Hazard Identification & Risk Assessment (HIRA)

Municipality of	**FORT FRANCES**
Designation	**TOWN**
Region/District	**RAINY RIVER DISTRICT**
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Introduction

Why Should I Have a HIRA?

One of the core challenges faced by emergency managers is how to prevent, mitigate, prepare, respond, and recover from different types of hazards.

Several questions must be asked when faced with this challenge:

- What hazards exist in or near my community?
- How frequently do these hazards occur?
- How much damage can they cause?
- Which hazards pose the greatest threat?

This Hazard Identification and Risk Assessment (HIRA) workbook can help guide you in answering these questions.

A HIRA can:

- Help you to prepare for the worst and/or most likely hazards.
- Save time by isolating any hazards which can not affect your community.
- Allows for the creation of emergency plans, exercises and training based on the most likely and/or highest risk scenarios.
- Helps your program to become proactive rather than just reactive.

What is a HIRA?

A HIRA is a risk assessment tool that can be used to assess which hazards pose the greatest risk in terms of how likely they are to occur and how great their potential impact may be. It is not intended to be used as a prediction tool to determine which hazard will cause the next emergency.

The HIRA Process

There are four steps to create and maintain a HIRA:

1) **Hazard Identification** - In this step the hazards that could impact your community are separated from those that cannot. This requires a review of all hazards and their causes to determine whether they may be a threat to your community. This may require the consultation of the scientific community, historical records and government agencies.

2) **Risk Assessment** - In this step the level of risk for each hazard is examined. This may involve speaking with hazard experts, researching past occurrences and possible scenarios. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance and critical infrastructure should be examined.

3) **Risk Analysis** - The information collected in the risk assessment step will be analyzed in this step. The desired outcome of the risk analysis is the ranking of the hazards. This highlights the hazards that should be considered a current priority for your emergency management program.

4) **Monitor and Review** - It is important to remember that a HIRA is an ongoing process and hazards and their associated risks must be monitored and reviewed.

Step One: Hazard Identification Worksheet

The list below is a starting point in identifying hazards. Check all that apply.

	Natural Hazards		Technological Hazards
X	Agricultural and Food Emergency	X	Building/Structural Collapse
X	- Farm Animal Disease	X	Critical Infrastructure Failure
X	- Food Emergency	X	Dam Failure
X	- Plant Disease and Pest Infestation	X	Energy Emergency (Supply)
X	Drinking Water Emergency	X	Explosion/Fire
X	Drought/Low Water	X	Hazardous Materials Incident/Spills
X	Earthquake	X	- Fixed Site Incident
X	Erosion	X	- Transportation Incident
X	Extreme Temperatures	X	Human-Made Space Object Crash
X	- Heat Wave	X	Mine Emergency
X	- Cold Wave		Nuclear Facility Emergency
X	Flood	X	Oil/Natural Gas Emergency
X	- Riverine Flood	X	Radiological Emergency
X	- Seiche	X	Transportation Emergency
X	- Storm Surge	X	- Air Emergency
X	- Urban Flood	X	- Marine Emergency
X	Fog	X	- Rail Emergency
X	Forest/Wildland Fire	X	- Road Emergency
X	Freezing Rain		**Human-Caused Hazards**
	Geomagnetic Storm	X	Civil Disorder
X	Hail	X	Cyber Attack
X	Human Health Emergency	X	Sabotage
X	- Epidemic	X	Special Event
X	- Pandemic	X	Terrorism/CBRNE
	Hurricane	x	War and International Emergency
X	Land Subsidence	Other:	
X	Landslide	Other:	
X	Lightning	Other:	
X	Natural Space Object Crash	Other:	
X	Snowstorm/Blizzard	Other:	
X	Tornado	Other:	
X	Windstorm	Other:	

Step Two: Risk Assessment

Risk Assessment - Frequency

How likely is it that your community could be impacted by the hazards you identified in the previous step?

The sources used for your hazard identification can also be used for assessing the frequency and magnitude. Once you have collected information on the frequency of each of the hazards, they can be grouped into the categories below:

Frequency	Category	Percent Chance	Description
1	Rare	Less than a 1% chance of occurrence in any year.	Hazards with return periods >100 years.
2	Very Unlikely	Between a 1- 2% chance of occurrence in any year.	Occurs every 50 – 100 years and includes hazards that have not occurred but are reported to be more likely to occur in the near future.
3	Unlikely	Between a 2 – 10% chance of occurrence in any year.	Occurs every 20 – 50 years
4	Probable	Between a 10 – 50% chance of occurrence in any year.	Occurs every 5 – 20 years
5	Likely	Between a 50 – 100% chance of occurrence in any year.	Occurs >5 years.
6	Almost Certain	100% chance of occurrence in any year.	The hazard occurs annually.

Example: The hazards for the imaginary community of Trillium were identified as being floods, explosions and earthquakes. The Trillium historical record shows that there have been floods every year. The Fire Chief said that explosions happen every five years or so. A local professor said that there has not been a strong earthquake in the history of the area, but one may be possible. The frequency table for Trillium would look like:

Hazard	Category	Frequency	Notes
Flood	Almost Certain	6	Flooding from ice break-up in the spring occurs annually. Urban flooding during heavy rain also occurs in some areas during the summer.
Explosion	Likely	5	Explosions occur within the community at least once every five years.
Earthquake	Rare	1	Trillium is in a stable geologic area and has not experienced an earthquake in >100 years.

Table 3. Frequency Worksheet

Use the work sheet below to record the frequency of the hazards that could affect your community. Print additional sheets if needed.

Hazard	Category	Frequency	Notes
Agricultural & Food Emergency Farm Animal Disease	3	Unlikely	Rainy River District has the majority of farms and not a main source for food supply.
Agricultural & Food Emergency Food Emergency	4	Probable	Being isolated has effects on shipping supply of food to District.
Agricultural & Food Emergency Plant Disease & Pest Infestation	1	Rare	
Drinking Water Emergency	1	Rare	
Drought/Low Water	1	Rare	Rainy Lake is the water basin for watershed and is controlled by IJC, MNRF, H2O Power and monitored on a 24/7 basis.
Erosion	3	Unlikely	2002, 2014 high waters (Floods) have had an impact on erosion to lands surrounding communities. Rock work completed in 2014 has secured a large area of land, but there remain some vulnerable areas.
Extreme Temperatures Heat Wave	4	Probable	
Extreme temperatures Cold Wave	4	Probable	
Flood	4	Probable	
Fog	3	Unlikely	
Forest/Wildland Fire	5	Likely	
Freezing Rain	5	Likely	
Hail	5	Likely	
Human Health Emergency Epidemic	4	Probable	
Human Health Emergency Pandemic	4	Probable	Influenza & COVID-19 Pandemics were the most recent incidents that affected our community
Land Subsidence	3	Unlikely	
Lightening	5	Likely	

Snowstorm/Blizzard	5	Likely	
Tornado	4	Probable	
Windstorm	4	Likely	
Building/Structural Collapse	3	Unlikely	
Critical Infrastructure Failure	1	Rare	
Dam Failure	1	Rare	
Energy Emergency (Supply)	4	Probable	
Explosion/Fire	4	Probable	
Hazardous Materials Incidents/Spills Fixed Site Incident	4	Probable	
Hazardous Materials Incidents/Spills Transportation Emergency	4	Probable	
Oil/Gas Emergency	4	Probable	
Transportation Emergency Air Emergency	2	Very Unlikely	
Transportation Emergency Marine Emergency	4	Probable	
Transportation Emergency Rail Emergency	5	Likely	
Transportation Emergency Road Emergency	5	Likely	
Civil Disorder	3	Unlikely	
Cyber Attack	4	Probable	
Sabotage	1	Rare	
Terrorism/CBRNE	1	Rare	
War & International Emergency	1	Rare	
Mine Emergency	3	Unlikely	Mines are located throughout District. No direct effects to Fort Frances, but we would act as a resource/support to any incident as the main Community Hub in the District.

Risk Assessment – Consequence

Consequence is divided into six categories based on recommended practices:

Social Impacts - The direct negative consequences of a hazard on the physical health of people.

Property Damage - The direct negative consequences of a hazard on buildings, structures and other forms of property, such as crops.

Critical Infrastructure Service Disruptions/Impact - The negative consequences of a hazard on the interdependent, interactive, interconnected networks of institutions, services, systems and processes that meet vital human needs, sustain the economy, protect public safety and security, and maintain continuity of and confidence in government.

Environmental Damage - The negative consequences of a hazard on the environment, including the soil, water, air and/or plants and animals.

Business/Financial Impact - The negative economic consequences of a hazard.

Psychosocial Impacts - The negative response of community or a subset of the community to a hazard caused by their perception of risk. This includes human responses such as self-evacuation, mass panic and other potential undesirable responses.

The total consequence value can be obtained by adding the values obtained from each of the sub variables. Note: The social impacts sub variable is further divided into the fatality rate, injury rate and evacuation rate. Since human impacts are often the most 'jarring' result of an emergency and have an unquantifiable impact on the community, social impact was intentionally weighted higher than the other sub variables.

The magnitude categories in this HIRA methodology are a scale of impact, rather than a prioritization. **The same value in two categories does not mean that the consequences of the two are equal and interchangeable.**

Consequence Variables

Fatalities		
Consequence	Category	Description
0	None	Not likely to result in fatalities within the community.
1	Minor	Could result in fewer than five fatalities within the community.
2	Moderate	Could result in 5 – 10 fatalities within the community.
3	Severe	Could result in 10 – 50 fatalities within the community.
4	Catastrophic	Could result in +50 fatalities within the community.

Injuries		
Consequence	Category	Description
0	None	Not likely to result in injuries within the community.
1	Minor	Could injure fewer than 25 people within community.
2	Moderate	Could injure 25 – 100 people within the community.
3	Severe	Could injure +100 people within the community.

Evacuation		
Consequence	Category	Description
0	None	Not likely to result in an evacuation shelter-in-place orders, or people stranded.
1	Minor	Could result in fewer than 100 people being evacuated, sheltered-in-place or stranded.
2	Moderate	Could result in 100 - 500 people being evacuated, sheltered-in-place or stranded.

3	Severe	Could result in more than 500 people being evacuated, sheltered-in-place or stranded.

Property Damage		
Consequence	Category	Description
0	None	Not likely to result in property damage within the community.
1	Minor	Could cause minor and mostly cosmetic damage.
2	Moderate	Localized severe damage (a few buildings destroyed).
3	Severe	Widespread severe damage (many buildings destroyed).

Critical Infrastructure Service Impact (CI)		
Consequence	Category	Description
0	None	Not likely to disrupt critical infrastructure services.
1	Minor	Could disrupt 1 critical infrastructure service.
2	Moderate	Could disrupt 2 – 3 critical infrastructure services.
3	Severe	Could disrupt more than 3 critical infrastructure services.

Environmental Damage		
Consequence	Category	Description
0	None	Not likely to result in environmental damage.
1	Minor	Could cause localized and reversible damage. Quick clean up possible.
2	Moderate	Could cause major but reversible damage. Full clean up difficult.
3	Severe	Could cause severe and irreversible environmental damage. Full clean up not possible.

Business/Financial Impact		
Consequence	Category	Description
0	None	Not likely to disrupt business/financial activities.
1	Moderate	Could result in losses for a few businesses.
2	Severe	Could result in losses for an industry.

Psychosocial Impact		
Consequence	Category	Description
0	None	Not likely to result in significant psychosocial impacts.
1	Moderate	Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.
2	Severe	Widespread psychosocial impacts, e.g. mass panic, widespread hoarding and self-evacuation and long-term psychological impacts.

Example: To calculate the consequence for floods in Trillium, the emergency manager used historic accounts, insurance reports and scientific information. This information showed that flooding in Trillium is likely to result in an evacuation of approximately 200 people and that severe property damage was to be expected. The emergency manager also found that during many past floods, roads were not accessible, several businesses had to be closed and there was isolated environmental damage due to erosion along the bank of the river.
Therefore, the magnitude worksheet section for floods would look like:

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/Financial Impact	Psycho-social Impact	Sub-variable Total
2	3	1	2	1	0	9

Table 10. Consequence Worksheet

Hazard	Fatalities	Injuries	Evacuation	Property Damage	CI Impact	Environmental Damage	Business/ Financial Impact	Psycho - social Impact	Total
Agricultural & Food Emergency Farm Animal Disease	0	0	0	0	0	1	2	0	3
Agricultural & Food Emergency Food Emergency	0	0	0	0	2	0	2	2	6
Agricultural & Food Emergency Plant Disease & Pest Infestation	0	0	1	1	1	1	1	1	6
Drinking Water Emergency	1	1	1	1	3	0	1	2	10
Drought/Low Water	0	0	0	1	1	1	1	1	5
Erosion	0	1	0	1	0	2	0	1	5
Extreme Temperatures Heat Wave	1	3	0	1	0	1	1	2	9
Extreme Temperatures Cold Wave	1	3	0	1	0	1	1	2	9
Flood	0	1	1	2	2	2	1	2	11
Fog	0	0	0	0	0	1	0	0	1
Forest/ Wildland Fires	0	1	3	2	1	2	1	2	12
Freezing Rain	0	1	0	2	1	1	1	2	8
Hail	0	1	0	2	1	1	1	1	7
Human Health Emergency Epidemic	1	2	1	0	1	0	2	2	9
Human Health Emergency Pandemic	1	2	1	0	1	0	2	2	9

Land Subsidence	0	1	1	2	1	2	1	2	10
Lightening	0	0	1	1	0	0	1	1	4
Snowstorm/ Blizzard	1	2	2	2	1	2	2	2	14
Tornado	1	2	2	2	2	2	2	2	15
Windstorm	0	1	0	1	1	1	1	1	6
Building/ Structural Collapse	1	1	1	2	0	1	0	0	6
Critical Infrastructure Failure	0	1	1	1	2	1	2	2	10
Dam Failure	0	1	1	2	1	2	1	2	10
Energy Emergency (Supply)	0	0	3	0	3	0	2	2	10
Explosion/ Fire	1	2	1	2	1	1	1	2	11
Hazardous Materials Incidents/ Spills Fixed Site Incident	1	2	2	1	1	2	1	2	12
Hazardous Materials Incidents/ Spills Transportation Emergency	1	1	2	1	1	2	1	2	11
Oil/Gas Emergency	0	1	3	1	1	0	2	2	10
Transportation Emergency Air Emergency	1	2	1	2	1	1	1	2	11
Transportation Emergency Marine Emergency	1	2	0	1	1	1	0	0	6
Transportation Emergency Road Emergency	1	2	0	1	1	1	1	1	8
Transportation Emergency Rail Emergency	1	2	2	1	1	2	2	2	13
Civil Disorder	1	2	1	3	2	2	2	2	15

Cyber Attack	0	0	0	1	3	0	2	2	8
Sabotage	1	2	0	1	1	0	1	1	7
Terrorism/ CBRNE	3	3	2	3	3	2	2	2	20
War & International Emergency	1	1	1	2	1	1	1	2	10
Mine Emergency	1	1	0	0	0	0	1	2	5

Total Consequence

Once the consequence values have been added up, they are put into groups as shown in the table below.

This gives equal weight to Consequence and Frequency.

Sub variable Total	Consequence	Description
1 - 4	1	Minor
5- 6	2	Slight
7- 8	3	Moderate
9 - 10	4	Severe
11 - 12	5	Very Severe
+13	6	Catastrophic

Example: The emergency manager of Trillium calculated a total of 9 for floods as shown on page 10. According to the table, this would mean that flood has a consequence of 4 which is described as 'severe'.

Table 12. Total Consequence Worksheet

Hazard	Sub Variable Total	Consequence Total	Description
Agricultural & Food Emergency Farm Animal Disease	3	1	
Agricultural & Food Emergency Food Emergency	6	2	
Agricultural & Food Emergency Plant Disease & Pest Infestation	6	2	
Drinking Water Emergency	10	4	
Drought/Low Water	5	2	
Erosion	5	2	
Extreme Temperatures Heat Wave	9	4	
Extreme Temperatures Cold Wave	9	4	
Flood	11	5	
Fog	1	1	
Forest/Wildland Fires	12	5	
Freezing Rain	8	3	
Hail	7	3	
Human Health Emergency Epidemic	9	4	
Human Health Emergency Pandemic	9	4	
Land Subsidence	10	4	
Lightening	4	1	
Snowstorm/Blizzard	14	6	
Tornado	15	6	
Windstorm	6	2	
Building/Structural Collapse	6	2	
Critical Infrastructure Failure	10	4	

Dam Failure	10	4	
Energy Emergency (Supply)	10	4	
Explosion/Fire	11	5	
Hazardous Materials Incident Fixed Site Incident	12	5	
Hazardous Materials Incident Transportation Emergency	11	5	
Oil & Gas Emergency	10	4	
Transportation Emergency Air Emergency	11	5	
Transportation Emergency Marine Emergency	6	2	
Transportation Emergency Road Emergency	8	3	
Transportation Emergency Rail Emergency	13	6	
Civil Disorder	15	6	
Cyber Attack	8	2	
Sabotage	7	3	
Terrorism/CBRNE	20	6	
War &International Emergency	10	4	
Mine Emergency	10	4	

Changing Risk

The frequency and consequence can be influenced by factors such as mitigation actions and climate change. Changing Risk helps to account for these changes.

Changing Risk = Change in Frequency + Change in Vulnerability

Changing Risk can be calculated by answering the questions below for each hazard:

Change in Frequency
1. Is the number of non-emergency occurrences of the hazard increasing?

2. Is human activity (e.g. population growth, change of drainage patterns) likely to lead to more interaction with the hazard or an increase in frequency?

3. Is there an environmental reason (e.g. climate change) why the frequency of this hazard may increase?

4. Are human factors such as business, financial, international practices more likely to increase the risk?

If the answer is 'yes' to two or more, then the change in frequency = 2
If the answer is 'yes' to one or fewer then the change in frequency = 1

Change in Vulnerability
1. Is a large number of the population vulnerable or is the number of people vulnerable to this hazard increasing?

2. Does critical infrastructure reliance or a 'just-on-time' delivery system (e.g. stores not keeping a supply of food and relying on frequent shipments) make the population more vulnerable?

3. Are response agencies not aware of, practiced and prepared to response to this hazard?

Are no prevention/mitigation measures currently in use for this hazard?

If the answer is 'yes' to two or more, then the change in vulnerability = 2
If the answer is 'yes' to one or fewer then the change in vulnerability = 1

Table 13. Changing Risk Worksheet

Hazard	Total Change in Frequency	Total Change in Vulnerability	Changing Risk Total
Agricultural & Food Emergency Farm Animal Disease	1	2	3
Agricultural & Food Emergency Food Emergency	2	2	4
Agricultural & Food Emergency Plant Disease & Pest Infestation	1	1	2
Drinking Water Emergency	2	2	4
Drought/Low Water	1	1	2
Erosion	1	2	3
Extreme Temperatures Heat Wave	2	2	4
Extreme Temperatures Cold Wave	2	2	4
Flood	2	1	3
Fog	1	1	2
Forest/Wildland Fire	2	2	4
Freezing Rain	2	1	3
Hail	2	1	3
Human Health Emergency Epidemic	2	2	4
Human Health Emergency Pandemic	2	2	4
Dam Failure	1	2	3

Land Subsidence	1	1	2
Lightening	1	1	2
Snowstorm/Blizzard	2	2	4
Tornado	2	2	4
Windstorm	2	1	3
Building/Structural Collapse	1	1	
Critical Infrastructure Failure	2	2	4
Energy Emergency (Supply)	2	2	4
Explosion/Fire	2	2	4
Hazardous Materials Incident Fixed Site Incident	2	2	4
Hazardous Materials Incident Transportation Emergency	2	2	4
Oil & Gas Emergency	2	2	4
Transportation Emergency Air Emergency	1	1	2
Transportation Emergency Marine Emergency	1	2	3
Transportation Emergency Road Emergency	1	2	3
Transportation Emergency Rail Emergency	2	2	4
Civil Disorder	1	2	3
Cyber Attack	2	2	4
Sabotage	1	1	2
Terrorism/CBRNE	2	2	4
War & International Emergency	1	2	3
Mine Emergency	1	2	3

Step Three: Risk Analysis

Once you have completed the Frequency, Magnitude and Changing Risk Work Sheets, you can now begin to prioritize your hazards by using the HIRA equation:

Risk = Frequency * Consequence * Changing Risk

Example: The Emergency Manager of Trillium found a frequency value of 6, a total consequence value of 4 and a changing risk value of 4 for floods. These numbers were entered into the equation and multiplied together. The result was:

Flood Risk = 6*4*4 = 96

Table 14. Risk Analysis Worksheet

Hazard	Frequency	Magnitude	Changing Risk	Risk Total
Agricultural & Food Emergency Farm Animal Disease	3	1	3	6
Agricultural & Food Emergency Food Emergency	4	2	4	12
Agricultural & Food Emergency Plant Disease & Pest Infestation	1	2	2	4
Drinking Water Emergency	1	4	4	8
Drought/Low Water	1	2	2	4
Erosion	3	2	3	9
Extreme Temperatures Heat Wave	4	4	4	20
Extreme Temperatures Cold Wave	4	4	4	20
Flood	4	5	3	23
Fog	3	1	2	5
Forest/Wildland Fires	5	5	4	29
Freezing Rain	5	3	3	18
Hail	5	3	3	18
Human Health Emergency Epidemic	4	4	4	20
Human Health Emergency Pandemic	4	4	4	20
Land Subsidence	3	4	2	14
Lightening	5	1	2	7
Snowstorm/Blizzard	5	6	4	34

Tornado	4	6	4	28
Windstorm	4	2	3	11
Building/Structural Collapse	3	2	1	7
Critical Infrastructure Failure	1	4	4	8
Dam Failure	1	4	3	7
Energy Emergency (Supply)	4	4	4	20
Explosion/Fire	4	5	4	24
Hazardous Materials Incident Fixed Site Incident	4	5	4	24
Hazardous Materials Incident Transportation Emergency	4	5	4	24
Oil & Gas Emergency	4	4	4	20
Transportation Emergency Air Emergency	2	5	2	12
Transportation Emergency Marine Emergency	4	2	3	11
Transportation Emergency Rail Emergency	5	3	4	19
Transportation Emergency Road Emergency	5	6	3	33
Civil Disorder	3	6	3	21
Cyber Attack	4	2	4	12
Sabotage	1	3	2	5
Terrorism/CBNRE	1	6	4	10
War &International Emergency	1	4	3	7
Mine Emergency	3	1	3	6

Table 15. Prioritization Worksheet

Once you have calculated the risk for the hazards, you may wish to group them based on their level of risk using the table below. This is particularly useful if you have several hazards with the same risk values.

Level of Risk	Description
< 10	Very Low
11 - 20	Low
21 - 30	Moderate
31 - 40	High
41 - 50	Very High
>50	Extreme

Enter your hazards into the work sheet below according to their risk which you calculated from the Risk Analysis Worksheet.

Level of Risk	Description	Hazards
>50	Extreme	
41 - 50	Very High	
31 - 40	High	Snowstorm/Blizzard
21 - 30	Moderate	Extreme Temperatures Heat Wave, Cold Wave Flood Forest/Wildland Fires Tornado Explosion/Fire Hazardous Materials Incident Fixed Site Incident, Transportation Emergency Transportation Emergency Road Emergency Civil Disorder

11 - 20	Low	Agricultural & Food Emergency Food Emergency Freezing Rain Hail Human Health Emergency Epidemic, Pandemic Land Subsidence Windstorm Energy Emergency (Supply) Oil & Gas Emergency Transportation Emergency Air Emergency, Marine Emergency, Rail Emergency Cyber Attack
<10	Very Low	Agricultural & Food Emergency Farm Animal Disease, Plant Disease & Pest Infestation Drinking Water Emergency Drought/Low Water Erosion Fog Lightening Building/Structural Collapse Critical Infrastructure Failure Dam Failure Sabotage Terrorism/CBNRE War &International Emergency Mine Emergency

Step Four: Monitor and Review

Hazards and risks may change over time, so it is important to review your HIRA annually.

Date of Current HIRA: May 2021

Date of Next Revision: May 2022

Signature:_____