / Landslide/Debris Flow / Earthquake / Electrical Outage.

Wastewater Interruptions

A deficit, interruption or failure of wastewater or sewer systems, services, supplies, or resources resulting in significant inconvenience or an emergency event. (BC E. M., 2021)

Related Hazards: Hurricane/Typhoon/High Wind Event / Animal Disease / Human Disease / Public Health Crisis / Earthquake / Water Service Interruption.

Fuel Source Interruptions

A deficit, interruption, or failure of fuel systems, services, supplies or resources. This can include pipeline damage, transportation delays due to weather and/or shipping infrastructure damage, or general shortages due to market supply problems, or panic fuel hoarding during emergencies. Fuel Source Interruptions are probable during disaster events. (BC E. M., 2021)

- The majority of fuel is transported from Alberta via Trans Mountain Pipeline and railway. Prince George is the distribution centre, where fuel is then trucked to its destination. There is a refinery in Prince George that refines gasoline, diesel, propane butane and heavy oil.

Related Hazards: Hurricane/Typhoon/High Wind Event / Snowstorms and Blizzards / Wildfire / Landslide/Debris Flow / Earthquake / Oil or Gas Pipeline Spill / Transportation Route Interruption / Rail Incident.

Cyber Security Threat

A circumstance or event with the potential to interrupt or adversely impact organizational operations, assets, or individuals (including mission, functions, image, or reputation). Cyber Threats occur through information systems via unauthorized access, destruction, disclosure, modification of information, and/or denial of service. Also, the potential for a threat-source to successfully exploit a particular information system vulnerability. (BC E. M., 2021)

- Cyber security is a big threat for government and businesses for business continuity.
- Increase in phone, Facebook, dating apps, and email scams affecting seniors and vulnerable populations. Limited statistics affecting the local community however recent news reports state that "British Columbians reported $3.5 million in losses to cryptocurrency investment scams in the first eight months of 2021" (Samanski-Langille, 2021).

Related Hazards: Telecommunications Interruption / National Security Threat.

Disease, Pest Infestations & Epidemics

Plant Disease and Pest Infestation 

Plant diseases include invasive pests including insects and mites, and plant pathogens including fungi, bacteria and viruses' impact upon crops, forests, and urban environments. New introductions and/or widespread outbreaks could have severe economic and environmental consequences. **(BC E. M., 2021)**

- With climate change, shifts in the distribution, lifecycles, and prevalence of agricultural pests (insects, diseases, weeds, and invasive species) are anticipated. Increasing average annual temperatures (in particular winter minimum temperatures) combined with shifting precipitation patterns are already magnifying pest impacts, pest management complexity and associated costs of production.
- Mountain Pine Beetle outbreaks have significantly impacted the region due to increased winter survival rates. Modelling of changes to biogeoclimatic zones (BGC zones) how the Interior Douglas Fir zone will spread northward and increase in area, while the Sub-Boreal Spruce zone will decrease dramatically. While this modelling was completed with a forestry lens, agricultural pests associated with these ecosystems would be expected to shift along with the BGC zones. (BC Agriculture & Food Climate Action Initiative, 2019)
- Since 2005, the Regional District of Bulkley-Nechako has partnered with the Northwest Invasive Plant Council (NWIPC) to address invasive plant species spread within the region. The NWIPC coordinates the invasive plant response based on priority areas and species and on funding availability through their network of partners. Specifically, funds contributed from the RDBN go toward several programs including local education and signage on invasive plants and invasive plant monitoring and treatment at RDBN owned and administered properties. In addition, the NWIPC administers the Private Landowner Rebate program that offers rebates to land owners that use contractors to treat for invasive plants on their property.
- The Northwest Invasive Plant Council (NWIPC) is currently targeting 60 invasive plants for management, as per the NWIPC 2020 Target Plant List. The list of species is reviewed, updated and approved by the membership every spring at the annual general meeting. The Nechako IPMA Plant list for 2020 identified species listed in electoral area D and F.
- Invasive plant species up and down rail lines and highways taking over farm fields – Knapp weed, hock weeds. This results in spraying along Creeks and rivers causing harm to the environment.
- Agriculture producers can also experience challenges due to pests, including grasshoppers, aphids, cutworms and more. Some resources and information are linked below to help with identification, monitoring and management of pests in gardens and crops. Grasshopper Monitoring and Control in BC ; Pesticides and Pest Management - Province of BC

Related Hazards: Animal Disease / Human Disease / Public Health Crisis / Drought / Food Source Interruption.

Animal Disease

Precipitation in the form of lumps of ice mainly associated with thunderstorms. Hail ranges in size from that of a small pea to the size of cherries but has been observed as large as grapefruit. Hail in Canada occurs most frequently during the summer when thunderstorm activity is at its peak.. (BC E. M., 2021)

- Risk of bovine – economic impacts in ranching community, there is no experience locally but could change any time.
- Moose and fish population hazards – rural communities are reliant on food harvested from the land.
- Increase in grasshopper populations on farmers' fields devastating crops.

Related Hazards: Human Disease / Plant Disease and Pest Infestation / Public Health Crisis / Food Source Interruption.

Human Disease (Including Pandemic and Epidemic)

Diseases that are caused by pathogenic microorganisms and are spread directly, or indirectly, from one person to another. Diseases can impact public health, cause death, have economic implications, and result in mass casualty response. These include epidemics such as meningitis, pandemic flu, hepatitis, E. coli, and other communicable diseases.

A pandemic is the worldwide spread of a new disease. The total number of people who get severely ill can vary. However, the impact or severity tends to be higher in pandemics in part because of the much larger number of people in the population who lack pre-existing immunity to the new virus. (BC E. M., 2021)

Notable Pandemic Incidents in BC:

- COVID-19 Pandemic (2020)
- Ebola (2013-16
- H1N1 Flu Pandemic (2009)
- SARS Outbreak (2003)
- The lands in BC have been populated by the ancestors of First Nations since time immemorial. Epidemics spread through First Nations communities in advance of explorers. Some researchers have suggested epidemics reached the Northwest Coast as early as the 1500s, believing the well-known epidemics from the Caribbean and Central America may have spread to the Pacific Coast through native trade networks and social contact. Some of the recorded epidemics in the Interior were known to have originated on the prairies during the historic period (early 1800s). The introduction of infectious diseases from Europe and Asia into the Northwest Coast and adjacent areas, and an increase in the severity of warfare, had devastating effects on the people. Smallpox, influenza, measles, and whooping cough were recorded epidemics, with smallpox particularly recurring with devastating effects in the native population. The 1918-19 influenza pandemic was the last major epidemic to seriously affect First Nations and marked the end of the epidemic cycles that had begun over 150 years previously. In some cases, entire villages were significantly reduced in single disease events, with mortality rates ranging from 50% to 90% of the population. (First Nations Health Council, 2011)

- History of Pandemics: **https://www.visualcapitalist.com/history-of-pandemics-deadliest/**

Related Hazards: Animal Disease / Plant Disease and Pest Infestation / Public Health Crisis.

Public Health Crisis

A localized or regional event that poses or causes a significant threat to the health of human populations. The event may be declared as a Public Health Emergency if the event meets at least two of the following criteria:

- a regional event that could have a serious impact on public health;
- a regional event that is unusual or unexpected;
- there is a significant risk of the spread of an infectious agent or a hazardous agent; and
- there is a significant risk of travel or trade restrictions because of the regional event.

An example of a Public Health Crisis is the contamination of a communities drinking-water supply by a hazardous material. If the event is regional in nature and poses a serious impact to public health, it may be declared a Public Health Emergency. (BC E. M., 2021)

- Overdose B.C.`s Public Health Emergency Progress Update on B.C.`s Response to the Overdose Crisis reported that on April 14, 2016, B.C.'s provincial health officer declared a public health emergency under the Public Health Act. In July 2017, the Ministry of Mental Health and Addictions was established, in part, to work in partnership to develop an immediate response to the overdose emergency. (Columbia B. , 2021)
- Preliminary data in 2021 has found that fentanyl or its analogues have been detected in 85% of all illicit drug toxicity deaths. In 2020, fentanyl or its analogues had been detected in 86% of deaths. (Service C. , 2021) In the Northern Interior,[12] the Illicit drug toxicity deaths between 2011-2021 have increased substantially. It should be noted that this health service delivery area includes Vanderhoof, Fort St James, Prince George and Quesnel, and are reported as follows:

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021[13]
8	12	8	11	15	24	35	63	34	84	36

- By Health Authority (HA), in 2021, the highest rates were in Vancouver Coastal Health (46 deaths per 100,000 individuals) and Northern Health (45 per 100,000). Overall, the rate in BC will be 39 deaths per 100,000 individuals in 2021.
- 2019 Taking the Pulse of the Population an Update on the Health of British Columbians identifies positive Mental Health as a public health challenge and a provincial goal. They were collecting public health statistics as indicators to monitor this complex public health crisis. Under Section 66 of the Public Health Act, the Provincial Health Officer (PHO) has the authority and responsibility to monitor the health of the population in BC and to provide independent advice on public health issues and the need for legislation, policies, and practices respecting those issues.
- Read: https://www2.gov.bc.ca/assets/gov/health/about-bc-s-health-care-system/office-of-the-provincial-health-officer/overdose-response-progress-update-aug-dec-2020.pdf

[12] Vanderhoof is in the North Interior Health Service Delivery Area.
[13] https://www2.gov.bc.ca/assets/gov/birth-adoption-death-marriage-and-divorce/deaths/coroners-service/statistical/illicit-drug.pdf

- Across Northern health and the province there are challenges in providing and maintaining levels of service in many remote and rural communities. The challenges include the difficulty of recruiting and retaining doctors and nurses, creating tight staffing levels across the province, and the ability for these professionals to offer a comprehensive level of service that address physical to mental health services in rural areas.

Related Hazards: Air Quality / Extreme Heat / Extreme Cold / Animal Disease / Human Disease / Plant Disease and Pest Infestation / Explosions / Hazardous Materials Spill / Structure Failure / Electrical Outage / Food Source Interruption / Telecommunications Interruption / Transportation Route Interruption / Wastewater Interruption / Water Service Interruption / Fuel Source Interruption.

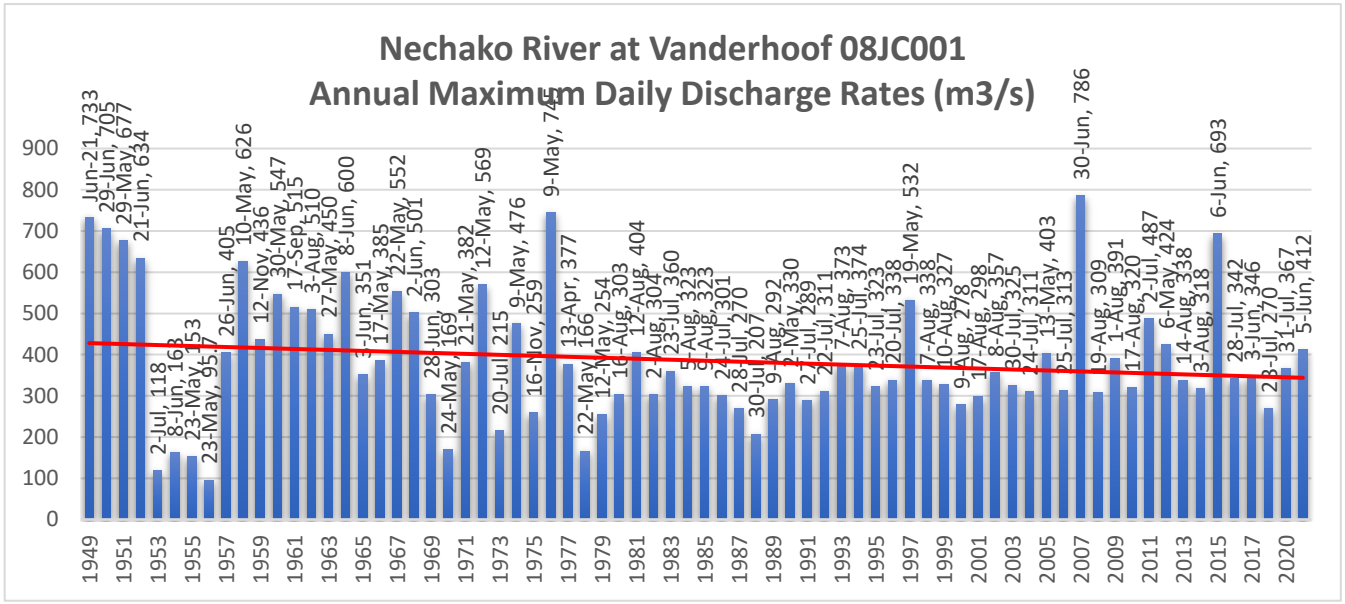
APPENDIX 1 – ELECTORAL AREA 'F' HISTORIC HAZARD EVENTS

Historic Hazard Experience					
Year	**Event Type**	**Severity**	**Cause**	**Impact Effect**	**Description**
1976	Flooding	moderate	Spring Runoff	Transportation, residential evacuation alert	Heavy rain, frost-free nights and a large snowpack in the Nechako drainage area caused a heavy runoff. On May 6, the Nechako River rose 5 ft. (1.5 m). Overnight May 6-7, the level remained steady. Though the river was some 5 ft. (1.5 m) above normal, it was still 2 ft. (60 cm) below flood level. Roads in the district washed out, cutting off some local residents and causing some flooded basements with water inching into yards and moving up city streets.
1996	Ice Jam	low	Ice Jam	Residential damage	A combination of higher-than-average flow and a sudden cold snap led to ice jamming. Temperatures in the region plummeted to –30C for a five-day period. This early and sustained cold snap caused ice to form quickly on the river, restricting the passage of flows and causing the river to overtop its banks at some points. Alcan had concluded a program of higher-than-normal water releases from the Nechako reservoir to create storage space for the 1997 spring runoff. Between November 21-23, the Nechako River at Vanderhoof rose 8 ft. (2.4 m), causing some basements in Vanderhoof to flood.
2002	Flooding	low	Spring Run off		Vanderhoof Neufeld Rd 6 miles of Vanderhoof April 21 A culvert takes water from Goldie Creek (only runs during runoff) under Hwy 16W by a property. The culvert is unable to hold the water, causing the Hwy to act as a dam and divert the water on to her property. Evacuated all animals out of barnyard. The water must rise another 8-10 inches before it will impact her home. It is 30-40 yds away from home. It is still rising. Rushing water is more than 100 yds from home.
2002	Flooding	low	Spring Run off	Road Washout	Vanderhoof, Mapes Rd April 24 Lives on Mapes Road and last Saturday a small creek started flowing over its banks and washed out his private road between his yard and his bail yard. He presently can't get through to his bail yard with his tractor. There is an alternate route through which he could access it by ATV.
2002	Flooding	low	Spring Run off	Flood	Vanderhoof 1546 Aspen Drive freshet. April 25 Caller reporting flooding of creek through property. Flooding is due to snowmelt. Flooding happened over the weekend but has since subsided and is now running through the culverts.

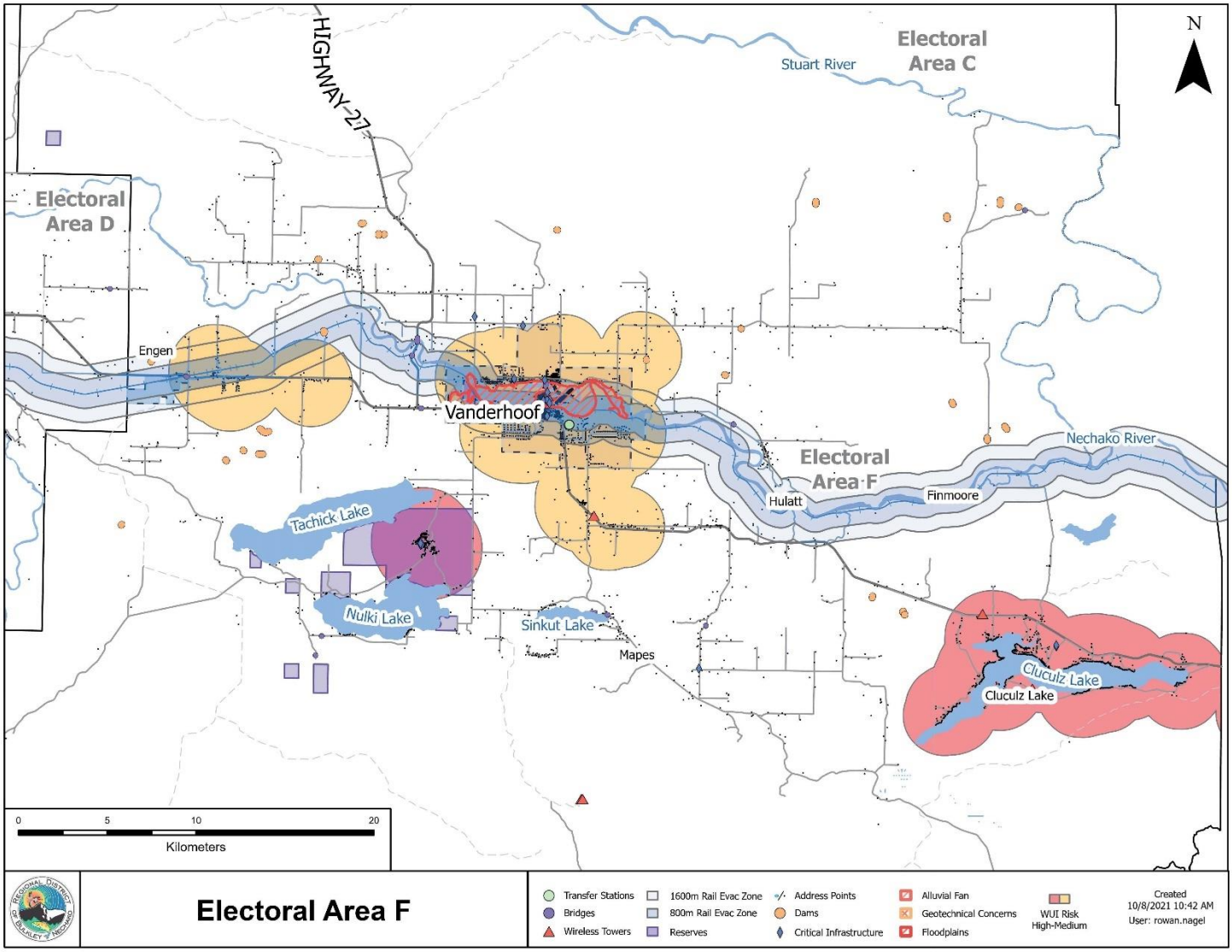
2004	Wildfire - EOC Activation	moderate	Industrial Caused	Industry and recreational evacuation	50 Hectare Fire caused by logging in area. Residents were evacuated from recreational cabins. Under control and contained by June 26.
2007	Flooding	high	Spring Run off	residential evacuation	Multi-home evacuation and damage.
2006	Flooding		Freshet	Clucluz Lake Residents	
2006	Electrical Outage	Low	Severe Weather	Transportation	On October 28, a massive snowstorm that hit northern British Columbia dumped 2.5-3 ft. (75-90 cm) of wet snow in some areas. It was a result of a combination of two weather systems, a warm Pacific and a large cold front, colliding. The Smithers airport set a 24-hour October record of 62 cm of snow. *1) Early on October 28, the 244-km section of Highway 16 between Moricetown-Fraser Lake was temporarily closed, to be reopened the next day. The early season snowstorm left an estimated 15,000 BC Hydro customers in northwestern British Columbia without power. Affected communities included: Mackenzie, Prince George, Vanderhoof, Fort St. James, Fraser Lake, Burns Lake, Takla Landing, Houston, Telkwa, Smithers and Hazelton. Three transmission lines were down and due to impassable roads crews in some areas were relying on helicopters to access problem areas. On October 30, an estimated 2,500 customers were still without power. On November 2, six days after the storm, about 200 households in about 10 communities near Burns Lake were still without power. Most of these were unlikely to get service back for several more days. The area most heavily affected was the south shore of Francois Lake, about 25 km south of Burns Lake. Large trees coated with ice hampered repair efforts. BC Hydro representative Elisha Moreno said, "There was about a metre-and–a-half of wet snow; then it froze."
2010	Wildfire - EOC Activation	moderate			Evacuation Ordered issued June 20 and rescinded June 25th.
2011	Rail Derailment	low	mechanical derailment	Transportation	December 21st, 2011, a unit coal train travelling westward experienced a train-initiated emergency brake application leading to the derailment of 19 loaded coal cars near Cariboo BC (west of Vanderhoof). There were no injuries. Nineteen CN rail cars carrying coal derailed on the main track after a wheel gave out and caused emergency braking. In the TSB investigated the above two derailments together and the reports are highly technical.

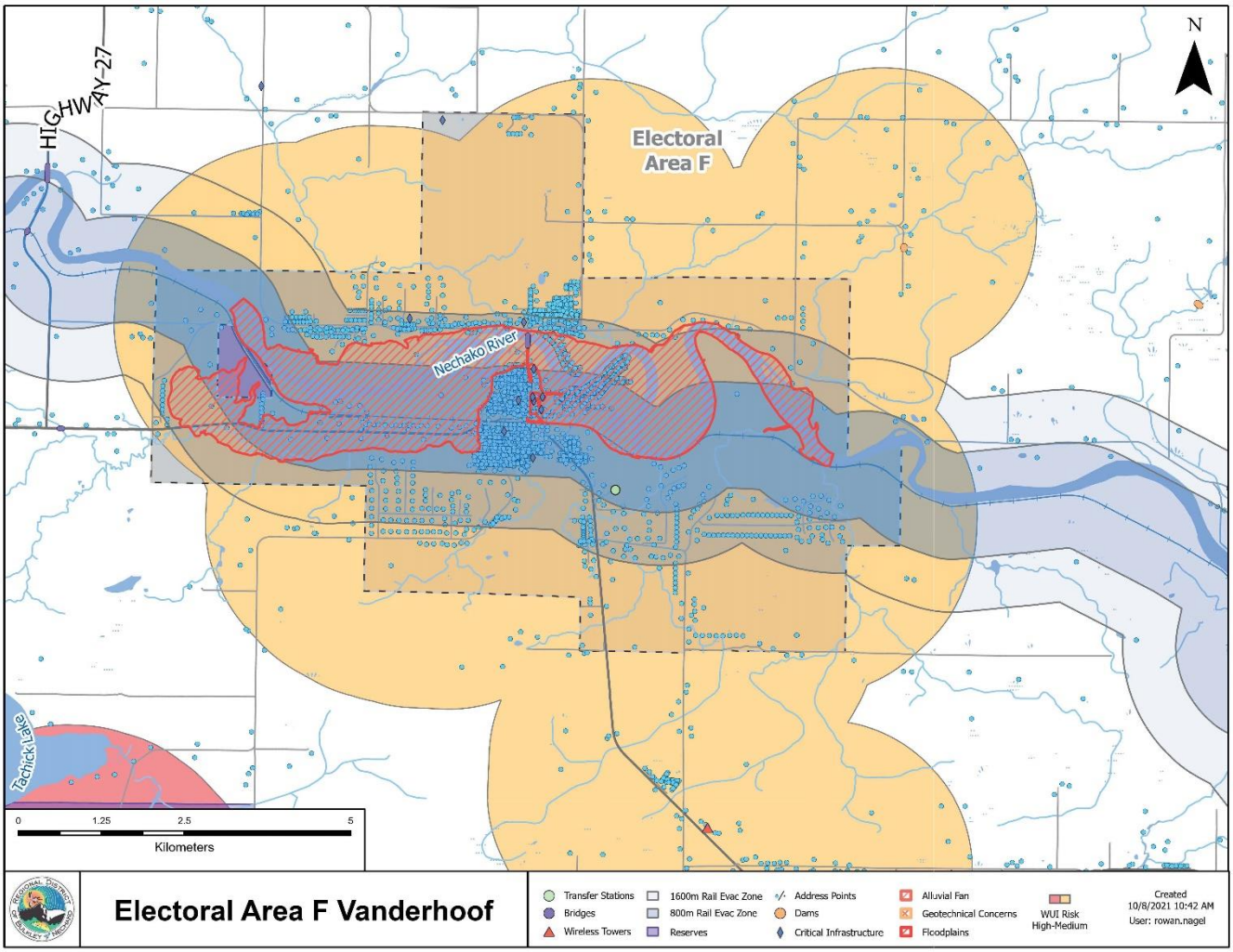
2014	Cattle Liner Rollover	low			Dome Creek Cattle Liner Rollover that occurred on the 21st of February
2015	Wildfire	High	Wildfire	Residential Evacuations	Little Bobtail Lake Wildfire 25,000 hectares, 100's on order and alert.
2020	Pandemic	moderate	Pandemic	Social economic	COVID-19 Pandemic, Business shut down and restrictions on gatherings and inter-community travel.
2021	Wildfire - EOC Activation	moderate	Wildfire	Residential Evacuation alert	Cutoff Creek (G41269) - 10,129 hectares as of July 11, 2021 lighting caused Cut Off Creek – Incident # 210398
2021	Wildfire - EOC Activation	moderate	Wildfire	Residential Evacuation alert	Grizzly Lake Wildfire - G41711 - 483 hectares as of July 12, 2021 lighting ignition date July 10th

APPENDIX 2 – ELECTORAL AREA 'F' HYDROMETRIC DATA



APPENDIX 3 – ELECTORAL AREA 'F' KNOWN HAZARDS MAP

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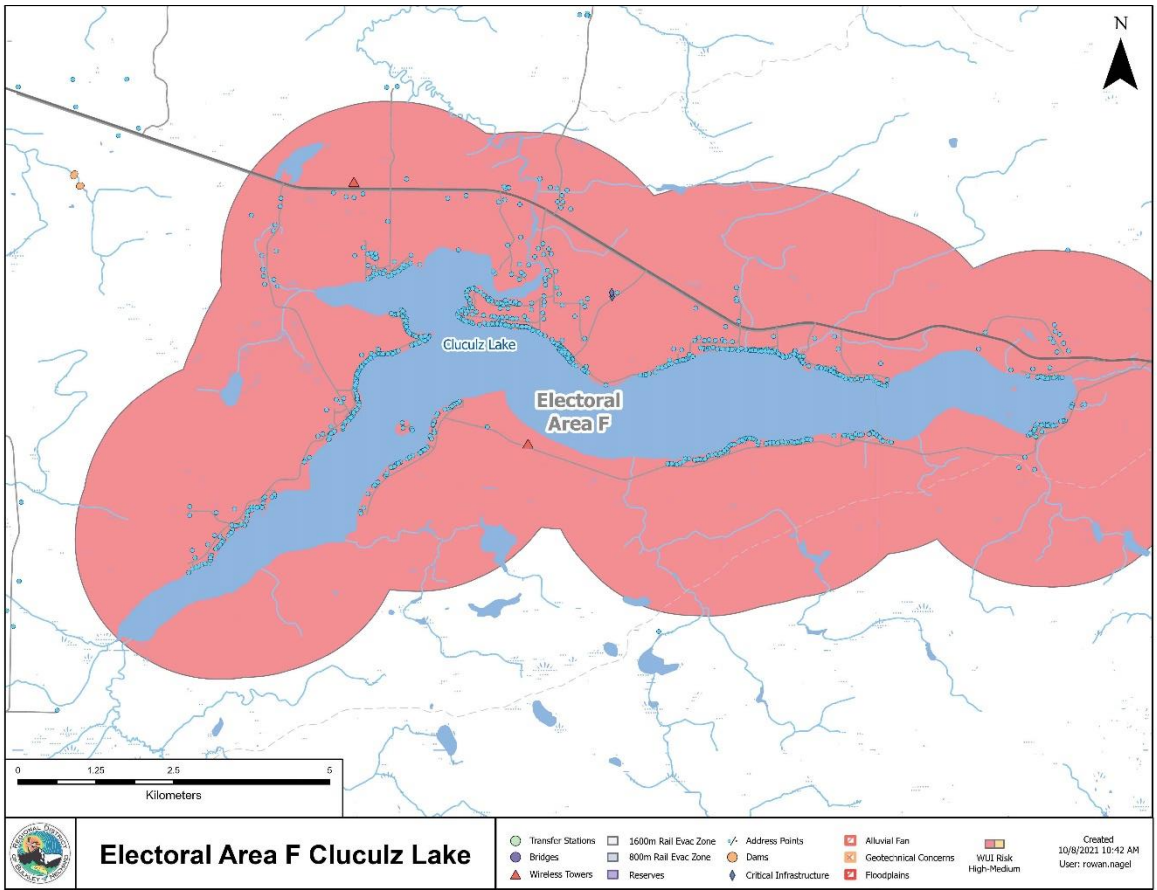
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Geotechnical Concerns
Floodplains
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