Annex B

North Slave Region Hazard Identification Risk Assessment

Northwest Territories Municipal and Community Affairs

Table of Contents

1 Executive Summary

The 2014 North Slave Region Hazard Identification Risk Assessment (HIRA) identifies the hazards and examines the risks that pose a threat to the people, property, environment and economy of the North Slave Region. This type of assessment is a critical part of any emergency management program. Identified hazards can be used in preparedness programs, emergency response plan exercises, and training and awareness programs.

Governments have limited resources and planning for every possible hazard is not a realistic approach. However, an informed ranking of hazards provides a cost-effective approach to hazard mitigation, emergency planning and response. This assessment identified and rated twenty hazards that could affect the North Slave Region, and then ranked them in order of emergency planning priority. Each region of the Northwest Territories (NWT) has some unique features that were taken into consideration in rating and ranking their hazards.

The North Slave Region Hazard Summary (insert) provides a list of the hazards ranked into three categories of high, medium and low. These rankings are supported by the North Slave Region risk matrix (page 6) and the information outlined in the hazard narratives in Section 2, “Hazard Narratives”. Each hazard narrative contains risk mitigation strategies to help emergency planners improve their preparedness and response plans. The rankings were determined using best practices methodology combined with insight from communities and local experts and therefore, may not be identical to risks assigned using other methods or criteria.

According to the 2011 census, the North Slave Region reported a population of 19,444 and a land area of 184,903.78 square kilometres. It is the most populous of the five regions. The region comprises just under half the population of the NWT, with Yellowknife alone

North Slave Region Hazard Summary

High

1. Fire/Explosion
2. Transportation Accidents
3. Critical Infrastructure Failure – Other

Medium

4. Human Disease
5. Industrial Emergency
6. Civil Unrest
7. Weather - Other Extreme
8. Weather - Winter Storm
9. Critical Infrastructure Failure - Energy Crisis
10. Weather - Wind Storm
11. Earth Movement - Permafrost Degradation
12. Snow Load Hazard

Low

13. Critical Infrastructure Failure - Water Contamination
14. Earth Movement – Other
15. Flood
16. Ice Hazard
17. Food and Agricultural Emergency
18. War/ International Incident
19. Earth Movement - Earthquake/ Tsunami
20. Falling Debris

boasting a population of 18,700.

Excluding Yellowknife, the North Slave Region has 7% of the NWT population and 4% of the NWT's personal income. The region consists of seven communities with the regional offices situated in Behchokǫ̀ and Yellowknife. With the exception of Yellowknife, the communities are predominately First Nations.

The resiliency of this region is strengthened by the traditional economy as North Slave region has the highest participation rates in hunting and harvesting.

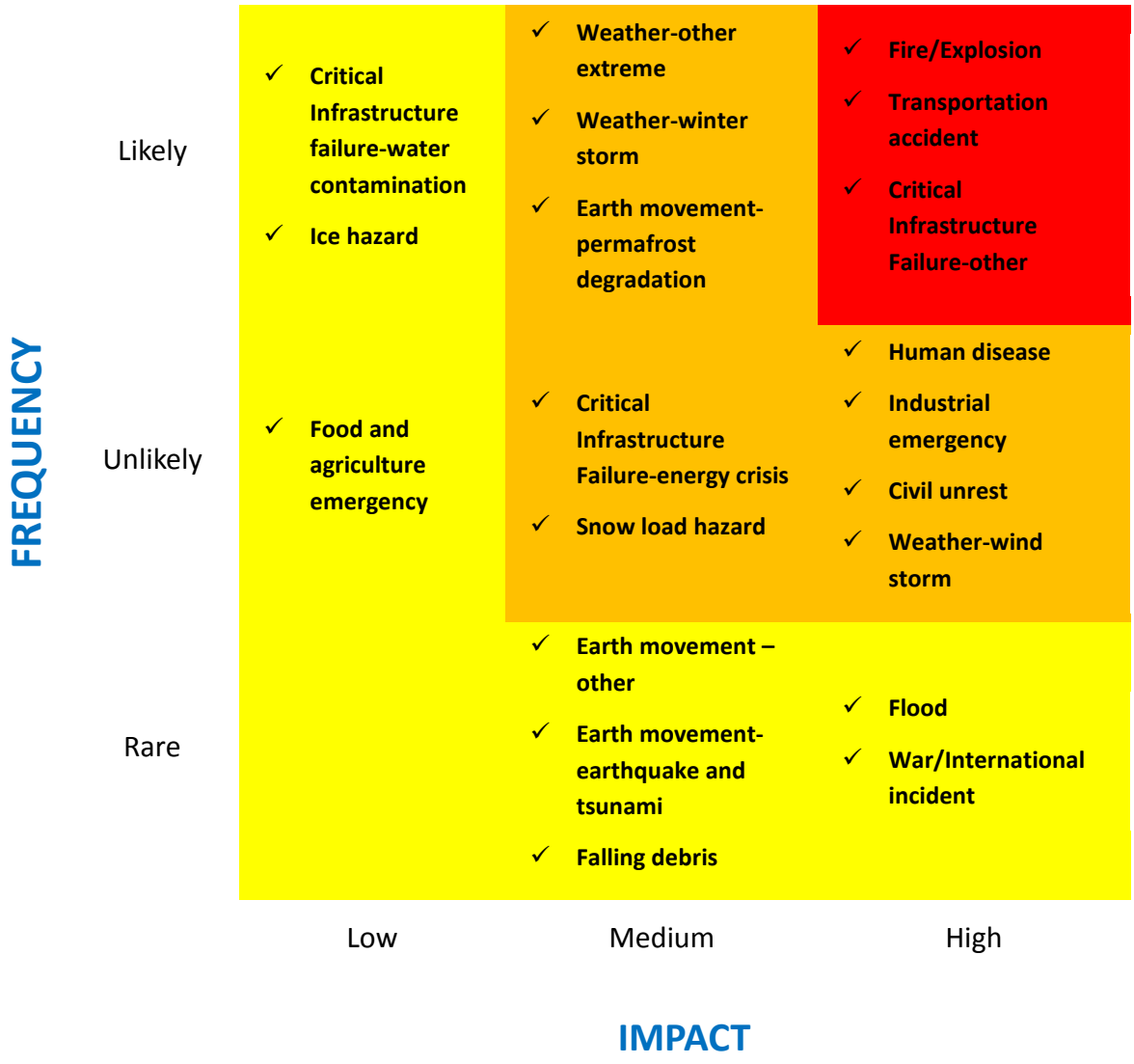
Yellowknife is the capital and only city in the NWT . In 2006 the city had 45% of the NWT's total population. Yellowknife accounts for about 55% of territorial income, and has the same percentage of territorial businesses.

Fire/Explosion was found to be the highest ranked hazard in the North Slave Region. In a ten-year period from 2002 to 2011, there were 250 wildfires (96% human-caused) within a 10 kilometre radius of Yellowknife.

Transportation accidents were also ranked high in the North Slave Region. Yellowknife is the primary supply and transportation centre for the region. The city has the NWT's largest airport. All-weather road connections are limited north of the community of Behchokǫ̀. However, there is an extensive ice road system supplying communities and mines in the region.

Yellowknife has a large business community and its financial, health and education institutions provide services to a significant area of the NWT. With this concentration of risk, Critical infrastructure Failure – Other ranked high in the North Slave and takes into account aging infrastructure issues, decaying sewer lines and road repair.

1.1 North Slave Risk Matrix



1.2 Emerging Issues

The North Slave Region has experienced significant growth over the last decade. The region's second largest community, Behchokǫ̀, is now approaching 1800 residents.

Yellowknife is headquarters for the NWT's three diamond mines, as well as a possible new gold mine. Future development of diamond mines and new gold properties might increase the risk of industrial accidents in the region.

1.3 Climate Change

Climate change strongly affects the hazards of the NWT. Temperatures have already increased by 3 to 4 degree Celsius over the past 50 years in the NWT and this rate will continue or increase. Climate change

shifts the wind and cloud patterns and changes how many storms and lightning strikes impact the region. Northern climate change has been hard to predict but these are some of the effects that could increase the frequency or impact of hazards in the future:

- Rapidly rising temperatures (Fire/Explosion Hazard, Transportation Accidents Hazard, Critical Infrastructure Hazards, Earth Movement Hazards, Human Disease Hazard);
- Shorter, warmer winters (Transportation Accidents Hazard, Critical Infrastructure Hazards);
- Increased rain and snowfall in many regions (Flood Hazard, Snow Load Hazard, Weather Hazards, Earth Movement Hazards);
- More extreme fall and winter storms (Weather Hazards);
- Less predictable weather (Weather Hazards);
- Increased winds in some areas (Weather Hazards);
- Thinner ice (Ice Hazard);
- Lower water levels in some lakes and rivers (Critical Infrastructure Hazards, Water Contamination Hazard, Transportation Accidents Hazard);
- More forest fires in some areas (Fire/Explosion Hazard); and
- Rising sea levels (Flood Hazard, Earth Movement Hazards).

A more extensive discussion on climate change can be found in the 2014 NWT HIRA Section 8.3 Specific Climate Change Report.

2 Hazard Narratives

2.1 High

2.1.1 Fire/Explosion

Figure 1: Coast Fraser Tower Fire in Yellowknife, 25 May 2010. (Source: CBC News, Photo submitted by Ben Morgan)

Definition Uncontrolled burning and/or a sudden, violent release of gas under pressure which causes or threatens loss of life and property and environmental damage	**Class** Natural and Human-induced
NWT greatest impacts to date 950 Evacuated Estimated Total Cost $12,044,118	
Climate Change Projected to increase both frequency and consequence	

Mitigation Strategies	✓ Consider implementing FireSmart programs for the community and include the response capabilities for urban/rural/wildland fires. ✓ Create fire education training and awareness sessions for first responders and the public. ✓ Enforce fire prevention practices.

Vulnerability	Description
People	High injury and fatality potential from the immediate threat of the fire and the blast as well as an increased mortality rate and respiratory symptoms due to smoke.
Infrastructure	Total loss or damage to most infrastructure including public buildings, roadways, rail-lines, power facilities and water treatment plants. Smoke can impede evacuation of remote communities by air.
Communications	Any existing power lines can be damaged and destroyed by fire/explosion cutting off communication links. The same holds true for microwave towers in regions without in-place power lines.

North Slave Exposure/History

Table 1: Wildfires and Urban Fires with Losses of $500,000 and Over

Where	When	Impact
Yellowknife	June 6-15, 1995	Wildfire - Damage was incurred by provincial, municipal and private property. Estimated Total Cost $3,432,310
Yellowknife	Aug 1997	Urban fire - Department store. Estimated Total Cost $1,050,000

Where	When	Impact
Tibbitt Lake	July 22-31, 1998	Wildfire - State of Emergency declared and the area closed to traffic and residents. Reached 140000 HA in size. Destroyed three vacation cabins. Evacuated 5 Estimated Total Cost $12,044,118
Behchokǫ̀	1999	Wildfire - Community evacuated.
Yellowknife	March 2005	Urban fire - Old Airport Road hardware store. Fatalities 2
Yellowknife	May 2010	Urban fire - Coast Fraser Tower blaze significantly damaged two apartments on the 14th floor, and units on the 12th and 13th floors had smoke and water damage.

Wildfire

Lightning activity over the Mackenzie Basin region is short but intense, with a strong peak in cloud-to-ground lightning during July. The maximum area of lightning activity is influenced by local moisture sources and by topography. Lightning causes up to 80% of the forest fires in the NWT. In a ten-year period from 2002 to 2011, there were 250 wildfires within a 10 kilometre radius of Yellowknife. The following communities throughout the North Slave region have a wildfire FireSmart hazard of high or extreme:

Table 2 FireSmart Hazard Areas of High or Extreme in NWT According to Community CWPP

Community	Development Area	FireSmart Hazard
Behchokǫ̀	Eastern residential area of Rae	Extreme
	Western residential area of Edzo	Extreme
	Sah Naji Kwe Lodge	High
Dettah	Deton'Cho Training Centre and along the north perimeter of the main community	Extreme
Łutselk'e	Łutselk'e East	High
	Fishing Lodge	Extreme
Whatì	Whatì East	High
Yellowknife	Engel Industrial/DND FOS	Moderate-High
	Yellowknife Bay East	High-Extreme

Many of the industrial activities in the NWT have a high or moderate forest fire risk classification including land clearing, timber harvesting, timber processing, mechanical site preparations and other silviculture treatments, gas or oil well operations, mining, highway maintenance and construction, engineering operations, plant harvesting, manufacturing, milling, trenching, and the use of explosives.

Explosion

In Yellowknife, fuel is stored in tank farms for shipment out to communities and mines. Many communities have large fuel tanks needed to prepare for the winter months. This large fuel load can result in an explosion if an ignition source is introduced. Nearby forests increase the fire load and the risks to the communities.

Community Meeting Feedback

In the North Slave region, residents confirmed a high exposure to the fire/explosion hazard. Lack of adequate fire-fighting resources and bulk fuel storage in or close to the community increases the risk.

2.1.2 Transportation Accidents

Figure 2: Highway 3 Accident - February 2013 (Source: GNWT, MACA)

Definition
All vehicle accidents which involve large loss of life and property damage

Class
Human-induced Hazard

NWT greatest impacts to date

- Fatalities 32
- Infrastructure damage (power failure, airport damage)
- Property damage

Climate Change
Projected to increase both frequency and consequence

Mitigation Strategies

- ✓ Enforce safety and prevention programs.
- ✓ Ensure Dangerous Goods practices/regulations are followed.
- ✓ Implement transportation route monitoring programs.
- ✓ Confirm that emergency response plans in place for all areas to allow for prompt response to transportation accidents.

Vulnerability	Description
People	Accidents, specifically motor vehicle accidents, are one of the highest causes of death and injury to Canadians every year. Amongst young Canadians (below age 25) vehicular accidents are the number one cause of death in the country. Largest loss of life in one accident usually occurs on passenger flight accidents.
Infrastructure	Any accident which occurs on a roadway has the ability to damage the roadway and therefore leave already isolated areas without any road access. The same holds true for aircraft accidents which may close down an airport making it virtually impossible to gain access to several communities in the NWT.
Communications	Given that communication hubs are serviced by a single communication line, especially in the southern NWT, any accident may cut these lines leading to loss of communications.

North Slave Exposure/History

When	Where	Impact
Jan 3, 2007	From Yellowknife	Bush plane went down in restricted weather. Injured: 1 Fatalities: 3
Sept 23, 2011	Yellowknife	An Arctic Sunwest Twin Otter float plane crashed in a parking lot after unsuccessfully attempting to land at the float base near Latham Island. The plane attempted to abort the landing but was unable to gain sufficient altitude before clipping power lines and

When	Where	Impact
		spiraling nose first into the empty lot between two buildings. Nobody on the ground or in the buildings was injured in the accident. Injured: 7 Fatalities: 2
March 29, 2011	Gamètì	Runway Incursion – the incident involved an Air Tindi Dash-7 on approach for landing and a privately operated Maule M5 that entered the runway unannounced causing the Dash-7 to pull up and go over-shoot.
Oct 7, 2011	Pethei Peninsula along the coast of Great Slave Lake	An Air Tindi Cessna 208B crashed into a cliff. Injured: 2 Fatalities: 2

North Slave transportation infrastructure includes a network of roads, ports and airports.

Motor Vehicle Accident / Ice Road Accidents

Figure 3: North Slave Region Highway System (Source: GNWT Transportation)

The North Slave region has all-weather roads to Yellowknife, Dettah and Behchokǫ̀, There are ice roads to Whatì and Gamètì . As may be expected, the areas with the heaviest traffic and the largest populations (e.g., Yellowknife) have the highest number of accidents. Highway Rescue units are only available in the North and South Slave region. This is most likely the reason that they have a lower percentage of accidents that end in injury or death.

Winter roads are open in winter, usually from about mid-December to late March, but may vary with weather conditions and locations. Some of them are privately operated and maintained, and offer no services, emergency or otherwise. Unleaded gas, diesel and propane are available in most communities on the highway system, with repair facilities in larger towns. Distances between these services may be significant however, and hours of operation limited.

To improve on safety, all trucks on ice roads must be equipped with two way radios, and drivers must report as they approach the numbered portages to alert each other of their presence on the same portage.

Each year collisions with wildlife, particularly bison, cause vehicle damage and injuries on NWT highways. Most incidents occur along Highways 3 and 5. Bison can also be found on and alongside Highway 7.

Aircraft Accident

Statistically, approximately 30% of aviation accidents are weather related and up to 75% of delays are due to weather. The NWT experiences a number of aviation weather hazards including icing, poor visibility, wind shear and turbulence, weather fronts and thunderstorms. Aging infrastructure at some airports increases the community hazard exposure.

Table 3: North Slave Transportation Risk Exposure

Community	Air	Road	Water/Rail
Behchokǫ̀	The community is accessible by air only on chartered aircraft from Yellowknife.	Accessible year-road by the Mackenzie Highway. An ice road opens in the winter giving the community access to Whatì. Northern Exposure offers year-round bus service from Yellowknife. Frontier Coachlines runs from Yellowknife, with regular stops in Behchokǫ̀, to Hay River, where it connects to Greyhound.	
Dettah	Accessible year-round by the Yellowknife airport.	Via ice road in the winter or during summer using the Ingraham Trail.	Accessible by a six and half kilometer boat ride.
Gamètì	Built in 1991, 3 km NE of the community, the airport has a gravel runway (3000' x 100') and an air terminal building.	A winter road off Highway 3 provides winter access to the community.	In the summer people can travel to and from Behchokǫ̀ by boat.
Łutselk'e	Located 1.8 km NE of the community, the airport was built in 1994 and has a gravel runway (3000' x 100') and an air terminal building. Scheduled flights operate throughout the week.	There is no road access to Łutselk'e.	Local residents often travel the 270 kilometers between Łutselk'e and Yellowknife by snowmobile, across Great Slave Lake, after the ice freezes.

Community	Air	Road	Water/Rail
Wekweètì	Three kilometers east of the community, the airport was built in 1994. It has one gravel runway (3000' x 75') and an air terminal building. A scheduled air service operates four days a week.	By an ice road covering both land and frozen water from January through March.	
Whatì	Built in 1991, the airport lies 1.6 km east of the community. It has a gravel runway (3000' x 100') and an air terminal building. Scheduled flights operate every day except on Saturdays.	A winter road off Highway 3 provides winter access to the community.	
Yellowknife	Four kilometers from the city centre, the full-service airport was built in 1946/47 and has two asphalt runways (7500' x 150' and 5000' x 150'). It has an air terminal building and aviation fuel is available. Sixty scheduled flights depart daily to destinations across Canada. Yellowknife Airport is deemed a port of entry into Canada and is staffed by the Canada Border Services Agency.	Accessible by the Mackenzie Highway and Highway 3 year-round.	

Community Meeting Feedback

The issue of transportation accidents was raised at several of the meetings held throughout the NWT. There is concern for poor highway infrastructure and the transportation of dangerous goods. The issue of aircraft accidents has been front and centre in the NWT over the past few years with several accidents involving the loss of life over the past two years. The participants could remember an aircraft accident occurring near Gamètì in the 1970s. The proximity of the Yellowknife airport to the city increases the possibility of an aircraft accident impacting the community.

2.1.3 Critical Infrastructure Failure – Other

Figure 4: Bluefish Dam. (Source: NWT Power Corp)

Definition	**Class**
Failure of services that meet basic human needs, sustain the economy, and protect public safety and security	Human-induced Hazard

NWT greatest impacts to date

- Communications failure
- Road Damages

Climate Change
Projected to increase both frequency and consequence

Mitigation Strategies	✓ Understand the potential risks associated with Critical Infrastructure Failure – Other. ✓ Build partnerships between stakeholders. ✓ Ensure back up/alternate systems in place for life safety. ✓ Ensure emergency response plans are in place.

Vulnerability	Description
People	People in the NWT rely on infrastructure to keep them supplied and in touch with other communities. Any infrastructure collapse could be catastrophic given the harsh nature of most areas where people live.
Infrastructure	Airports are subject to closure regularly in the winter, ice roads rely on a consistent pattern of cold weather and all weather roads are also subject to closure during winter season. Any infrastructure collapse is also exacerbated by the fact that the isolated nature of these communities makes it extremely difficult to repair failed infrastructure. Given the isolated nature of most of the communities within the NWT, any incident which closes down an airport could be severe.
Communications	Communications break downs are common throughout the north as severe weather can shut down facilities and “power bumps” often hamper effective communications. Again, given the isolated nature of the area, repair of these systems is often extremely difficult.

North Slave Exposure/History

When	Where	Impact
Jan 2003	NWT-wide	Mid-winter temperatures ranging from -1°C in Yellowknife to an incredible 7°C in Fort Smith. The mild El Nino weather put winter road and ice bridge construction behind schedule by a few weeks and created problems for mining and oil and gas industries, which rely on the frozen roadways to transport yearly supplies.

When	Where	Impact
Oct 16, 2009	Yellowknife	The Mackenzie Valley Land and Water Board granted an emergency exemption to the NWT Power Corporation (NTPC) replace the failing Bluefish dam. Evidence provided by the corporation and EBA Engineering Consultants Ltd. indicated that the dam was in a critical condition. Leakage from the dam's walls had increased almost 400 per cent in two years, and accelerated the decay of the dam's timber spillway and crib.
Oct 2011	Wekweètì	Days of dense fog meant flights could not land. Effectively cut the community off from groceries, supplies and travel for a week and stranded other community members in Yellowknife until the fog cleared. Many airports, like the one in Wekweètì, do not have GPS help on approach. Instead, pilots must be able to see the runway in order to land.
Oct 6, 2011	10 communities	Telesat's Anik F2 satellite suddenly ceased operating. Remote northern locations were the most affected, with 10 of 33 NWT communities served by NorthwesTel seeing disruptions from the outage. First Air airline cancelled 48 flights, stranding about 1,000 passengers just before the Thanksgiving long weekend.
Feb 14, 2012	Yellowknife	A Canadian Forces Griffin helicopter struck a power line on its way to Yellowknife airport causing power outages to the city. The power outage lasted over an hour and the city relied on diesel generators to get the city powered up. The damage caused was significant and Northland Utilities warned of rotating outages for the next day while asking commercial users with backup generators to use those to lessen power needs.
Jan 30, 2013	Behchokǫ̀	Malfunction of a piece of equipment out at the Snare Hydro Substation caused 200 to 250 homes in Behchokǫ̀, and 8,200 homes in Yellowknife to lose power for up to 12 hours. Caused property damage due to frozen pipes.

The Consequences Classification for a failure of the Duncan and Bluefish dams is considered to be low—no loss of life and low social, economic and/or environmental losses.

Community Meeting Feedback

The issue of infrastructure failure was discussed at all of the regional meetings. The biggest concern commented upon was the present state of the highways and roads throughout the NWT and the reliance on seasonal roads. The span of time these seasonal roads could be accessed was believed to be directly affected by climate change according to many residents. The reliance on air transportation and the implications of an airport closure anywhere in the Territories was also commented upon.

Residents also expressed a concern over the lack of cellular phone service throughout the region and the lack of a 911 service within Yellowknife, an example of infrastructure gap that could increase the impact of any hazard needing a medical response.

2.2 Medium

2.2.1 Human Disease

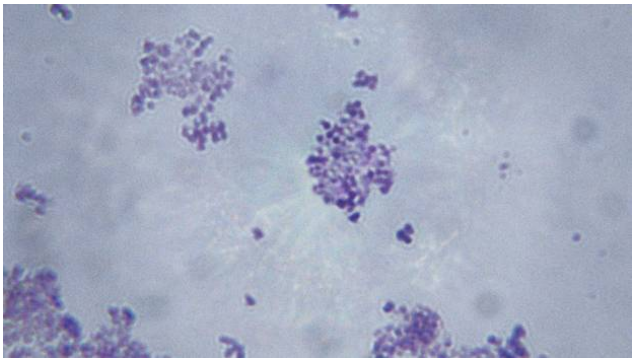


Figure 5: Staphylococcus aureus (Source: Canadian Press, 12 Oct 2012)

Definition	Class
A grave or widespread illness that presents a danger to people's health	Natural Hazard

NWT greatest impacts to date
Fatalities 600

Climate Change
Projected to increase both frequency and consequence

Mitigation Strategies	
	✓ Ensure disease monitoring plans are in place between all levels of government and private sector. ✓ Ensure preparedness plans are in place. ✓ Ensure response plans are in place and are exercised, including containment and quarantine procedures. ✓ Human vaccination against anthrax is available for personnel likely to be involved in investigating or responding to anthrax outbreaks.

Vulnerability	Description
People	Injury and death from human disease can severely impact an isolated community where continual medical care is limited.
Infrastructure	While human diseases do not impact infrastructure directly, some disruption in critical services could occur when enough of the population is affected. Support services to remote communities could be cut off during a pandemic or severe epidemic.
Communications	N/A

North Slave Exposure/History

When	Where	Impact
1902	Behchokǫ̀	Measles epidemic. Fatalities: 60
Since 2008	NWT wide	Methicillin-Resistant Staphylococcus Aureus (MRSA) infections. 55 hospitalizations (5 of them had to be flown south for treatment). Fatalities: 2
November 2009	NWT wide	H1N1 - 45 hospitalizations. Fatalities: 1

Pandemic

Worst case scenario in the GNWT Pandemic plan—each community may be completely isolated and little or no extra resources (human or material) will be available from the Region, Territory, or Nation during the Pandemic period.

Table 4: Health Care Facilities in North Slave Region

Community	Health Care Facilities
Behchokǫ̀	Health Centre
	Jimmy Erasmus Seniors Home
Dettah	Health Station
Gamètì	Health Centre
Łutselk'e	Health Centre
Wekweètì	Health Centre
Whatì	Health Centre
Yellowknife	Stanton Territorial Hospital – manages the provision of all medevac and patient transfer services in NWT
	Stanton Medical Clinic
	Stanton Medical Centre
	Stanton Ophthalmology Clinic
	Healthy Family Program Centre (47th Street)
	Home and Community Care, Public Health (1st floor, Jan Stirling Building)
	Centre for Northern Families
	Frame Lake Community Health Clinic
	Yellowknife Primary Care Centre
	Aven Cottages – Territorial Dementia Facility - AVENS – A Community for Seniors
	Aven Manor – A Community for Seniors

Community Meeting Feedback

Residents believe there is a higher risk of a pandemic hitting the region due to the influx of travellers and tourists to the city of Yellowknife. There was also concern for the lack of formal coordination for medical evacuation.

2.2.2 Industrial Emergency

Figure 6: Diavik Diamond Mine Site (Source: Photo Courtesy of the Diavik Diamond Mine, www.diavik.ca)

Definition	**Class**
Emergencies involving businesses that handle dangerous goods, hazardous wastes or chemicals or engage in potentially hazardous activities	Human-induced Hazard
NWT greatest impacts to date Environmental Damage	
Climate Change Projected to increase both frequency and consequence	

Mitigation Strategies	✓ Identify the industries in each community and rank according to risk. ✓ Ensure back-ups are in place for the industries ranked as critical. ✓ Ensure appropriate safety and emergency plans are in place.

Vulnerability	**Description**
People	Industrial accidents have an enormous impact on the health of workers and on the economy in general, which is reflected in the death, disability and personal suffering of workers on one hand, and in absence from work, loss of productivity and health costs on the other.
Infrastructure	Industrial accidents can have a dramatic negative affect on physical and virtual systems which are considered critical. This would include fires or explosions, oil spills which could impact water treatment and dam failure which could impact power supply.
Communications	Communications hubs in small communities could be damaged by an industrial accident in the community.

North Slave Exposure/History

Mining and oil and gas industries are the most common hazardous industries in the NWT. In mining, traumatic injury remains a significant problem. Common causes of fatal injury include rock fall, fires, explosions, mobile equipment accidents, falls from height, entrapment and electrocution. Less common but recognized causes of fatal injury include flooding of underground workings, wet-fill release from collapsed bulkheads and air blast from block caving failure. The systematic application of risk management techniques has contributed to a substantial decline in injury frequency rates.

When	Where	Impact
April 02, 2003	300 kilometres northeast of Yellowknife	BHP Diamonds Inc., NSL-Fox Fuel Tank Farm – 62,500 L Diesel Fuel

Community Meeting Feedback

During the community meetings there was little in the way of information received regarding industrial accidents. The transportation of dangerous goods throughout all regions and the lack of knowledge among residents as to what was actually being transported through their community were discussed at great length. Low impact fuel spills have occurred on the ice roads.

2.2.3 Civil Unrest

Figure 7: Giant Mine. (Source: Wikipedia)

Definition	Class
People breaking the law in order to bring attention to their cause	Human-induced Hazard

NWT greatest impacts to date

- Fatalities 9
- Property Damage (Mine)

Climate Change

Projected to increase both frequency and consequence

Mitigation Strategies	
	✓ Have intelligence and monitoring plans in place with law enforcement and stakeholders. ✓ Coordinate integrated response plans with stakeholders.

Vulnerability	Description
People	Civil unrest can directly impact the safety and security of individuals or groups of persons whether or not they are targeted by the unrest. There is also a threat of injury to public responders and those persons involved in the unrest.
Infrastructure	Damage to public and private property is almost always a staple of civil unrest. There is also an increase in cyber terrorism which targets computer systems which control defense establishments as well as public utilities.
Communications	Acts of civil unrest or terrorism can impact communications which disrupt public authorities' ability to deal with the unrest.

North Slave Exposure/History

When	Where	Impact
Sept 18, 1992	Yellowknife	A rail car in the Giant Yellowknife gold mine, 230 metres below ground, was destroyed by an explosion. RCMP investigators said a deliberately-planted home-made bomb caused the blast. During the strike there had been picket line violence, deliberately set fires and at least two earlier, non-fatal, explosions. Fatalities: 9
Dec 21, 2012	Yellowknife	Idle No More rally - more than 200 people gathered and proceeded to march to a downtown intersection where a ceremony was held. Traffic was disrupted for approximately an hour but there were no incidents.

Community Meeting Feedback

This hazard was not mentioned as a concern at the North Slave meeting.

2.2.4 Weather - Other Extreme

Figure 8: Yellowknife came close to breaking temperature records when temperatures fell to –43.4 C, around half a degree higher than the record low for Dec. 31, set in 1949 - 31 Dec 2013. (CBC, Janice Stein)

Definition	**Class**
All weather related hazards excluding wind storm and cold weather storms	Natural Hazard

NWT greatest impacts to date

- Power failures
- Road Damages

Climate Change

Projected to increase both frequency and consequence

Mitigation Strategies	
	✓ Develop and enforce building standards for identified extreme weather hazards. ✓ Develop/distribute and facilitate public awareness programs. ✓ Ensure that emergency plans are in place. ✓ Ensure "safe areas" are available and known to community members.

Vulnerability	**Description**
People	Extreme cold temperatures can cause injury and death. Temperatures of -55 and colder have an extremely high risk of causing injury as exposed skin can freeze in less than 2 minutes. Temperatures of -48 to -54 have a very high risk of causing injury as exposed skin can freeze in 2 to 5 minutes. Temperatures -40 to -47 have a high risk of causing injury as exposed skin can freeze in 5 to 10 minutes. Under foggy conditions, visibility is reduced to less than 1 kilometre and vehicle accidents can result (see Transportation Accidents Hazard). Ocean and lakes areas, and in particular the large lakes such as Great Bear Lake and Great Slave Lake, are cloud and fog prone through the fall until they freeze over completely (see Transportation Accidents Hazard).
Infrastructure	Extreme cold temperatures can cause significant property damage, mechanical malfunctions and burst pipes. Drought can cause crop failure, depletion of municipal water sources, increase in forest fire risk (see Fire/Explosion Hazard) and insufficient water flow through waterways. Lighting storms can lead to fires (see Fire/Explosion Hazard). Combining heat wave with the dry climate of the Arctic creates ideal conditions for wildfires (see Fire/Explosion Hazard).

Vulnerability	Description
Communications	A geomagnetic storm can knock out communications and have a variety of effects on technology. Radio waves used for satellite communications or GPS navigation are affected by the increased ionization with disruption of the communication or navigation systems. The high energy particles affect satellites causing failure or equipment damage. The magnetic disturbances directly affect operations that use the magnetic field, such as magnetic surveys, directional drilling, or compass use. Magnetic disturbances also induce electric currents in long conductors such as power lines and pipelines causing power system outages or pipeline corrosion.

North Slave Exposure/History

When	Where	Impact
Jan 2008	Yellowknife, Norman Wells and Fort Simpson	Cold snap of nine straight days of -40°C temperatures. Lingering ice fog obscured entire neighbourhoods, caused several flight disruptions, lengthened work commutes, and halted mail delivery. The -50°C wind chill and freezing fog caused a 90 minute power failure and impelled the homeless to fill emergency shelters. Schools were closed.
July 20, 2008	Yellowknife	An intense 20-minute storm dumped enough hail and rain to flood streets and grounds in a metre of water in some areas. Drains were unable to keep up with the hail-chocked flow and backed up. During the peak of the storm, residents were seen canoeing across some streets. The golf-ball size hail forced construction workers and others to flee for cover.

Community Meeting Feedback

There was much discussion among residents at all meetings regarding the increase in extreme weather. This mostly included higher temperatures in the summer months and a shifting in seasons. Whereas in the past, summer weather deteriorated in late August, recent years have seen warmer weather lasting into late September. There was also a general agreement that although the NWT is not as consistently cold has it has been in the past, there are wilder swings and more extreme storms than in the past.

2.2.5 Weather - Winter Storm

Figure 9: Tłı̨chǫ winter roads to Whatì and Gamètì. (Source: Tłı̨chǫ Government website)

Definition	**Class**
Strong weather characterized by ice, snow and freezing rain	Natural Hazard

NWT greatest impacts to date

- Infrastructure damage (power failure, airport damage)
- Property damage

Climate Change

Projected to increase both frequency and consequence

Mitigation Strategies	✓ Develop and enforce snow load standards. ✓ Ensure that plans are in place for severe winter storms. ✓ Develop/distribute and facilitate a public awareness program around how to prepare for and what to do in a severe winter storm. ✓ Identify and communicate available "safe areas" for community members.

Vulnerability	**Description**
People	Heavy winds and cold temperatures can combine with power loss to cause injury and death that could be extensive. Blowing snow creates hazardous driving and working conditions (see Transportation Hazard).
Infrastructure	Heavy winds and snow can cause damage to buildings, loss of power and water and sewage systems. Snow build-up on roofs can cause collapse (see Snow-Load Hazard).
Communications	Snow and heavy winds can knock out communications systems.

North Slave Exposure/History

Winter storms cause millions of dollars of lost revenue due to shut down of operations and slow transportation of goods and services every year. The increased frequency of snowstorms has had an impact on roadway safety. More snow removal is necessary to allow for safe travel, and the transportation of goods.

Community Meeting Feedback

There was a general consensus among participants at all meetings that while the NWT was experiencing milder winters on the whole, the winter weather was becoming more extreme in terms of storms and temperature variance. This was attributed to climate change by virtually all present.

2.2.6 Critical Infrastructure Failure - Energy Crisis

Figure 10: Snare Hydro System (Source: NWT Power Corporation)

Definition	**Class**
Failure to provide energy required to meet basic human needs, sustain the economy, and protect public safety and security	Human-induced Hazard

NWT greatest impacts to date
Declared state of emergency

Climate Change
Projected to increase both frequency and consequence

Mitigation Strategies	✓ Understand the potential risks associated with Critical Infrastructure Failure – Energy Crisis. ✓ Build partnerships between stakeholders. ✓ Ensure back up/alternate systems in place for life safety. ✓ Ensure emergency response plans in place.

Vulnerability	Description
People	Given the severe weather in the north, the population relies on a steady and safe supply of energy to provide heating in the winter. Most areas of the NWT are extremely isolated and the health hazards of being left without energy/power are both physical and mental.
Infrastructure	Water lines and sewage lines can freeze and break in severe winter weather without heat or flowing water. Loss of power can cause a situation where pipes burst in the colder temperatures.
Communications	Loss of electrical power can cause disruption to communication systems such as radio and television which people rely on for information.

North Slave Exposure/History

In the NWT, there are three main energy sources used to generate electricity: natural gas, diesel fuel and hydro resources. Hydroelectric generation is used in the communities in the Great Slave Lake area. The remaining 4 communities have electricity provided by diesel-fired power plants. Fuel must be shipped into the communities by road, pipeline, barge, ice road or air. A shortened ice road season, barge or pipeline disruption, or prolonged extreme weather events can lead to shortages of fuel in communities.

Community	Power Source (NWT Power Corporation website)
Behchokǫ̀	Primarily supplied with electricity generated from the Snare Hydro System. The standby plant consists of: • An 850 kW diesel generator; and • A 350 kW diesel generator.
Dettah	Bluefish Hydro Facility.
Gamètì	Diesel plant has three generators rated at 100, 212 and 300 kW.

Community	Power Source (NWT Power Corporation website)
Łutselk'e	Diesel plant consists of three diesel generators rated at 180, 320 and 320 kW.
Wekweètì	Diesel Generator.
Whatì	The main diesel plant contains two generators, rated at 175 kW and 480 kW each. In addition, a separate module also contains a 320 kW generator. NTPC uses excess heat from diesel generation to provide heating to the local school through the Waste Heat Recovery System.
Yellowknife	Bluefish Hydro Facility.

Community Meeting Feedback

This issue was addressed at each community meeting. In most cases the concern was the remoteness of much of the NWT and the difficulty in ensuring reliable energy infrastructure was in place.

2.2.7 Weather - Wind Storm

Figure 11: Funnel Cloud near Long Lake Yellowknife – 25 July 2010. (Source: Northern News Services online/Becca Kroeger)

Definition	**Class**
Strong weather characterized by damaging movement of air	Natural Hazard

NWT greatest impacts to date

- Property Damage (drill rig)
- Infrastructure (transmission tower)

Climate Change

Projected to increase both frequency and consequence

Mitigation Strategies	✓ Develop and enforce building standards for severe winds. ✓ Develop/distribute and facilitate public awareness programs. ✓ Ensure emergency plans include response to wind storms. ✓ Ensure "safe areas" are available and known to community members.

Vulnerability	**Description**
People	All wind storms have the potential to cause injury or death due to structural damage, flying debris or storm surges. Hurricanes also can cause flooding (see Flood Hazard). Tornados can cause many injuries and death but are very rare across the NWT.
Infrastructure	Heavy winds can cause great damage to buildings and infrastructure, and knock out power across large areas. Tornados can cause heavy damages but are very rare across the NWT.
Communications	Heavy winds are often responsible for damage to communications towers.

North Slave Exposure/History

When	**Where**	**Impact**
July 30, 1978	Near Yellowknife and Behchokǫ̀	A tornado toppled a tower near Yellowknife and then ripped up a transmission tower near Behchokǫ̀. It was the third tornado reported in the NWT since 1960.

Community Meeting Feedback

There was agreement amongst the residents of all meetings that the NWT was seeing more extreme windstorms in recent years.

2.2.8 Earth Movement - Permafrost Degradation

Figure 12: Abandoned section of NWT highway 4, east of Yellowknife, being examined for damage caused by permafrost thaw. (Source: Natural Resources Canada)

Definition	**Class**
Movement of the ground causing wide spread damage caused by loss of permafrost	Natural Hazard

NWT greatest impacts to date

- Power failures
- Road Damages

Climate Change
Projected to increase both frequency and consequence

Mitigation Strategies	✓ Develop and enforce building standards for building slumping and/or collapse. ✓ Develop/distribute and facilitate public awareness programs. ✓ Include permafrost degradation risk actions in emergency plans.

Vulnerability	Description
People	Injury and death could result from the unexpected collapse of land or a building.
Infrastructure	Permafrost has always figured heavily into Arctic infrastructure design, construction, and maintenance (NRTEE, 2009; CSA, 2010). Infrastructure systems in permafrost have depended on the stability of permafrost as a foundation material. Permafrost erosion along streams and rivers is threatening dikes, bridges and culverts.
Communications	Some damage to communication towers possible.

North Slave Exposure/History

Ground movement caused by melting permafrost has resulted in the cracking or sloping of building walls and foundations. It has also resulted in heaving, slope failure, sinkholes and potholes, affecting all forms of infrastructure. An example of the effect of permafrost degradation is the roadway buckling on Franklin Avenue hill. This road was rebuilt after only three years in service due to excessive buckling owing to permafrost melting.

A mixture of different types of permafrost is found under all of the NWT including: continuous, extensive discontinuous and sporadic discontinuous permafrost. Communities in the sporadic permafrost zone are the least vulnerable as most buildings are there are not founded on permafrost. The North Slave Region falls primarily within the zone of discontinuous permafrost.

Infrastructure adaptation is occurring in the NWT. The Yellowknife airport runway required extensive restoration after the permafrost below began to thaw. A new insulating liner was installed four metres

beneath a 100-metre section of the runway. Portions of Highway 3 from Yellowknife to Fort Providence have been abandoned and rebuilt over more stable permafrost.

Figure 13: Permafrost Zones (Source: Atlas of Canada Permafrost Map)

Community Meeting Feedback

Residents mentioned that some buildings were shifting in Whatì.

2.2.9 Snow Load Hazard

Figure 14: Municipal Garage Roof Collapse in Enterprise, January 28, 2013 (Source: Paul Bickford/NNSL Photo)

Definition	**Class**
Potential collapse of buildings due to the weight of build-up or drifting of snow	Natural Class

NWT greatest impacts to date
Property Damage (Roofs)

Climate Change
Projected to increase both frequency and consequence
Structures are built using historical snow load standards. When the snow load exceeds the standards, due to wetter, heavier, more frequent or drifting snow, structures can collapse.

Mitigation Strategies	✓ Include snow load hazards in community response plans. ✓ Clear snow from public building rooftops. ✓ Perform a roof risk assessment on key community structures such as schools and community centers.

Vulnerability	Description
People	High numbers of injuries or deaths could occur if an occupied community building or school were to collapse.
Infrastructure	Loss of the building and contents plus loss of the use of this building until repairs or a new structure can occur.
Communications	Potential collapse of microwave towers due to snow load could impact the community's communications.

North Slave Exposure/History

Community Snow Load Risk Factors

Studies show that approximately one fifth of public buildings (22%) in the NWT are at risk of collapse due to changing/increasing snow loads. Public buildings at risk include schools, hospitals, community centers and medical centres. Of those buildings at risk, about 10% have been retrofitted since 2004, and another 12% are under a snow load watch status.

Community	Community Snow Load Risk Factor
Behchokǫ̀	Moderate
Dettah	Moderate
Gamètì	Moderate
Łutselk'e	Moderate
Wekweètì	Moderate
Whatì	Moderate
Yellowknife	Moderate

Community Meeting Feedback

Response among participants at regional meetings was mixed on this issue. While many residents agreed that weather was, in general, becoming more extreme, with higher temperatures and more intense winds, there was no agreement on snow loads. Residents of Yellowknife spoke of a decrease in the snow load.

2.3 Low

2.3.1 Critical Infrastructure Failure - Water Contamination

Figure 15: Gamètì water treatment system (Source: GNWT MACA)

Definition	Class
Serious contamination of drinking water or loss of supply, that presents a danger to the general health of the public	Human-induced Hazard

NWT greatest impacts to date
Boil water advisories

Climate Change
Projected to increase both frequency and consequence

Mitigation Strategies	✓ Understand the potential risks associated with Critical Infrastructure Failure – Water Contamination. ✓ Plan for identification and reduction of contaminants into ground and surface water. ✓ Ensure water sampling and monitoring program in place. ✓ Ensure emergency response plans are in place.

Vulnerability	Description
People	The levels of contaminants in drinking water are seldom high enough to cause acute (immediate) health effects. Examples of acute health effects are nausea, lung irritation, skin rash, vomiting, dizziness, and even death.
Infrastructure	Disasters that destroy infrastructure may result in water contamination by sewage. Chloride ions, usually found in seawater or acid rain, increase the conductivity of water and accelerate corrosion. Chloride can penetrate and deteriorate concrete on bridge decking and parking garage structures, and damage reinforcing rods, compromising structural integrity. It damages vehicle parts such as brake linings, frames, bumpers, and other areas of body corrosion. It impacts railroad crossing warning equipment and power line utilities by conducting electrical current leaks across the insulator that may lead to loss of current, shorting of transmission lines, and wooden pole fires.
Communications	Chloride ions from acid rain significantly aggravate the conditions for pitting corrosion of most metals by enhancing the formation and growth of the pits through a process which weakens them over time.

North Slave Exposure/History

The responsibility for ensuring safe drinking water is vested with the Government of the NWT, which has passed specific public health legislation designed to ensure the safety of drinking water supplies. The Department of Health is the regulator and is responsible for enforcing the *Public Health Act*, *Water Supply System Regulations*, and *General Sanitation Regulations* as well as ensuring the *Guidelines for Canadian Drinking Water Quality* are met.

Community governments have the authority and responsibility to provide safe potable water to their residents. In communities where the community government is the owner and operator of the water treatment facilities, the community government is responsible for the treatment and safety of the water supply in those operations. Responsibilities include treatment of water to meet the Guidelines for Canadian Drinking Water Quality, the submitting of water samples to a laboratory for bacteriological and chemical analysis, and maintaining records of raw water quality, finished water quality and the amounts of chemicals used in treatment. A new water treatment plant in Yellowknife is necessary to meet national standards for drinking water adopted by the territorial government in 2009.

When	Where	Impact
2007	Wekweètì	Boil water advisory due to broken chlorine pump.
May 2009	Most of the NWT communities	Oil sands development in the Wood Buffalo Region threatens the water supply to most of the NWT 33 cities, towns and hamlets which are located on water directly downstream from the oil sands. The main area of concern is that contaminants may be getting into the water system which would directly affect the drinking water of virtually all residents of the NWT.

Community	Public Water Source	Water treatment system classification
Behchokǫ̀ (Edzo)	West Channel	Class II
Behchokǫ̀ (Rae)	Marian Lake	Class II
Dettah	see Yellowknife	N/A
Gamètì	Rae Lake	Small System
Łutselk'e	Great Slave Lake	Small System
Wekweètì	Snare Lake	Small System
Whatì	Ground Water	Class I
Yellowknife	Yellowknife River	Class I

Community Meeting Feedback

This hazard was not mentioned as a concern at the North Slave meeting.

2.3.2 Earth Movement – Other

Figure 16: Sink Hole at Giant Mine Site near Yellowknife – July 2011. (Source: CBC News North video)

Definition	Class
Movement of the ground causing wide spread damage not involving permafrost degradation or earthquake	Natural Hazard

NWT greatest impacts to date

- Fatalities 1
- Property damage $1,000,000
- Infrastructure

Climate Change

Projected to increase both frequency and consequence

Mitigation Strategies	
	✓ Develop and enforce building standards. ✓ Develop/distribute and facilitate public awareness programs. ✓ Ensure that emergency plans are in place. ✓ Ensure "safe areas" are available and known to community members.

Vulnerability	Description
People	Injuries or even death could occur from riverbank collapse or sinkholes.
Infrastructure	Damage to buildings, roads and other infrastructure has and is being caused by these earth movements including erosion, riverbank collapse and sinkholes. Also increase in maintenance costs associated with landslides and avalanches, even where no infrastructure damage occurs.
Communications	Interruption can occur if earth move impact communication towers.

North Slave Exposure/History

Across the NWT, people have experienced losses from various earth movement hazards. In Yellowknife a sinkhole which first appeared in May 2011 at the former Giant Mine, could result in water seeping into the site's underground arsenic chambers. It is located between Baker Creek and an open pit that is connected to the underground section of the mine. As well, the depression is close to four underground chambers in which thousands of tons of arsenic trioxide are stored.

Community Meeting Feedback

Erosion was mentioned as an issue in Dettah where there has been some subsistence near the beach and they have added rock as a barrier to prevent further incursion. Residents at several regional meetings spoke of sink holes and slumping as being issues which were affecting road infrastructure.

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2.3.3 Flood

Figure 17: Yellowknife aerial view. (Source: City of Yellowknife website)

Definition An overflow or surge of water which causes or threatens loss of life and property and environmental damage	**Class** Natural Hazard
NWT greatest impacts to date 1800 Evacuated Estimated Total Cost $3,500,000	
Climate Change Projected to increase both frequency and consequence	

Mitigation Strategies	✓ Outline a water management and community development policy. ✓ Develop and exercise plans/programs for: o watershed management; o river/lake/ocean modeling/prediction and monitoring; o erosion control; and o flood response. ✓ In the face of rapid snowmelt and intense rains in spring and summer, communities susceptible to flash flooding should review and improve their drainage facilities and protect vulnerable buildings and facilities.

Vulnerability	**Description**
People	Evacuation of communities due to flood events is common. Deaths and injury due to flooding can occur during heavy rainstorm events which can interfere with evacuation attempts. Deaths in the NWT due to flooding are rare.
Infrastructure	Personal property damage can be extensive. Contamination by floodwaters, structural damage, and mold can destroy buildings. Roads can be damaged or washed away. Damage to infrastructure can be extensive. Flooding can also negatively affect utilities and critical infrastructure. Utilities such as wastewater treatment, electricity and gas may be disrupted in the event of a flood. Emergency ground vehicles may be unable to respond if roads and bridges are flooded, washed out or covered by debris.
Communications	Communication towers can be damaged by flooding events.

North Slave Exposure/History

Within the North Slave region, the majority of streams flow southward, draining into Great Slave Lake. Great Slave Lake is the fifth largest lake in North America covering an area of 28,568 km^2. It is the deepest lake in North America, with an average depth of 73 m and a maximum depth of 614 m. Precipitation received in most of the North Slave region has relatively little impact on Great Slave Lake water levels. Flooding in the North Slave region is rare compared to the rest of the NWT.

Community Meeting Feedback

Residents confirmed that flooding was not a major issue in their communities although in Behchokǫ̀, there is a need, with a culvert and pump, to remove water from the school property annually.

2.3.4 Ice Hazard

Figure 18: Mackenzie River Breakup near Tulita (Source: GNWT, MACA)

Definition	**Class**
Formations or movements of ice which cause loss of life, property and/or environmental damage	Natural Hazard

NWT greatest impacts to date

- Property Damage

Climate Change
Projected to decline

Mitigation Strategies	
	✓ Develop and enforce building standards for ice accumulations. ✓ Develop/distribute and facilitate public awareness programs. ✓ Confirm that ice storm emergency plans in place. ✓ Ensure "safe areas" are available and known to community members.

Vulnerability	**Description**
People	Injury and loss of life can occur when boats or ships are damaged or sunk by ice (see Transportation Hazards).
Infrastructure	Ice shoves can damage buildings that are near to a body of water (see Industrial Hazards).
Communications	None

North Slave Exposure/History

Research did not reveal any exposure or history of this hazard in the North Slave. Please review the 2014 NWT HIRA for further information.

Community Meeting Feedback

This hazard was not mentioned as a concern at the North Slave meeting.

2.3.5 Food and Agricultural Emergency

Figure 19: Bison (Source: GNWT, Parks)

Definition	Class
Any emergency which affects food security, food quality or food safety for many people	Natural Hazard

NWT greatest impacts to date

- Food recall

Climate Change

Projected to increase both frequency and consequence

Mitigation Strategies	
	✓ Ensure disease and recall monitoring plans are in place between all levels of government and private sector. ✓ Ensure public awareness information and programs are available from the Federal Government and industry associations. ✓ Ensure that response plans include containment and quarantine procedures.

Vulnerability	Description
People	Humans are reliant on a well regulated safe supply of food and agricultural processes. Any emergency caused by a failure of this system can impact on the immediate and long term health of anyone affected.
Infrastructure	N/A
Communications	N/A

North Slave Exposure/History

When	Where	Impact
Feb 12, 2012	All Co-op grocery stores in the NWT	A brand of frozen hamburgers manufactured in Ontario was recalled as it may have been contaminated with E. coli. Consumption of food which contains this strain of virus can cause life-threatening illness.

Community Meeting Feedback

Very little was discussed at many of the meetings regarding agriculture as there is very little agriculture industry within the NWT.

2.3.6 War/ International Incident

Figure 20: Joint Task Force North Headquarters Yellowknife. (Source: Wikipedia)

Definition	**Class**
An action or clash that results in a wider dispute between two or more nation-states.	Human-induced Hazard

NWT greatest impacts to date
N/A

Climate Change
Projected to increase in frequency

Mitigation Strategies	✓ Ensure notification and information/communication protocols are in place with Federal Government Departments. ✓ Ensure appropriate emergency plans are in place based on the perceived or real risk of war and potential casualty threats.

Vulnerability	**Description**
People	The main effects of war on people are poverty due to destruction of properties and business, death and property destruction. War can also cause a dramatic impact on civilian health, because of the weapons which may be highly radioactive.
Infrastructure	The most commonly held thoughts on war's effect on infrastructure is the destruction of roadways, railways and bridges to hamper an enemy's ability to move freely and accumulate forces at a given point. In recent wars there have been specific examples of water and power plants being targeted in order to dramatically impact the ability of a populace to survive in a given area.
Communications	Communication facilities are likely the first to be targeted in any war or act of war or terrorism. Without communications authorities will be unable to respond to threats coherently and the loss of information can lead to a general state of panic amongst a population.

North Slave Exposure/History

Research did not reveal any exposure or history of this hazard in the North Slave. Please review the 2014 NWT HIRA for further information.

Community Meeting Feedback

While there was no specific mention of this issue at the meetings, there was some discussion centering on the activities of the Canadian Military in the North. Most of this discussion revolved around the impact any exercises in the area may have on local wildlife and resources. There was specific mention of an incident near Yellowknife when a Canadian Forces helicopter knocked out power to Yellowknife after striking a power line. However, there was no discussion regarding issues such as Canadian sovereignty in the north.

2.3.7 Earth Movement - Earthquake/ Tsunami

Figure 21: Rock avalanche triggered by October 5, 1985 Nahanni earthquake (Source: Geoscience Canada, 2009/R Horner)

Definition	**Class**
A slip along a fault in the earth causing the ground to shake and/or the large wave caused by it	Natural Hazard

NWT greatest impacts to date
Minor Property damage 1985

Climate Change
Could increase impact

Mitigation Strategies	✓ Develop or adopt and enforce building standards for earthquakes. ✓ Develop/distribute and facilitate public awareness programs for what to do in the case of an earthquake or tsunami. ✓ Ensure that emergency plans are in place. ✓ Develop tsunami inundation mapping and hazard zones for at risk communities. ✓ Plan and communicate "safe areas" for community members to go to in the event of an earthquake or tsunami.

Vulnerability	**Description**
People	Some injury and possible death may occur due to landslide or structural collapse caused by a major earthquake in the western part of the territory.
Infrastructure	Structural damage to buildings and infrastructure could be caused by a major earthquake in the western part of the territory.
Communications	Communications could be disrupted by a major earthquake.

North Slave Exposure/History

Research did not reveal any exposure or history of this hazard in the North Slave. Please review the 2014 NWT HIRA for further information.

Community Meeting Feedback

This hazard was not mentioned as a concern at the North Slave meeting.

2.3.8 Falling Debris

Figure 22: First piece of debris found from the crashed Cosmos-954 Soviet satellite (Source: Wikipedia)

Definition	**Class**
Any object (such as a satellite) which survives its passage through the Earth's atmosphere and impacts Earth	Natural Hazard

NWT greatest impacts to date
Environmental

Climate Change
N/A

Mitigation Strategies	✓ Have monitoring and notification protocols in place with appropriate agencies (i.e. CSA, NASA, NAV CANADA). ✓ Ensure emergency plans are in place for potential risks associated with falling debris.

Vulnerability	**Description**
People	Any object falling to earth from space will be of concern in terms of public safety and there will always be a worry of people being injured or killed by falling debris. Given the low population of the NWT and rare occurrence of these events there is a low likelihood of this happening.
Infrastructure	Damage to buildings, roads and other infrastructure would be a concern in the event of falling debris.
Communications	An object which falls from space may impact a communications satellite or microwave tower which could directly impact communications in a region.

North Slave Exposure/History

When	**Where**	**Impact**
January 24, 1978	Near Great Slave Lake	A soviet satellite, Cosmos 954, crashed to earth scattering radioactive waste across 124,000 square kilometers of the NWT, Alberta and Saskatchewan. The clean-up operation continued into October 1978.

Community Meeting Feedback

This hazard was not mentioned as a concern at the North Slave meeting.

3 Existing Response Capabilities

This section provides a summary of the North Slave Region's response capabilities that were considered when assessing the regions overall risk to the hazards discussed in Section 2.

3.1 Emergency Response and Preparedness Organizations

Under overall management of the MACA Regional Superintendent, the GNWT is responsible for assisting Local Authorities within the North Slave Region when requested, or assuming operational control when the Local Authority's capacity or jurisdiction is exceeded. In fulfilling these regional responsibilities the GNWT shall:

- Establish a committee to plan for and respond to emergencies;
- Develop and maintain the North Slave Regional Emergency Response Plan;
- Implement plans and procedures for an integrated response to emergencies within the Region affected;
- Provide prompt and coordinated response to specific requests for assistance from the Local Authority and/or when the capacity of the Local Authority is exceeded;

The response to most emergencies is managed by the Local Authority, as the community government of the affected community. The Regional Emergency Response Committee is established as the body responsible for the planning and coordination of the area response to emergencies within each region. The Regional Emergency Response Committee provides support and assistance in specific areas as requested by the Local Authority. Should the emergency exceed the capabilities of the Local Authority to respond, or should its jurisdiction be surpassed, the GNWT may assume control of emergency operations in an effort to return conditions to normal under the authority of the Emergency Measures Officer, as the senior territorial emergency official appointed by the Minister Responsible for Civil Emergency Measures.

The GNWT, through the Emergency Measures Organization, is responsible for providing assistance to support regional emergency operations, or assuming operational control when the incident is a matter of GNWT jurisdiction. In fulfilling its headquarters responsibilities the GNWT shall:

- Establish committees, comprised of various designated emergency agencies, to plan for and respond to emergencies;
- Develop and maintain the NWT Emergency Plan;
- Implement procedures for an integrated response to emergencies within any part of the NWT;
- Provide prompt and coordinated response to emergencies to assist regional emergency operations;
- Coordinate the provision of specialized assistance of agencies from the Federal Government and other provinces and territories not provided for in the Plan, and
- Assume direction and control of GNWT emergency operations when the emergency is a matter of Territorial Government jurisdiction.

In accordance with established Government of Canada emergency arrangements, Public Safety Canada (PSC) will assist the GNWT in responding to emergencies in the Northwest Territories. To fulfill its emergency responsibilities PSC has agreed to:

- Appoint a senior representative to TERC; and
- Coordinate the required assistance of federal departments and agencies not resident in the NWT during any GNWT response to emergencies.

Joint Task Force North (JTFN) - in accordance with Canadian Forces (CF) Directive "Provision of Essential Services to Civilian Authorities", JTNF may assist the GNWT in:

- Search and rescue;
- Communications;
- Emergency transportation;
- Provision of manpower and other resources;
- Disposal of hazardous materials; and
- Specialized training within the CF area of expertise.

3.2 Fire

The Fire Chief/Local Assistant is responsible for directing the activities of the Fire Department to ensure that loss of life, property or injury as a result of fire is prevented and/or minimized within each community. The Fire Chief/Local Assistant is the sole authority and command at the scene of a fire.

MACA delivers training to community government fire departments through its School of Community Government.

The Office of the Fire Marshal (OFM) protects the public from loss of life and property as a result of fire. The OFM has direct contact with fire departments and the public across the NWT. The OFM plays a regulatory role by enforcing the *Fire Prevention Act* and its associated regulations, namely the *Fire Prevention Regulations*, *Fireworks Regulations*, and *Propane Cylinder Storage Regulations*. The NWT has adopted Firesmart principles to identify, mitigate and document hazards.

Fire departments in the North Slave are largely composed of volunteers, with only Yellowknife employing full-time fire fighters and a full-time fire chief.

Many communities in the NWT experience difficulty in the recruitment of volunteers. Although reasons vary, a significant factor is the training which requires individuals to take time away from home and work for even the basic level.

Wildfire

The Department of Environment and Natural Resources directs the GNWT Forest Fire protection and suppression initiatives to provide:

- Assistance in the provision of and support to mobile/portable radio systems;
- Assistance in the procurement of radio communications equipment;

- Monitoring of weather, forest and fire conditions, forecasting fire behaviour and conditions to guide preparedness arrangements, and managing NWT forest fire suppression operations;
- Advice to the Emergency Management Office and communities on forest fire conditions and behaviour, and recommending appropriate courses of action (seasonal); and
- The requisition of special firefighting and safety equipment, and other specialized materials and supplies which are available (seasonal).

The Department of Environment and Natural Resources is working with communities in the NWT to develop and implement Community Wildfire Protection Plans (CWPP). These plans are designed to identify and reduce wildland fire risk in communities. CWPP's are becoming a national standard for agencies and communities responsible for wildland fire management. The process is recognized as a crucial first step in better preparing homeowners and communities to reduce the risk of loss.

Community Wildfire Protection Plans (CWPP) North Slave

Behchokǫ̀ CWPP 2012
Dettah CWPP 2012
Gamètì CWPP 2012
Łutselk'e CWPP 2012
Wekweètì CWPP 2012
Whatì CWPP 2012
Yellowknife CWPP 2012

3.3 Police

Police servicing in the NWT is designated as G Division and is split into a North and South District. The capital city of Yellowknife is its own entity and does not fall under either district command. There are currently 4 RCMP Detachments in the North Slave Region:

- Behchokǫ̀ Detachment;
- Gamètì Detachment - does not have existing infrastructure in place to allow for RCMP members to reside and work in that community full-time. RCMP members are designated as part of this detachment and travel into it on a regular basis;
- Whatì Detachment; and
- Yellowknife Detachment – also services the communities of N'dilo and Dettah.

3.4 Medical and Health Authorities

The North Slave Region spans three Health and Social Services Authorities.

Tłı̨chǫ Community Services Agency

Community	Health Care	Health Resources
Behchokǫ̀	Jimmy Erasmus Seniors Home	
	Health Centre	7 Nurses, 2 Social Workers, Addiction Counselor
Gamètì	Health Centre	1 Nurse
Wekweètì	Health Station	Nurse
Whatì	Health Centre	2 Nurses

Stanton Territorial Health Authority

Yellowknife - Stanton Territorial Hospital, with 80 beds available for inpatient care and 30 beds dedicated to ambulatory care (i.e. Medical Day Care Unit, Surgical Day Care Unit), Stanton Medical Clinic, Stanton Medical Centre, and Stanton Ophthalmology Clinic.

Yellowknife Health and Social Services Authority

Yellowknife Health and Social Services Authority (YHSSA) provides community-based health and social services programs to 20,000+ residents of Dettah, Fort Resolution, Łutselk'e, N'Dilo and Yellowknife.

Community	Health Care	Health Resources
Łutselk'e	Łutselk'e Health Centre	2 community health nurses, a community health representative, Physician visits
Yellowknife	Home and Community Care (1st floor, Jan Stirling Building)	
	Public Health (1st floor, Jan Stirling Building)	
	Healthy Family Program Centre (47th Street)	
	Integrated Services	
	Centre for Northern Families	Walk-in clinic, A nurse practitioner and a doctor
	Frame Lake Community Health Clinic	11 Physicians, 2 Nurse Practitioners,
	Yellowknife Primary Care Centre	15 Physicians, 4 Nurse Practitioners,

Ground Ambulance and Highway Rescue Services

The communities of Yellowknife and Behchokǫ̀ (Tłı̨chǫ Community Services Agency) operate a community-based ground ambulance service which is operated by full-time staff. In light of the necessary resources, capacity, equipment and training, Health and Social Services Authorities generally do not provide support for ground ambulance services within communities or on NWT highways. Yellowknife also provides both highway ambulance and rescue services within a prescribed distance of their municipal boundaries. Behchokǫ̀ ground ambulance service providers may support highway incidents when medical assistance is necessary, and if the event is within reasonable proximity to the community.

The GNWT utilizes a Highway Emergency Alerting Protocol (HEAP) to assist the RCMP and community Fire Departments in responding to vehicular accidents on territorial highways and winter roads. The Protocol describes a uniform plan for emergency response to highway accidents in various zones designated across the NWT. It guides the following activity:

- Establishing command authority;

- Dispatching resources;
- Accident reporting;
- Emergency landing procedures; and
- Clarifying medevac coverage areas.

The Stanton Territory Health Authority coordinates inter-facility and medevac services for the territory, including the North Slave region.

3.5 Search and Rescue

SAR response to	Primary	Secondary
Aircraft incidents	Canadian Forces	RCMP Civil Air Search and Rescue Association (CASARA) Search and Rescue Volunteer Association of Canada (SARVAC) Any multi-tasked Federal aircraft or vessel
Marine incidents in tidal and international waters	Canadian Coast Guard	Canadian Forces Canadian Coast Guard Auxiliary (CCGA) Search and Rescue Volunteer Association of Canada (SARVAC) Any multi-tasked Federal aircraft or vessel Police force of jurisdiction Vessel of opportunity
Ground and inland water incidents	Parks Canada within National Parks, Crown owned land – military bases and training areas Territorial responsibility delegated to RCMP	Canadian Forces Canadian Coast Guard Any multi-tasked Federal aircraft or vessel Civil Air Search and Rescue Association (CASARA) Canadian Coast Guard Auxiliary (CCGA) Yellowknife Search and Rescue Association Search and Rescue Volunteer Association of Canada (SARVAC)

Organization	SAR Responsibility
Royal Canadian Mounted Police	Coordination of public ground search and rescue (including inland waters).
Canadian Forces	Humanitarian assistance including air and marine search and rescue.
Fisheries and Oceans (Coast Guard)	Marine emergency alerting including ship spills and marine search and rescue under coordination of the National Search and Rescue Program and support of marine search and rescue volunteer training under the coordination of the National Search and Rescue Program.
Transportation Canada	Air search and rescue alerting and support of air search and rescue volunteer training under the coordination of the National Search and Rescue Program.
Park Canada Agency	Available to provide professional advice and support on search and rescue.
Yellowknife Search and Rescue Association	Aid in the implementation of an integrated emergency response, rescue and recovery system by providing trained volunteers to aid in the search and rescue of people in distress.

3.6 Canadian Forces

Headquartered in Yellowknife, NWT, JTFN is responsible for Canadian Joint Operations Command's single largest region by far. In fact, Joint Task Force (North)'s area of responsibility encompasses approximately four million square kilometres, or 40 per cent of Canada's land mass, and 75 per cent of its coastal regions.

Created as part of a broader transformation of the Canadian Forces in 2006, JTFN is one of 6 regional Joint Task Forces across Canada, and reports directly to Canadian Joint Operations Command, located in Ottawa, Ontario.

In addition to its headquarters located in Yellowknife, NWT, JTFN maintains detachments in Whitehorse, Yukon, and Iqaluit, Nunavut.

Figure 23: 1st Canadian Ranger Patrol Group in NWT (Source: Government of Canada, Canadian Army website)

North Slave Region Communities with a Ranger Patrol

Behchokǫ̀
Gamètì
Łutselk'e
Wekweètì
Whatì
Yellowknife

JTFN is responsible for the command of the Canadian Rangers in the North through the 1st Canadian Ranger Patrol Group and support the Cadet Program and the Junior Canadian Rangers Program in the three territories.

In total, there are approximately 250 Regular Force, Reserve Force and civilian personnel who are working north of the 60th parallel within one of the following units:

- JTFN Headquarters and its two detachments in Iqaluit and Whitehorse;
- Area Support Unit (North);
- 1st Canadian Ranger Patrol Group;
- 440 (Transport) Squadron;
- 1 Field Ambulance Detachment; and
- C Company of the Loyal Edmonton Regiment.

4 HIRA Conclusions

This type of assessment is a critical part of any emergency management program. Identified hazards can be used in preparedness programs, emergency response plan exercises, and training and awareness programs.

Qualitative data, definitions and more extensive analysis of each hazard is provided in 2014 Northwest Territories (NWT) Hazard Identification Risk Assessment (HIRA) Section 5 Hazard Narratives. Other regional summaries are contained in Appendix 8.7 which provides communities with a more locally focused risk assessment.

Hazards are interconnected, fluid, not subject to regional and territorial boundaries and may have unique outcomes. The North Slave HIRA should be updated routinely when new information about hazards that could impact the North Slave becomes available.