



Office of the Auditor General of Ontario

Value-for-Money Audit:
Management
of Hazards and
Emergencies in the
Environment



November 2022

Management of Hazards and Emergencies in the Environment

1.0 Summary

As the impacts of climate change intensify and population density rises in Ontario, emergency management programs will only become more critical. Effective emergency management can save lives and protect property and the environment in the event of a natural hazard such as a forest fire or flood. The Province needs to be able to respond quickly and efficiently to emergencies while ensuring the continuity of government operations and critical assets.

Several provincial ministries are assigned responsibility for preparing for and responding to emergencies. Our audit looked at two of those ministries. The Ministry of Natural Resources and Forestry (Natural Resources Ministry) is responsible for seven types of emergencies—forest fires; floods; drought/low water; dam failure; incidents involving oil and gas wells; erosion; and soil and bedrock instability. The Ministry of Mines (Mines Ministry) has responsibility for abandoned mine hazards.

Emergency management programs themselves involve five components: prevention, mitigation, preparedness, response and recovery. We focused primarily on the mitigation and preparedness initiatives that exist for each hazard assigned to the Natural Resources Ministry and the Mines Ministry, and on the ministries' response to emergency events.

Overall, our audit found that although both ministries have measures in place to prepare for and manage

emergencies, there are weaknesses in the programs, making Ontario vulnerable in the event of a large-scale emergency situation. For example, the Province lacks some of the resources and tools needed to prepare for such an emergency, and some mitigation and preparedness activities are not being carried out effectively. More also needs to be done in terms of reviewing and updating hazard risk assessments; updating technical guides and bulletins; conducting practice tests of the emergency response plans; and conducting after-action reviews. Improvements to emergency management programs should be based on lessons learned from past events as well as practice tests.

Our significant audit findings include:

Floods

- **The current location of some First Nations communities exposes them to recurring floods and evacuations.** Kashechewan First Nation, a community of roughly 2,000 residents located on the northern shores of the Albany River near James Bay, experiences significant flooding almost on an annual basis—four times between 2017 and 2021. The Natural Resources Ministry assisted with evacuation efforts in three of those years in which an evacuation was needed. The cost of just the flights used for the evacuations totalled \$3.6 million. Other costs for related accommodations and other supports incurred by communities to host evacuees of the Kashechewan First Nation was unknown.

Emergency Management Ontario told us that prior to 2021 these costs were incurred by municipalities who requested reimbursement directly from the federal government. In 2019, Kashechewan reached an agreement with the federal and provincial governments to permanently relocate the community within eight to 10 years. We noted that other nearby First Nations communities experienced significant flooding in spring 2022, including the Fort Albany and Attawapiskat First Nations.

- **Ontario’s level of flood preparedness is lagging, in part because of gaps in flood maps.** A 2020 report by the Intact Centre on Climate Change Adaptation found that Ontario significantly lagged in its flood mapping initiatives, which identify at-risk areas. Being prepared is especially crucial because the frequency of flooding has increased. According to the Canadian Disaster Database, the average annual number of floods in Ontario has increased by 55% over the past 20 years.
- **After-action reports to assess how responses were conducted are not being completed, as required by the Ministry Emergency Response Plan.** The Ministry responded to seven of the 53 significant flood emergencies that occurred from 2017 to 2021, but prepared after-action reports for only three of those events. Based on our review of seven after-action reports completed covering three significant flood events, we noted that they were prepared in an inconsistent format, and were vague with general statements that did not fully explain the issues.
- **After-action reports cite the need for a clearer delineation of roles and responsibilities amongst parties responding to emergencies, more host communities and more community support services.** One recurring issue raised in the Ministry’s after-action reports was the need to better define roles and responsibilities of the Ministry, Emergency Management Ontario and local governments/communities in emergency flood response. The Ministry noted it tends to be

a “go to” ministry during emergencies, providing support outside of its mandate, training and experience. For example, it was noted that fire crews deployed to support flood response and working under municipal officials, were often asked to work in flood waters and build sandbag berms, areas where they did not have sufficient experience or training in. After-action reports prepared by Emergency Management Ontario in relation to evacuations noted issues with an insufficient number of host communities; a lack of mental health supports and other services; and social problems arising in host communities. First Nations confirmed some of the issues noted by EMO and emphasized the need for Indigenous-led host communities and Indigenous mental health providers.

- **The Ministry does not have standing contracts with air carriers to secure pricing for flights needed in emergency evacuations.** Most evacuations requiring Ministry support occur in Northern Ontario, especially at First Nations reserves located on or near floodplains or close to forests. We noted that the Ministry does not have standing agreements with air carriers to secure a fixed competitive price. Between 2017 and 2021, \$14.4 million was spent on charter flights for flood and fire evacuations in Northern Ontario. While carrier pricing depends on the type of aircraft operated, we noted instances of variability in the per-mile rate for the same aircraft across vendors, such as \$12.39 to \$39.53 per mile for Boeing 737-300.

Fires

- **Ministry response times to forest fires was often longer than four hours.** The Aviation, Forest Fire, and Emergency Services Branch employs an alert system for initial response to forest fires, with all fire crews required to dispatch within four hours of the reported time, regardless of alert level. The Ministry did not track the average time taken by districts to dispatch a crew to a fire or to extinguish a fire. Tracking of such information could help identify

performance issues and/or resource shortages. Based on our work, we noted that it took longer than four hours to dispatch fire crews to 15% of fires from 2017–2021. In addition, we found that in 2021, five of 25 districts took more than four hours on average to dispatch a fire crew to a forest fire that required a full response. Dryden and Cochrane took the longest time on average to dispatch a fire crew in 2021, at 13.6 hours and 11.0 hours, respectively. The Ministry does track the initial attack success rate, defined as the percent of times it contained a forest fire by noon the following day or put it out before it grew to more than four hectares. However, the Ministry did not attain its target rate of 96% in any of the last five years and has not evaluated the rationale for its shortcomings. The initial attack rate achieved in 2020/21, the last fiscal year for which we have information, was 90%.

- **Lessons learned from past responses to forest fire emergencies and practice exercises are not incorporated into the Ministry Emergency Response Plan.** According to the Plan, Ministry staff are to conduct an after-action review following significant incidents and all exercises to identify opportunities for improvement and corrective actions. For the 11 declared emergencies for forest fires from 2017–2021, we found the Ministry had completed after-action reviews for only two fires. The Ministry had also completed several after-action reviews for non-declared emergencies, however, they were often brief in nature with little detail as to what went well and what could be improved. Ministry staff told us that informal reviews are performed verbally by fire crews. Without an effective strategy of incorporating lessons learned from past events or practice tests into emergency plans, recurring issues could continue to arise during future emergencies, such as delays in dispatching a crew, and poor communication of expectations and priorities upon arrival to a fire.
- **A key fire prevention strategy has not been used to its full potential.** FireSmart, one of

the Ministry's key fire prevention strategies, is designed to reduce the likelihood of large uncontrollable wildfires near communities and infrastructure. We noted that over the last three fiscal years (2019/20–2021/22), the Ministry spent less than half of the \$1 million it budgeted for the FireSmart program. One component of the FireSmart strategy is to create Wildfire Protection Plans. These plans are intended to help communities assess their wildfire risk and make recommendations to lessen the threat and impact from forest fires. As of August 2022, only 15 out of 144 municipalities in Northern Ontario had a Wildfire Protection Plan in place. The Ministry did not know how many communities required a plan, but we noted 63% of districts with a rating of extreme or very high risk of fire had no communities with Wildfire Protection Plans. Funding was not targeted to those districts assessed as having an extreme or high risk of fire. In addition, no funding was allocated to unorganized communities (geographic areas without a local municipal organization), including those in high-risk districts.

Erosion

- **The Ministry has not taken steps to proactively reduce the risks to residents and properties located in areas susceptible to land erosion.** It has not identified land exposed to erosion risk, particularly around Lake Erie where there is significant coastal erosion and wave action. Shoreline protection structures have been erected in some areas, however this is largely a reactive measure that is not expected to address the problem in the long-term. We also noted that there are no provincial hazard maps for shoreline erosion. The Ministry told us it had no plans to provide education and awareness programs targeted at local residents, homeowners and real estate agents, or to undertake property buy-back programs for existing at-risk properties. According to the Ministry, conservation authorities may provide this service to speculative buyers

and real estate agents, and that homebuyers and agents should take reasonable steps to complete their own due diligence.

Soil and Bedrock Instability

- **The Ministry has no plans to address the increasing occurrence of sinkholes.** Sinkholes can happen when bedrock—the rocky material found under soil, sand and gravel—is unstable. Some sinkholes are the result of natural causes such as water erosion, while others are caused by human activities, such as broken water-mains, collapsing sewers, or abandoned mines. Sinkholes have been more common in Ontario in recent years, as demonstrated by recent incidents in such cities as Thunder Bay (2016), Ottawa (2019), Toronto (2021) and Timmins (2022). The Ministry does not consider “soil and bedrock instability” under Order in Council (1039/2022) to include sinkholes, and therefore regards them to be outside its scope of responsibility. Consequently, the Ministry has no plans to conduct land-subsidence and sinkhole risk assessments, or to identify mitigation measures.

Drought/Low Water

- **The Ministry has not updated the Ontario Low Water Response Strategy since 2010.** The strategy was created to support preparedness for droughts and low-water events, to provide strategies for managing water supply and demand, and to support local response efforts in the event of a drought/low-water situation. We found that some components of the Ontario Low Water Response Strategy are outdated or no longer relevant, which could potentially lead to confusion around roles and responsibilities for local authorities in the event of an emergency. At the time of our audit, the Ministry had no formal plans to review and update the Ontario Low Water Response strategy.

Mines

- **Little progress has been made on the rehabilitation of hazardous abandoned mines.** We found that only 111 of the 3,942

abandoned mine sites with hazards had been partially rehabilitated, while 2,335 sites had not been rehabilitated at all. The rehabilitation status of the remaining sites was marked “unknown” by the Mines Ministry.

- **The Mines Ministry does not have a public awareness program in place to educate Ontarians on the dangers of abandoned mines.** It has also not taken any steps to counter potentially dangerous information available online that promotes exploring abandoned mines in Ontario.

Oil and Gas Wells

- **Few oil and gas wells are being inspected annually.** The Ministry has not assessed the risk of all 27,000 oil and gas wells in the province, and is therefore unable to determine whether it is focusing its proactive inspection efforts on the highest risk wells. Furthermore, based on our analysis of inspection data in the Ministry’s database for oil and gas wells, we found that only 19% of oil and gas wells in the province have been inspected since 2005. Of those, 38% of inspections occurred more than a decade ago. The low rate of inspections could lead to a risk of complacency by well operators.
- **Unreliable information on how many high-risk wells have been plugged.** Wells that are poorly maintained and improperly plugged can lead to contaminants getting into the province’s groundwater or rising to the land surface around the well. Based on our own analysis, we noted that 6% or 1,625 wells are not in use and have not been plugged. A further 30% or 8,011 were plugged prior to 1970 when materials used to plug them included logs, gravel and lead which can lose their integrity over time. As a result, at least 36% of wells could pose a danger. Further, we found that three high-risk wells have been leaking since at least 2018, but only one is scheduled to be plugged during 2022/23. We were told that the gas explosion that took place in Wheatley, Ontario in August 2021, was in part due to a well that had been plugged in the

1960s, where the materials used to plug the well had deteriorated over time.

Dams

- **An assessment of the replacement value for dams owned by the Ministry is incomplete.** Only 31% of 316 Ministry-owned dams that will reach the end of their serviceable life within 20 years have been assessed and their cost of replacement is estimated at \$321 million. We reviewed information contained in the Ministry's IT system used to prioritize rehabilitation, reconstruction and/or other capital projects for the 316 dams it owns, and noted that important information needed to prioritize dams for maintenance and construction was missing, such as the age and condition of the dam, the likelihood of the dam failing, and the impact of a dam failure.
- **Privately owned dams are not inspected by the Ministry.** Although the Ministry has been assigned responsibility under the Order in Council for hazards resulting from dam failures, it does not conduct periodic inspections or reviews of about 1,050 privately owned dams, even though it has broad regulatory authority to do so under the *Lakes and Rivers Improvement Act* and its regulations.

Risk Assessments and Technical Guides

- **Hazard identification and risk assessment processes are outdated, incomplete and not co-ordinated across the province.** Each of the Natural Resources Ministry's 25 districts is expected to maintain a current district risk assessment for all hazards it is assigned to monitor. Although districts are required to revisit their risk assessments annually, we found that 16 of the 25 districts had not updated their risk assessments since 2018. Contrary to best practices, hazard experts, municipalities, First Nations, and local stakeholders were not involved in the risk assessment process. Also, districts in Northern Ontario used four levels of risk ratings while the Southern region used six levels of risk

ratings. Further, we noted differences between the Ministry's provincial risk assessment ratings for districts and the districts' own self-assessed ratings.

- **Many technical guides and bulletins to support local authorities in implementing policies for assigned hazards are outdated.** In some cases, components of technical guides are not available online for the public. This leaves local planning authorities such as municipalities, conservation authorities and First Nations without guidance and direction on best practices in preparing for potential emergencies.

Overall Conclusion

Our audit concluded that both the Natural Resources Ministry and the Mines Ministry should improve their operational systems and procedures to be better prepared to protect the public, the environment and infrastructure against hazards for which they are responsible.

The Natural Resources Ministry needs to conduct timely and robust risk assessments for hazards it is assigned to manage—forest fires; floods; drought/low water; dam failures; emergencies involving crude oil and natural gas exploration and production, natural gas and hydrocarbon underground storage, and salt solution mining; erosion; and soil and bedrock instability. As well, the Ministry needs to take immediate action to eliminate known high-risk hazards, such as leaking wells. The Ministry also needs to update its technical guides and bulletins for specific hazards to ensure they reflect current technologies and the impacts of climate change. It also needs to implement a formal and disciplined approach to reviewing its performance during actual and simulated emergencies in order to identify lessons learned and take corrective actions to avoid recurring issues in future emergency response efforts.

There is also no clear delineation of roles and responsibilities for emergency response between the Natural Resources Ministry, the Provincial Emergency Management Office, local governments and

communities. The provincial government should determine whether existing regulations, policies and plans contain gaps that need to be addressed to improve clarity, accountability and future cooperation.

Some emergency management activities at the Natural Resources Ministry are not carried out efficiently or economically. For example, the Ministry has not investigated options to secure standing contracts with air carriers at competitive prices to avoid incurring excessive and unplanned costs for emergency evacuations during the forest fire and flood season.

Regarding abandoned mine hazards, the Mines Ministry has not rehabilitated the majority of known abandoned mines in the province and does not know the rehabilitation status of another quarter of them. In addition, almost three-quarters of abandoned mines have not been inspected in over a decade.

This report contains 30 recommendations, with 70 action items, to address our audit findings.

OVERALL MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry thanks the Auditor General for her recommendations. The Ministry recognizes the critical leadership and support role it holds protecting the people of Ontario from natural hazards and natural hazard-based emergencies. The Ministry has a proud and long-standing history of helping to keep people and property safe from natural resource hazards such as forest fires, floods, erosion and oil and gas emergencies.

The Ministry is committed to working collaboratively with federal, provincial, First Nations and Indigenous communities, municipalities, conservation authorities and other partners to ensure that the guidance and services supporting community and public safety, infrastructure/property and natural resources are delivered safely, effectively, and efficiently.

The Ministry is currently undertaking a natural resource disaster management review to ensure the effectiveness of our prevention, mitigation, preparedness, response and recovery programs,

services, and guidance—for the well-being of Ontarians as well as the province's economic prosperity. The Ministry recognizes the contributions that the Auditor General's recommendations will have in guiding the evolution of its emergency management program and looks forward to sharing its continued progress in the coming years.

OVERALL MINISTRY OF MINES RESPONSE

The Ministry has recently adopted a risk-based process to regularly monitor and inspect abandoned mines and will continue to conduct planned inspections of high-risk abandoned and operational mines under its jurisdiction, based on the available resources and Ministry priorities.

The Ministry recognizes that the majority of the high-risk abandoned mine sites are complex and require multi-year efforts to plan and develop appropriate rehabilitation strategies to mitigate potential financial and environmental risks.

In the last five fiscal years, the Ministry of Mines has incurred about \$63 million for abandoned mine rehabilitation.

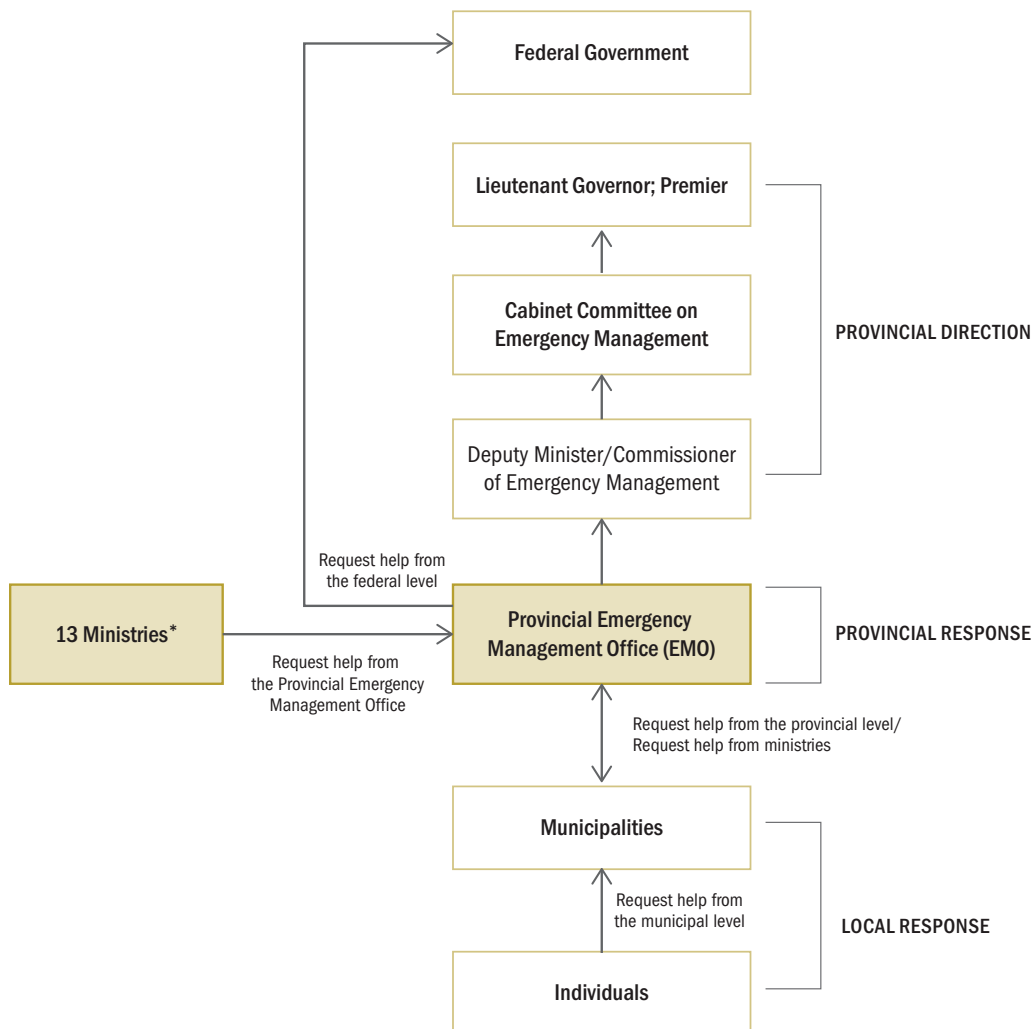
2.0 Background

2.1 Emergency Management in Ontario

Emergency management in Ontario is designed to save lives, protect property and the environment, and ensure the continuity of government services and critical infrastructure. Through an Order in Council 1157/2009 (which was replaced with OIC 1039/2022 after the start of our audit), the government assigned 13 ministries responsibility for preparing emergency management programs for specific types of emergencies and related functions. Ontario uses a bottom-up approach to emergency response—as outlined in the Emergency Management Doctrine for Ontario—that is consistent with

Figure 1: Roles and Responsibilities in Emergency Management for Ontario

Prepared by the Office of the Auditor General of Ontario



* This audit focuses only on the emergency management efforts of the Ministry of Natural Resources and Forestry and the Ministry of Mines in relation to hazards assigned under Order in Council.

the approach used by the federal government and other provinces. Municipalities are responsible for managing most local emergencies, although they can request resources and assistance from the Province when needed. (Refer to **Figure 1** for the roles and responsibilities of the parties involved in emergency management in Ontario.)

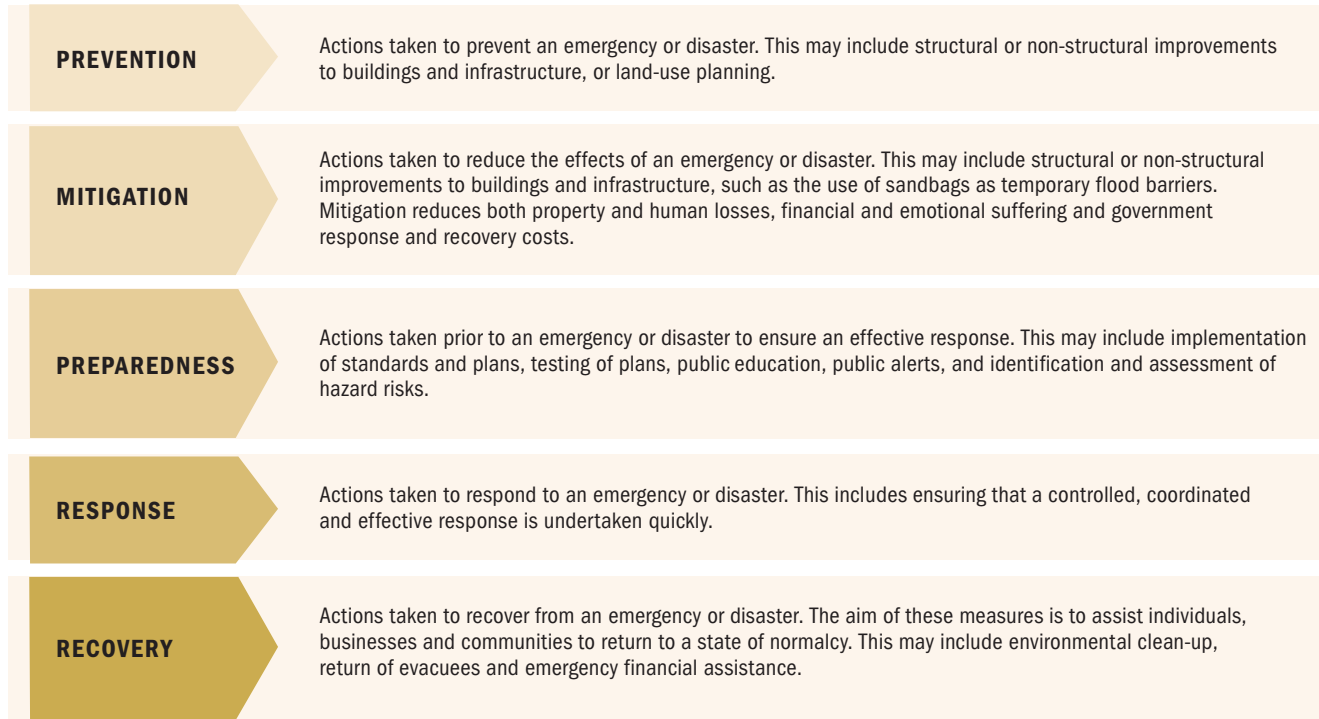
The emergency management programs in Ontario are based on five components: prevention, mitigation, preparedness, response and recovery (see **Figure 2**).

2.2 Hazards Assigned to the Ministry of Natural Resources and Forestry and the Ministry of Mines

As part of the 2009 Order in Council, the then Ministry of Natural Resources and Forestry was assigned responsibility for managing emergencies resulting from seven types of hazards: forest fires; floods; drought/low water; dam failures; emergencies involving crude oil and natural gas exploration and production, natural gas and hydrocarbon underground storage, and salt

Figure 2: Five Components of Emergency Management in Ontario

Source of data: Ministry of the Solicitor General



solution mining; erosion; and soil and bedrock instability. The then Ministry of Northern Development and Mines was assigned responsibility for managing emergencies from abandoned mine failures and any emergency that required the support of provincial emergency management in Northern Ontario.

In June 2021, these two ministries were combined to form the Ministry of Northern Development, Mines, Natural Resources and Forestry, and a revised Order in Council was issued giving this newly formed Ministry responsibility for managing all nine hazards. However, in June 2022 the Ministry of Northern Development, Mines, Natural Resources and Forestry was split into three ministries—the Ministry of Mines (Mines Ministry), the Ministry of Natural Resources and Forestry (Natural Resources Ministry) and the Ministry of Northern Development (Northern Development Ministry). The responsibility for most of the hazards assigned under the Order in Council remains with the Natural Resources Ministry. For a brief description of each type of hazard see **Figure 3**.

Under the *Emergency Management and Civil Protection Act (Act)*, an “emergency” means a situation or an impending situation that constitutes a danger of major proportions that could result in serious harm to persons or substantial damage to property and that is caused by the forces of nature, a disease or other health risk, an accident or an act whether intentional or otherwise.”

An emergency is declared by the local government authority where the emergency occurs, such as a municipal council or a First Nation Chief. During large-scale emergencies or emergencies on Crown land, the premier and Cabinet may declare a provincial emergency. With respect to the hazards assigned to the Natural Resources Ministry and the Mines Ministry, responsibility to respond to emergencies varies based on where a hazardous event occurs. **Figure 4** shows who is responsible for emergency events, by jurisdiction impacted.

Figure 5 shows the number of significant events, including declared emergencies, that have resulted

Figure 3: Hazards Assigned to the Ministry of Natural Resources and Forestry¹

Prepared by the Office of the Auditor General of Ontario

Hazard	Description
1. Floods	An overflow or inundation of water from a river or other body of water, or over land, that causes or threatens damage.
2. Forest fires	Any fire in forests, shrub lands or grasslands.
3. Abandoned mine hazards¹	A mine that has been permanently closed or is not operating, whether it is privately owned or has a filed closure plan. The site contains hazards such as unprotected and concealed shafts or pits, deteriorating structures, derelict mining-related equipment, destabilized and collapsing underground mine workings, contaminated mill tailings, stockpiled waste rock and surface/ground water, discarded tanks or drums of chemicals, toxic gases, unstable explosives, dust, uncontrolled surface drainage causing sedimentation damages.
4. Dam failure	The uncontrolled release of stored water due to the breaching or destruction of a dam or barrier intended to hold back water or other fluids.
5. Oil/natural gas	The uncontrolled release of oil, natural gas, or both. The release could be from a pipeline or distribution system, a vehicle, a well, a storage facility, or a combination of these.
6. Drought/low water	An extended period, with one or more of the following: <ul style="list-style-type: none"> • three or more consecutive months with below-average precipitation which may be combined with high rates of evaporation; • conditions in which the water levels in streams are at the minimum required for the survival of aquatic life; • water must be rationed only for high-priority uses since many wells are becoming dry; and • conditions that have socioeconomic impacts that are felt over a much larger area than the individual properties where the drought/low-water conditions have been reported.
7. Erosion	The gradual wearing away and removal of soil or rock particles by water, ice, snow, air, plants, animals, humans or an abnormal, sudden rise of sea or lake level associated with a storm event.
8. Soil and bedrock instability, land subsidence	Landslides – any type of slope failure or downward movement of rock and/or sediment. Land subsidence – the gradual settling or sudden sinking of the earth’s surface owing to subsurface movement of earth materials.
9. Support to the North^{1,2}	Any emergency that requires the support of provincial emergency management in Northern Ontario.

1. As of June 2022, the newly formed Ministry of Natural Resources and Forestry is responsible for managing and responding to all hazards assigned under Order in Council, except for mines, which are the responsibility of the newly formed Ministry of Mines, and support to the North, which is the responsibility of the newly formed Ministry of Northern Development.

2. This is not in the scope of this audit.

Figure 4: Summary of Responsibilities for Emergency Events by Jurisdiction Impacted

Prepared by the Office of the Auditor General of Ontario

Location of Emergency	First Respondent or Party with Primary Responsibility
On Crown land	Ministry ¹
Within a municipality	Municipality, with support from the Ministry if required
In a First Nation community	First Nation community, with support from the Ministry as directed by Emergency Management Ontario (Treasury Board Secretariat) ²
On Federal lands including parks	Federal government, unless there is an agreement in place with the province ²
In unorganized territories	In this case, it is unclear who has the legal responsibility to respond; often the Ministry responds. For further discussion see Section 4.9.1

1. Ministry of Natural Resources and Forestry is responsible, except where the hazard involves mines, in which case the Ministry of Mines is responsible.

2. The Ministry of Natural Resources and Forestry has agreements with First Nations communities and Indigenous Services Canada (federal government) for forest fire suppression. Costs incurred by the Ministry to fight forest fires in First Nations communities and on federal lands are recoverable from Indigenous Services Canada under the Department of Indian Affairs and Northern Development Agreement (1991).

Figure 5: Significant Events¹ and Declared Emergencies² by Hazard Type in Ontario over the Last Five Calendar Years

Source: Emergency Management Office, Treasury Board Secretariat

Hazard	Significant Events					5-yr Total		Declared Emergencies		Non-Declared Emergencies	
	2017	2018	2019	2020	2021	#	%	#	%	#	%
Floods ³	12	5	31	3	2	53	63	43	78	10	33
Forest fires	1	6	4	3	8	22	26	11	20	11	37
Abandoned mine hazard	0	0	1	5	2	8	9	0	0	8	27
Dam failures	0	0	1	0	0	1	1	0	0	1	3
Petroleum industry Activities	0	0	0	0	1	1	1	1	2	0	0
Drought/low water	0	0	0	0	0	0	0	0	0	0	0
Erosion, soil and bedrock instability ⁴	0	0	0	0	0	0	0	0	0	0	0
Total	13	11	37	11	13	85	100	55	100	30	100

1. Events that have a significant amount of response activity from local governments and potentially require provincial resources.
2. A significant event that is declared as an “emergency” by a municipality or First Nation community. This declaration happens when a municipality or First Nation community determines they have exceeded their capabilities to respond locally.
3. An event when a river’s water level rises to the point where it overruns the banks.
4. In **Figure 4**, this is presented as two separate hazard types. However for tracking purposes, Emergency Management Ontario combines these events into a single category.

from each type of hazard over the last five calendar years.

In 2021/22, the Ministry of Natural Resources and Forestry incurred \$276 million for emergency responses, of which 90% was for emergency firefighting.

2.3 Hazard Identification and Risk Assessment

The hazard identification and risk assessment process (risk assessment) is key to the development of an emergency management program. The Act requires each ministry and municipality, in developing their emergency management program, to conduct a risk assessment to identify hazards and assess the various risks to public safety that could give rise to emergencies. The Act also requires them to identify the risks to facilities and other infrastructure for which they are responsible.

Risk assessment is meant to be ongoing as new hazards are identified and risk levels change. The

primary purpose is to identify and implement measures to reduce high-priority risks to public safety through mitigation, prevention and preparedness. The Natural Resources Ministry has conducted a provincial risk assessment which has assessed the risk levels for each type of hazard for each of its districts (see **Appendix 1**). All of the natural hazards assigned to the Natural Resources Ministry are expected to be affected or exacerbated by climate change.

2.4 Floods

Flooding in Ontario is often the result of heavy or prolonged rainfall, rapid snowmelt, ice jams formed in rivers and streams, and lake/stream surges.

Under the Order in Council 1039/2022, the Natural Resources Ministry is the provincial lead for emergency management and response for floods in Ontario. Although the Natural Resources Ministry has primary responsibility for flood hazards, it works with other ministries, municipalities, agencies and partners to deliver emergency management and respond to flood

emergencies. Additional provincial direction is provided by other ministries including the Ministry of the Solicitor General, the Ministry of Municipal Affairs and Housing, the Ministry of Transportation, the Ministry of Agriculture, Food and Rural Affairs and the Ministry of the Environment, Conservation and Parks, based on established roles and responsibilities.

Flood forecasting and monitoring services are delivered through the Natural Resources Ministry's Surface Water Monitoring Centre (Centre), in co-operation with local districts and conservation authorities that provide local expertise and information on water conditions in their respective jurisdictions. The Centre collects, monitors and analyzes real-time surface water data (precipitation, snow depth, temperature, water levels and water flow) on a provincial scale through a network of 600 water monitoring stations that are jointly funded and operated by the federal and provincial governments. The Centre issues flood-warning and flood-watch messages to districts, conservation authorities and other partners responsible for responding to flood events. For a listing of flood-related mitigation/preparedness activities, see **Appendix 2**.

The Natural Resources Ministry also owns and operates 126 weather stations across Northern Ontario (63 in the Northwest region and 63 in the Northeast). All stations measure and report on the temperature, humidity, wind and precipitation, and some stations also measure and report barometric pressure and snow depth. This information is used to model and forecast weather conditions, as well as predict forest fires.

From 2017–2021, there were 53 significant flood events, of which 43 were emergencies declared by a municipality or First Nation community. Half of the significant events occurred during record-breaking floods in the spring of 2019. For a listing of significant flood events that have occurred over the last five years and related details, see **Appendix 3**.

In response to these floods, the Natural Resources Ministry developed the Protecting People and Property: Ontario's Flooding Strategy in 2020. This strategy is intended to strengthen Ontario's resiliency to flooding through a series of actions designed to better prepare the Province for future flood events, reduce their

impacts, and equip the Province to respond to and recover from floods quickly. Some of the key activities identified in the document include: enhancing flood mapping to help understand flood risk; enhancing flood forecasting and early warning to improve flood preparedness; enhancing emergency response; and reviewing disaster recovery programs and assistance for Ontarians and municipalities.

2.5 Forest Fires

The Natural Resources Ministry has primary responsibility for emergency management and response to forest fire emergencies on Crown lands and unorganized territories (areas not governed by a municipality) under the *Forest Fires Prevention Act*. Not all fires require emergency response actions; some are beneficial and renew and maintain healthy forests. However, a forest fire that poses a threat to people, infrastructure and/or the ecosystem (such as loss of biodiversity or loss of trees for harvesting) requires an organized and co-ordinated response.

The Natural Resources Ministry's Aviation, Forest Fire and Emergency Services Branch of the Provincial Services Division is responsible for program delivery for the protection of people, property and communities threatened by forest fires. At the local level, fire response is delivered from 14 Fire Management Headquarters located across the province: seven in the Northwest and seven in the Northeast region. Fire crew staff are hired on a seasonal basis by the respective Fire Management Headquarters to work through the fire season (April to October). In the 2021 fire season, there were 769 fire crew staff employed across all regions.

There were almost 4,500 fires in Ontario from 2017–2021 involving 1.44 million hectares of land, of which 91% occurred in the Northwest region of the province. According to data from Emergency Management Ontario, from 2017 to 2021 there were 22 significant events due to forest fires, of which 11 were emergencies declared by municipalities or First Nations communities. Based on our analysis of Ministry forest fire data, 68% of the fires the Ministry responded to

from 2017 to 2021 were caused by lightning, and 32% were human caused.

For a list of all significant forest fire events that have occurred over the last five years, see **Appendix 4**. Although Ontario has avoided disastrous fires in recent history, the province is not immune to the destructive fires that devastated parts of British Columbia in 2021, Alberta in 2016 and California in 2020. For the number of forest fires and hectares burned over the last 20 years, see **Figure 6**.

One form of mitigation used by the Ministry is prescribed burns, which are fires deliberately set to maintain the health of the forest. These burns are performed at a time when they pose the least threat to the public. Between 2017 and 2021, there were 16 prescribed burns that covered 884 hectares in total, or less than 0.1% of the total hectares that burned during that time period. For a list of mitigation/preparedness activities related to forest fires, see **Appendix 2**.

2.6 Abandoned Mines

An abandoned mine is one that has been permanently closed or is not operating, irrespective of whether it is owned privately or by the Crown, or whether it has a closure plan in place. Under Ontario's *Mining Act*, mining companies are required to prepare and submit a closure plan to the Mines Ministry for approval that

outlines how the site will be rehabilitated after it ceases to operate to mitigate mine hazards. Hazards related to abandoned mines are noted in **Figure 3**.

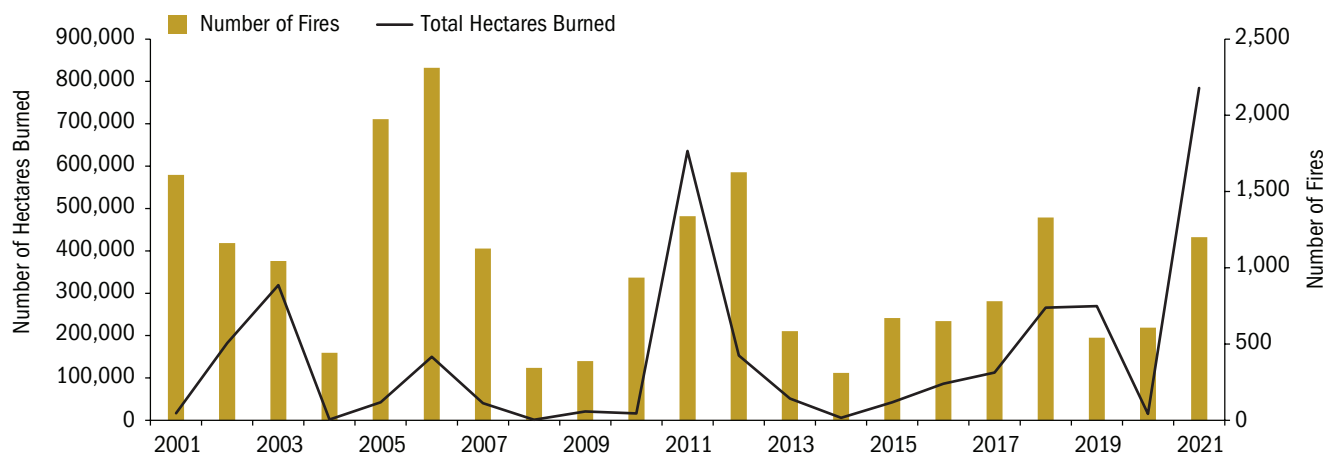
As of April 2022, the Mines Ministry had knowledge of 5,746 abandoned mine sites in Ontario, of which 57% are on privately held land, 40% on Crown land and 3% straddling both Crown and private lands. All but one (Faraday Mine) of the 5,746 abandoned mines are regulated by the Ministry.

The Mines Ministry has the primary responsibility to rehabilitate mine hazards in Crown-held abandoned mines that can have an impact on public health, safety or the environment. The Ministry is also responsible for ensuring that privately owned mines comply with the *Mining Act*, including the rehabilitation of mine hazards. Privately owned mines revert to the Crown if, for example, the mining company has unpaid rent or taxes, the company is dissolved, or the owner dies. Between 2016 and 2021, 37 privately held abandoned mine sites reverted to the Crown. In such cases, the Province becomes responsible for the rehabilitation costs related to the mine hazards.

As of March 31, 2022, contaminated mine sites that have been assessed made up \$1.3 billion of the Province's \$1.8 billion contaminated sites liability. The mine site posing the largest liability—\$730 million—is Steep Rock Mines, an open-pit iron ore mine near Atikokan, Ontario which was mined from the 1940s to the 1970s.

Figure 6: Number of Forest Fires and Area Burned in Ontario, 2001–2021

Source: Ministry of Natural Resources and Forestry



As stated in the Order in Council, the Mines Ministry is responsible for the formulation of emergency plans for any potential hazard related to an abandoned mine. These include spills, or a discharge into the environment, from a structure, vehicle or container that is abnormal in quality or quantity; a mine tailings dam (which is used to store waste products from the mining process); and other containment structures such as a dyke. Since 1989, the Mines Ministry has been maintaining information on all mine sites in Ontario, whether abandoned, active or inactive, in a centralized database called the Abandoned Mines Information System (mines database).

Between 2017 and 2021, there have been eight significant hazardous events in Ontario involving abandoned mines. The events did not result in any injuries or deaths, but cost the Province \$3.8 million in rehabilitation costs. For details including the cause of the events see **Appendix 5**.

For a listing of mitigation/preparedness activities related to abandoned mine hazards, see **Appendix 2**.

2.7 Dam Failures

There are about 3,500 dams in the province. The government of Ontario owns and operates 398, or 11%, of them. Other owners include:

- Ducks Unlimited Canada, a not-for-profit organization, with 970 dams for wetland conservation;
- municipalities and conservation authorities, with about 320 dams;
- Ontario Power Generation, with 241 dams;
- Parks Canada, which is responsible for about 150 dams used to manage water levels for the Trent-Severn Waterway;
- other private owners of about 400 mine tailings dams; and
- other private owners with about 1,050 dams.

As part of its Dam Management program, the Natural Resources Ministry is responsible for about 316 water control structures (dams) owned by the Crown, with an estimated replacement value of about \$800 million. These structures are located across

the province, with about half in Southern Ontario, a quarter in the Northeast and a quarter in the Northwest.

Many of the Ministry dams were constructed or reconstructed in the 1950s and 1960s. Many of them date back to the turn of the century and were originally built to facilitate timber runs and milling. Once these privately owned dams were no longer needed or the original owners went out of business, the ownership, responsibility and liability for these dams often reverted to the Crown.

The Ministry is also responsible for regulating the design, construction, operation, maintenance and safety of all dams in Ontario. In general, major causes of dam failures occur due to:

- extreme water inflow from prolonged rainfall and flooding, which can put pressure on the dam and cause the structure to collapse;
- use of substandard construction materials;
- poor maintenance; and
- design flaws, such as no proper system to gauge the water level in reservoirs.

For a listing of mitigation/preparedness activities related to dams, see **Appendix 2**.

2.8 Oil/Natural Gas

The Natural Resources Ministry regulates the following under the *Oil, Gas and Salt Resources Act* and Ontario Regulation 245/97:

- exploration and production of oil and gas, and salt-solution mining (pumping water into buried salt deposits, dissolving the salts and pumping the salt solution to the surface for drying and further use);
- underground geological storage of hydrocarbons (for example, natural gas, propane); compressed air energy storage (which when needed, can be retrieved to produce power);
- disposal of oil field fluid in an underground geological formation; and
- geological evaluation or testing of rocks.

The Ministry has documented information on about 27,000 oil and gas wells. As of May 2022, more

than 3,400 oil and gas wells were active in Ontario, while over 15,300 wells were considered abandoned. In response to our audit, the Ministry said it lacked information on an additional 7,300 wells. The remaining 1,000 were comprised of wells in various states of inactivity. **Appendix 6** provides further details on the oil and gas wells in Ontario.

The Ministry provides governance, licensing, inspection and enforcement activities for Ontario's oil, gas, salt and underground storage industries prior to being transferred to the end user. It also operates the Abandoned Works Program, which takes care of plugging the highest-risk abandoned oil and gas wells that pose a threat to public and environmental safety. Since the beginning of the program in 2005, the Ministry has spent about \$23 million to plug about 380 wells.

The Ministry also is responsible for inspecting oil and gas wells and associated works related to the production of oil and natural gas, while the Technical Standards and Safety Authority (a regulatory authority established by the Province) is responsible for inspecting all oil and gas transmission pipelines and gas distribution pipelines.

As per Order in Council 1039/2022, the Ministry is responsible for the formulation of emergency plans where the Crown is expected to respond for any emergency pertaining to crude oil and natural gas exploration and production, natural gas and hydrocarbon underground storage, salt solution mining and compressed energy storage. The Ministry also provides technical advice and support to municipalities for oil and gas wells on private land and participates in any community's Emergency Operations Centre during a municipality-led emergency.

Between 2017 and 2021, there was one significant petroleum operations emergency in Wheatley, located in southwestern Ontario. In August 2021, gas leaking through an underground well caused an explosion that flattened two buildings, badly damaged other buildings, injured 20 people and forced the evacuation of 100 people. In November 2022, a lawsuit was filed against the Municipality of Chatham-Kent and an external service provider that the municipality retained to do monitoring for gas. The Statement of Claim alleged that the parties "failed to trace the source of the

gas leak and cap, or otherwise remediate, the source of the gas." The Ministry received a written notice of claim in September 2021 but was not named in the recently-filed lawsuit.

For a listing of mitigation/preparedness activities related to oil and natural gas wells, see **Appendix 2**.

2.9 Drought/Low Water

Long periods of dry weather leading to drought and low-water levels have historically been relatively uncommon in Ontario, occurring about once every 10–15 years. However, in the late 1990s, Southern Ontario experienced extended periods of high temperatures and low rainfall, resulting in some of the lowest surface water levels and driest soils recorded in decades. The issue was of particular significance to the Grand River Basin in Southern Ontario, which supplies water to more than 800,000 people. This heightened concerns over the Provincial management of regional water resources.

The Ministry provides Provincial drought/low-water monitoring, early warning and notification through the Surface Water Monitoring Centre. The multi-year drought conditions of 1997–1999 led in March 2000 to the development of the Ontario Low Water Response program and related strategy document, the Province's first drought/low-water program. The strategy document is intended to ensure the Province is prepared in case of drought/low-water conditions and to assist local agencies in mitigating its effects.

In addition to the Natural Resources Ministry, management of drought/low water in Ontario involves various other provincial ministries and agencies, including the Ministry of Municipal Affairs and Housing; the Ministry of Agriculture, Food and Rural Affairs; and the Ministry of the Environment, Conservation and Parks.

While there were no significant events related to drought/low water in Ontario between 2017 and 2021, studies indicate that drought/low-water levels may become more frequent, compounded by climate change and the province's steadily increasing demands for water, as noted in the Ministry's Ontario Low Water Response Plan.

2.10 Erosion, Soil and Bedrock Instability

Erosion is a natural process that happens along shorelines, valley slopes, embankments and rock formations when runoff from heavy rain carries away the top layers of soil. It becomes a hazard when it poses a threat to human life, property or the environment. Factors that can accelerate the effects of erosion include:

- heavy rainfall that carries topsoil down slopes, embankments and valley walls causing slope instability or failure;
- human activity such as digging, deforestation and removing natural vegetation; and
- development in vulnerable areas such as lake-fronts, river lots and ravines.

Soil and bedrock instability can trigger landslides and sinkholes, which can damage property and pose serious risks to public safety. According to the Natural Resources Ministry, areas of the province known to have unstable soils and bedrock include the Niagara Escarpment, Bruce Peninsula, Manitoulin Island and parts of eastern Ontario.

The combination of a changing climate, settlement patterns along waterways, and an increase in seasonal property investments is exposing more properties and assets to shoreline erosion. A 2012 study found that prior to 2000, the average rate of coastal erosion was 0.01 metres to 0.50 metres per year, but from 2014 to 2018 some parts of Great Lake shorelines experienced average annual erosion rates of 0.49 metres to 1.19 metres. More recent research published by the Institute for Catastrophic Loss Reduction suggests that the problem has increased because the combination of high-water levels, more frequent storms, and less ice cover is exacerbating lake edge erosion.

Under Order in Council 1039/2022, the Natural Resources Ministry is the provincial lead for emergency management and response of hazards resulting from erosion and soil/bedrock instability. Conservation authorities and municipalities are charged with regulating development on private land on behalf of the Province for public safety and prevention.

Municipalities are required to implement land-use planning policies to direct land development away from hazardous areas. Where conservation authorities do not exist, the Ministry manages those hazards through its regional district offices.

There were no declared emergencies related to erosion or soil/bedrock instability from 2017 to 2021. There was, however, one significant event involving a massive landslide in Horton Township (eastern Ontario) in March 2016, damaging several properties including the Renfrew County hydroelectric plant and local sewage plant. The landslide involved 10 hectares of land.

For a listing of mitigation/preparedness activities related to erosion or soil/bedrock instability, see **Appendix 2**.

3.0 Audit Objective and Scope

3.1 Audit Objectives

Our audit objective was to assess whether the Ministry of Natural Resources and Forestry (Natural Resources Ministry) and the Ministry of Mines (Mines Ministry) have systems and processes in place to ensure that:

- effective emergency management programs are in place to protect the public, the environment and infrastructure against hazards for which the Ministries have been assigned responsibility by Order in Council;
- emergency management operations are carried out with due regard for economy and efficiency and in compliance with relevant legislation, regulations, policies and best practices; and
- emergency management program objectives are appropriately measured, evaluated for effectiveness and publicly reported.

3.2 Audit Scope

Before starting our work, we identified the audit criteria we would use to address our audit objectives. These criteria were established based on a review of

applicable legislation, policies and procedures, internal and external studies, and best practices. Senior management at the Natural Resources Ministry and the Mines Ministry reviewed and agreed with the suitability of our audit objectives and related criteria, as listed in **Appendix 7**.

We conducted our audit from January to August 2022, and obtained written representation from the Natural Resources Ministry and the Mines Ministry that effective November 25, 2022, they have provided us with all the information they were aware of that could significantly affect the findings or the conclusion of this report.

We assessed the Ministries' emergency management processes to ensure the adequacy of their efforts in mitigating, preparing and responding to eight specific hazards/emergency types assigned to it through Order in Council. These eight hazards were forest fires; floods; drought/low water; abandoned mines; dam failures; crude oil and natural gas exploration and production, natural gas and hydrocarbon underground storage, and salt solution mining emergencies; erosion; and soil and bedrock instability.

We examined the activities of the Aviation, Forest Fires and Emergency Services Branch of the Provincial Services Division, the Regional Operations Division within the Natural Resources Ministry, and of the Mines and Minerals Division within the Mines Ministry, as they have direct emergency management responsibilities.

We visited the Natural Resources Ministry's Emergency Operations Centre in Sault Ste. Marie, including the weather office that monitors weather conditions and provides regular briefings to the Surface Water Monitoring Centre, with respect to potential floods; the district offices, with respect to potential fires; and the Aviation Service Centre, which has or requisitions aircraft to conduct reconnaissance, put out forest fires, evacuate people from disaster areas and return them home at the end of a disaster. We also visited the Surface Water Monitoring Centre in Peterborough,

which determines and communicates potential low-water and drought conditions across the province.

We also reviewed reports on audits completed by the Ontario Internal Audit Division and legislative audit offices in other provinces, at the federal level and in other countries, along with reports on best practices.

We also met with staff from Emergency Management Services of the Mushkegowuk Tribal Council to obtain their perspective on the Province's emergency response efforts related to the repeat flooding events at Kashechewan First Nations.

We engaged an independent consultant with expertise in the field of emergency management to assist us on this audit and conduct jurisdictional scans on select aspects of emergency management.

We did not look at recovery efforts, as those activities are handled by the Ministry of Municipal Affairs and Housing and were examined during our 2017 audit of Emergency Management in Ontario. Furthermore, funding for recoveries is provided by the federal government.

We conducted our work and reported on the results of our examination in accordance with the applicable Canadian Standards on Assurance Engagements—Direct Engagements issued by the Auditing and Assurance Standards Board of the Chartered Professional Accountants of Canada. This included obtaining a reasonable level of assurance.

The Office of the Auditor General of Ontario applies the Canadian Standard on Quality Control and, as a result, maintains a comprehensive quality control system that includes documented policies and procedures with respect to compliance with rules of professional conduct, professional standards and applicable legal and regulatory requirements.

We have complied with the independence and other ethical requirements of the Code of Professional Conduct of the Chartered Professional Accountants of Ontario, which are founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour.

4.0 Detailed Audit Observations

4.1 Floods

4.1.1 First Nation Community Exposed to Recurring Floods and Evacuations

Of the 53 significant flood events that occurred between 2017 and 2021, we noted that Kashechewan First Nation, a community of approximately 2,000 residents in northeastern Ontario, had declared a flood emergency in four consecutive years (2017–2020). The Natural Resources Ministry assisted with evacuation efforts in the three years in which an evacuation was needed, at a total cost of \$3.6 million. The costs of accommodations and other supports incurred by communities to host evacuees from Kashechewan was unknown to the Province, as Emergency Management Ontario told us that prior to 2021 these costs were incurred by municipalities who requested reimbursement directly from the federal government.

Kashechewan First Nation is located on a flood-plain on the northern shores of the Albany River which flows into James Bay, making it susceptible to spring flooding (see the map in **Figure 7**). The Albany River

is the second largest river in Ontario and frequently gets jammed by the breakup of the ice in the spring. Ice jams are a common cause of spring flooding faced by riverside communities, particularly in northern Canada. Ice jams cause the river water to rise, which can also cause the river to overflow its banks.

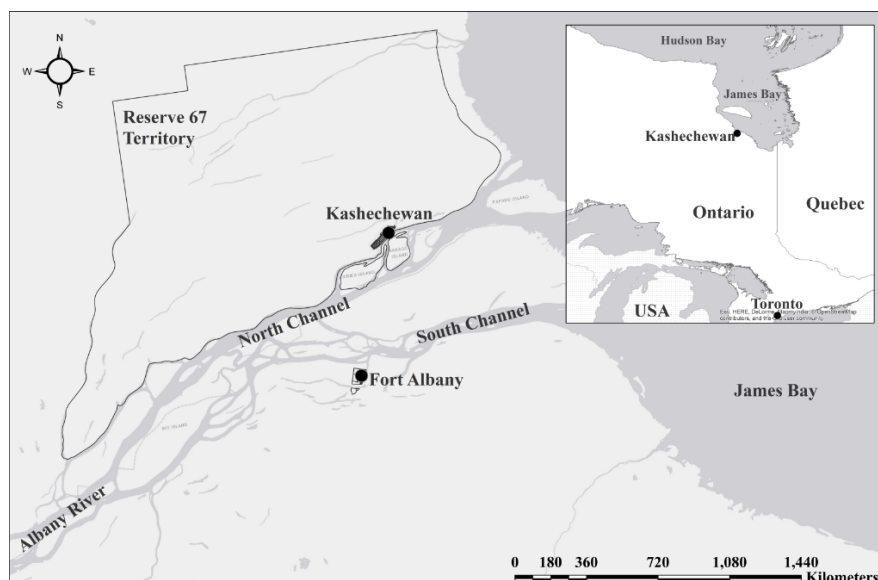
Although Kashechewan has a dyke built around it (5.0 kilometres long and 3.5 metres high), the community continues to experience flooding almost annually. Community representatives told us that the dyke has been deteriorating.

In 2019, Kashechewan reached an agreement with the federal and provincial governments to relocate the entire community within eight to 10 years. Based on our conversation with a community representative, the community does want to be relocated. Media articles note similar relocation commitments by the federal government as far back as 2005, indicating delays in relocating the community.

At the time of our audit, we noted that several other nearby First Nations communities also experienced significant flooding in spring 2022, including Fort Albany First Nation, located on the opposite side of Kashechewan on the southern shores of the Albany River, and

Figure 7: Kashechewan First Nation Location Map

Source: Frequent Spring Flooding Impacts, Evacuation Experiences, and Perceived Adaptive Capacity of Kashechewan First Nation, Northern Ontario, University of Alberta, 2020



Attawapiskat First Nation, located north of Kashechewan at the mouth of the Attawapiskat River on James Bay. Both of these communities, in addition to Kashechewan, were evacuated in spring 2022.

RECOMMENDATION 1

To prevent high-risk First Nations communities from repeatedly flooding and needing to be evacuated on a frequent basis, we recommend the provincial government (Treasury Board Secretariat/Emergency Management Ontario):

- work with the federal government to permanently relocate the Kashechewan First Nation community to higher, drier ground as soon as possible; and
- evaluate whether other First Nations communities at risk of recurrent flooding and evacuations, such as Fort Albany and Attawapiskat, also need to be relocated or whether any dykes or floodways should be built.

EMERGENCY MANAGEMENT ONTARIO RESPONSE

In consultation with the Ministry of Indigenous Affairs, Emergency Management Ontario (EMO) has been informed that the Government of Ontario, led by the Ministry of Indigenous Affairs and supported by the Ministry of Natural Resources and Forestry, continues to work with Kashechewan First Nation, Fort Albany First Nation, and Indigenous Services Canada, to provide whatever assistance it can to support the relocation of Kashechewan First Nation due to the threat of annual spring flooding.

While the federal government has ultimate responsibility for the relocation, Ontario manages the provincial Crown lands that may be transferred to Canada to support the relocation. Ontario has committed to move quickly on the provincial actions necessary to transfer the land.

The choice to relocate is community-driven. Kashechewan First Nation is exploring multiple options for community relocation and/or redevelopment, on and off of the current reserve. Any

option requires engagement with Fort Albany First Nation, which, together with Kashechewan First Nation, are legally recognized as one Band (the Albany Band) under the *Indian Act*. Each community has its own custom elections and a separate Chief and Council. Therefore, the relocation decision requires agreement between Kacheshewan and Fort Albany First Nations.

The Government of Ontario reaffirms its commitment to supporting critical emergency management supports to First Nation leaders and community members upon their request, and their right to self-determine any desire to explore relocations and/or new infrastructure.

4.1.2 Post-Mortem Reports Highlight Important Issues with the Province's Emergency Response Efforts

During our audit we requested and reviewed any after-action reports involving hazards assigned to the Natural Resources Ministry, whether prepared by the Ministry itself or another entity.

Ministry of Natural Resources and Forestry

According to the Natural Resources Ministry's Emergency Response Plan, following significant incidents, Ministry staff are responsible for conducting a post-mortem and completing a written after-action report to identify opportunities for improvement and corrective actions. Although the Ministry responded to seven of the 53 significant flood emergencies that occurred from 2017 to 2021, as shown in **Appendix 3**, we found that it had prepared a total of seven after-action reports covering only three of the seven significant flood incidents it responded to. Moreover, we noted that the Ministry did not prepare an after-action report for any of the three Kashechewan flood emergencies it responded to between 2017 and 2021.

Further, in the after-action reports that were completed, there was no evidence that the Ministry sought feedback from the communities it provided emergency response services to. This can lead to internal bias or "blind spots" when conducting post-mortems, and key

problems being overlooked and uncorrected. As well, the Ministry was unaware whether the federal government had completed any after-action reports.

Based on our review of after-action reports prepared by the Ministry, we noted that they were prepared in an inconsistent format, and were vague with general statements that did not elaborate to fully explain the issues. However, one recurring issue raised in the Ministry's after-action reports related to floods was the need to better define roles and responsibilities of the Ministry, Emergency Management Ontario (EMO) and local governments/communities in emergency flood response. The Ministry noted it tends to be a "go to" ministry during emergencies, providing support outside of its mandate, training and experience. For example, it was noted that fire crews deployed to support flood response and working under municipal officials, were often asked to work in flood waters and build sandbag berms, areas in which they did not have sufficient experience or training.

First Nations (Mushkegowuk Tribal Council)

Some First Nations communities collectively produced an after-action report in June 2022, which we obtained from the Ministry and reviewed. The Mushkegowuk Council Emergency Management Services Group held a lessons-learned discussion in May 2022 to identify the problems their communities experienced following the spring 2022 floods and evacuations. Participants included leaders of the First Nations communities of Kashechewan, Fort Albany and Attawapiskat, as well as input from Indigenous Services Canada and Emergency Management Ontario. Some of the key issues expressed in the report dealt with the evacuation process and host communities, such as:

- a need to develop capacity within Indigenous communities and give them priority in hosting evacuees from other First Nations communities who are impacted by natural hazard emergencies. (The report stated that Indigenous host sites would allow First Nation residents to maintain cultural awareness and enable the leadership to enforce Band Council Resolutions, which are otherwise unenforceable in a municipality. Indigenous host sites were also expected

to be better able to mitigate some of the incidents faced in non-Indigenous host communities involving drugs and alcohol.);

- a need for municipal host communities to choose safe locations as accommodation for evacuees, such as being a reasonable distance from bars and liquor stores to limit disruptions and safety incidents;
- a need to ensure youth are not given accommodation without a guardian present;
- a desire for better transportation options to enable evacuees (especially the elderly) to access essential services and to dine at banquet halls or community centres instead of old, rundown diners/bars; and
- a need for Indigenous mental health providers.

Based on our review of government documents, we noted that the Province is aware of First Nations peoples' preference for the use of First Nations-led host communities and service providers. The Province's plan is to continue to advocate to the federal government to build First Nations capacity to host other First Nations impacted by natural hazard emergencies.

Emergency Management Ontario

We noted that Emergency Management Ontario (EMO) had completed only one after-action report in 2019 covering flood and forest fire evacuation events that occurred from April–June 2019. The report noted that approximately 2,450 people were evacuated in that period to Northern communities, such as Cochrane and Kenora. Some of the key issues EMO noted included an insufficient number of host communities, in part because some municipalities will not act as host communities; a lack of available bed spaces for evacuees in existing host communities; insufficient mental health supports, such as stress and trauma checks, and access to other mental health resources; inadequate catering and food services, such as a lack of balanced meal options; and social problems arising in host communities, in part due to delays in bringing evacuees home sooner. The report also noted that the Natural Resources Ministry's weather reports were too detailed and long, and recommended they be truncated.

We noted from our review of government documents that the current capacity in existing host municipalities is 2,000 evacuees. In 2021, almost 3,000 people had to be evacuated at the same time from various communities for a period of at least 30 days due to fire and smoke threats. Based on data from EMO, over the last five years the average length of time that a First Nation community was evacuated for was 23.5 days, to a maximum of 45 days.

In anticipation of future evacuations, EMO has sought to implement a contingency plan that would allow it to build and maintain capacity to support up to 5,000 evacuees, should the number of evacuees in future emergency evacuations exceed the amount that can be supported through existing municipal/First Nations host communities. Recognizing the current capacity is 2,000 evacuees, EMO has sought additional funding to enter into contracts with vendors such as the Canadian Red Cross, and other profit and not-for-profit entities, for the provision of emergency management services, particularly within host communities. This includes establishing additional hosting capacity in Sudbury and two communities in Southern Ontario. EMO's request to enter into contracts with vendors to provide emergency management services was approved in March 2022.

RECOMMENDATION 2

So that lessons learned from past flooding events are incorporated into emergency response plans to improve future emergency response efforts, we recommend that the Ministry of Natural Resources and Forestry:

- document after-action reviews related to flooding incidents in a formal and standardized report in a timely manner;
- take timely action to address areas needing improvement and ensure that progress is tracked, followed-up and reported on until fully implemented; and

We also recommend that Emergency Management Ontario:

- continue to strive to put in place contingency arrangements to deal with the future potential that additional capacity will be needed in host communities.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry of Natural Resources and Forestry agrees with this recommendation and will work with its Federal, Provincial, Municipal and First Nation partners to develop a protocol for after-action reviews based on the incident type/severity and to conduct timely after-action reviews, in accordance with that protocol, within a reasonable period. To support this work, the Ministry will update and enhance its after-action review processes and policies and guidance documents for staff and management.

The Ministry will also document, track, and report on the implementation of corrective actions to areas identified as needing improvement.

EMERGENCY MANAGEMENT ONTARIO RESPONSE

Treasury Board Secretariat, through Emergency Management Ontario, sees the contingency host community model as the foundation in helping to encourage future potential additional capacity in host communities. In collaboration with the federal government, municipalities, Indigenous organizations, non-governmental organizations and host communities, Emergency Management Ontario will continue regular engagements to identify host communities and additional supports that could be provided to host communities.

The government annually forms planning working groups months in advance of each flood and wildland fire season to ensure regular engagement with municipalities, key ministry partners and First Nations organizations including the First Nations Emergency Response Association.

4.1.3 Ontario's Flood Preparedness Has Gaps Because Floodplain Mapping Is Incomplete

According to the Canadian Disaster Database, there were 31 significant floods in Ontario in the 40 years from 1960 to 1999. (In this context, “significant” means that 10 or more people were killed, or 100 or more were injured, evacuated, left homeless or otherwise impacted). In the 20 years that followed, there were 24 significant floods. Comparing the 40-year period to the 20-year period reveals that the average annual number of floods has increased by 55%.

A 2020 report by the Intact Centre on Climate Change Adaptation found Ontario to be below average in some of its flood preparedness efforts, specifically relating to risk assessments. The report indicated that the Province does not always make assessments on flood preparedness publicly available, and frequently passed the responsibility for developing these assessments to local governments. Accurate flood-risk assessments are dependent upon up-to-date floodplain (flood-prone areas near rivers and streams) mapping, an area where the report said Ontario significantly lagged.

During the course of the audit, we were informed that the Natural Resources Ministry provided funding to municipalities and conservation authorities for floodplain mapping up until 1993. Between 1994 and 2015 there was no funding provided to municipalities and conservation authorities for floodplain mapping by either the provincial or the federal government. Any floodplain mapping performed during that period would have been self-funded by municipalities and conservation authorities. Since 2016, federal funding has been made available to municipalities and conservation authorities for floodplain mapping through the National Disaster Mitigation Program. The Natural Resources Ministry, along with the Ministry of Municipal Affairs and Housing, screens applications from municipalities and conservation authorities for the federal funding. Between 2016 and 2022, a total of 103 provincial floodplain mapping projects were federally funded by Public Safety Canada, which included 83 conservation authority projects, 19 municipal projects in Ontario, and one First Nations project. At the time

of our audit, the Ministry maintained that municipalities and conservation authorities were responsible for applying for funding for floodplain mapping.

The average age of the 64 floodplain maps that the Ministry funded prior to 1993, was 36 years old. Of the 103 municipalities and conservation authorities and one First Nation that have done floodplain mapping under federal funding, the oldest map is six years old and the average is 2.7 years old. Making floodplain mapping a priority would align with Ontario's Flooding Strategy to “understand flood risks.”

First Nations communities have had access to federal funding through the whole period for floodplain mapping. However, no mechanism has been in place for unincorporated territories (discussed in **Section 4.9**) to obtain funding for floodplain mapping. It is critical to have such information because building or living in a floodplain increases the risk to people and structures if flooding occurs.

We noted that the Natural Resources Ministry does not maintain a repository of all floodplain maps that exist in the province. Without current and accurate flood maps, districts cannot effectively identify at-risk areas or conduct effective flood-risk assessments.

In 2019, a special advisor was appointed by the Minister of Natural Resources and Forestry to review the Province's flood management framework. The report, completed in October 2019, focused primarily on river and lake flooding, and resulted in the Ministry releasing a new strategy in 2020 entitled, *Protecting People and Property: Ontario's Flooding Strategy*. This strategy focuses on five key priorities: understanding flood risks; strengthening governance of flood risks; enhancing flood preparedness; enhancing flood response and recovery; and investing in flood risk reduction (mitigation).

A key element of the strategy is to establish a multi-agency, flood-risk mapping technical team and develop a multi-year approach to updating flood maps so as to better understand flood risk. The Ministry informed us that the technical team is expected to finalize its project-specific terms of reference by March 2023.

Apart from information on floodplains, municipalities also need accurate data on wetland boundaries.

Wetlands allow water to percolate into the underlying soil, which reduces runoff and mitigates the impacts of flooding. The Natural Resources Ministry is responsible for maintaining wetland mapping data that shows the location and boundaries of all identified wetlands. These boundaries can change over time, yet 91% of data on unevaluated wetlands was collected from 28–40 years ago. For further information on issues related to wetland preservation and restoration, refer to our other 2022 report *Climate Change Adaptation: Reducing Urban Flood Risk*.

RECOMMENDATION 3

To protect Ontarians and critical infrastructure, and better understand flood risks across the province, we recommend that the Ministry of Natural Resource and Forestry increase floodplain mapping efforts to better support municipalities, conservation authorities, First Nations and unorganized territories.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry will address this recommendation by investing in local floodplain mapping efforts under the Flood Hazard Identification and Mapping Program.

4.1.4 Some Ministry-Operated Weather Reporting Stations Are Not Inspected in a Timely Manner

The Natural Resources Ministry's Provincial Weather Office, based in Sault Ste. Marie, provides daily weather briefings on current and forecasted weather conditions to the Surface Water Monitoring Centre, the Ministry Emergency Operations Centre, and the Ministry's regional offices. Key information communicated includes forecasted rainfall, temperature, wind activity, and thunderstorms—weather events that can contribute to fires, floods and drought/low-water conditions.

These updates support situational awareness and emergency planning efforts. For example, intelligence obtained from the Weather Office is used to warn fire crews fighting wildfires of any threatening or changing conditions, such as drastic wind shifts.

The Weather Office obtains data and information from internal and external sources, including the 126 Ministry-owned and operated weather stations in Northern Ontario.

We noted that the Ministry does not have a policy on how often weather stations should be inspected. The Ministry told us that it is best practice for weather stations to be inspected annually to ensure they are operating as intended. During inspection, the technician checks calibration issues, battery voltage levels, wind sensors and rain gauges.

We noted that the Ministry was not tracking inspection dates for all their weather stations. As a result, we asked the Ministry to pull inspection records for a sample of weather stations to determine when each was last inspected as of June 2022. We identified that 10% of the weather stations we sampled were overdue by at least eight months, including one in Manitowadge that was overdue by 22 months, as it was last inspected in 2019. Ministry staff told us that travel restrictions due to COVID-19 contributed to delays in some station site visits.

RECOMMENDATION 4

To confirm that weather stations are in good working order and operating as intended, we recommend that the Ministry of Natural Resources and Forestry:

- establish a formal policy clarifying how often weather stations should be inspected;
- conduct inspections in accordance with policy; and
- track inspection dates and results of inspections for all weather stations using a database that flags upcoming inspections.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry accepts this recommendation and will review its current guidance and manufacturer recommendations related to weather station inspections, and amend its processes and related documentation accordingly.

The Ministry will conduct inspections of weather stations in accordance with the updated policy.

The Ministry will also develop a process and/or system to track upcoming inspection dates and the results of inspections.

4.1.5 No Standing Contracts to Secure Availability and Pricing for Air Carriers in Emergency Evacuations

Most evacuations due to floods or forest fires involve First Nations communities. The Province of Ontario provides emergency preparedness and response assistance to First Nations, pursuant to its contractual arrangement with the Government of Canada. When an emergency exists within a First Nation that compels a partial or full evacuation of the residents from that community, Emergency Management Ontario, in partnership with the Natural Resources Ministry (and other relevant federal/provincial departments) is responsible for co-ordinating and conducting the evacuation, if requested by the Provincial Emergency Operations Centre. The Natural Resources Ministry will assist with the evacuation of Northern communities by arranging for air transportation of the evacuees from the First Nation community to the relevant host communities, and the return of those residents to their home communities when it has been declared safe to do so.

Most evacuations requiring Ministry support occur in Northern Ontario with First Nations communities located on/near floodplains or wildland. In a flood or fire emergency, First Nations leadership (Chief and Council) in each community determine if/when residents will evacuate.

Private air carriers available to the Ministry normally have seating capacity of nine to 37 persons depending on the type of aircraft operated by the carrier. Some

communities have as many as 2,000 members, and lack the infrastructure and runways for large planes. Therefore, the Ministry arranges for many smaller planes to evacuate the residents.

During our audit we noted that the Ministry does not have standing contracts with the air carriers guaranteeing availability at a competitive price. Instead, the Ministry maintains a list of eligible air carriers who, annually, provide their estimated rates in effect for the fiscal year. When planes are needed, the Ministry goes down its list of eligible vendors to find planes that are available.

Between 2017 and 2021, \$14.4 million was spent on charter flights for flood or fire evacuations in Northern Ontario. Based on our testing and analysis of air carrier invoices for the same period, the overall average cost for flights equated to roughly \$18 per standard mile, where rates ranged from as low as about \$7 per mile to as high as about \$40 per mile, depending on the vendor and/or aircraft. While the rate depends on the type of aircraft operated (e.g., smaller aircraft with 7–9 seat capacity are cheaper than planes with 27–36 seat capacity), we noted variability in the per mile rate for the same model/type of aircraft across vendors. Refer to **Figure 8** for examples of variability in rates across carriers.

The Ministry advised us that while the rates should be similar across vendors, there are times when noticeable cost differences occur in an emergent situation when only one aircraft is available. We also noted some instances when the actual rate charged by the air carrier exceeded the annual quote submitted to the Ministry, demonstrating that the annual estimated rates provided by eligible air carriers to the Ministry are informal estimates only and do not necessarily protect the Ministry against price gouging.

All costs incurred by the Ministry for the evacuation of First Nations communities between 2017 and 2021 were recovered by the Ministry from Indigenous Services Canada.

RECOMMENDATION 5

In order to be prudent with taxpayers' funds and to ensure timely access to air carriers at competitive

Figure 8: Comparison of Average Per Mile Rates Charged by Air Carriers for 2020/21 and 2021/22

Source: Ministry of Natural Resources and Forestry

Air Carrier	Rate Per Mile (\$)		
	DASH 8 100	DASH 8 300	BOEING 737-300
Carrier #1	10.23	12.88	12.39
Carrier #2	14.00	16.00	39.53
Carrier #3	21.00	21.68	n/a

rates in the event of an emergency evacuation, we recommend that the Ministry of Natural Resources and Forestry conduct a competitive tender and enter into fixed price contracts with air carriers.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry agrees with the importance of an effective value-for-money procurement process and contractual arrangements which maximize the availability of aircraft and provide the best value (e.g., minimize price) during an emergency event.

The Ministry will consult its internal procurement experts to determine the best procurement solution—one that maximizes the availability of aircraft and mitigates pricing variability, and is in accordance with the Ontario Public Service Procurement Directive and relevant inter-provincial and international trade agreements to which the Province of Ontario is a party. The Ministry will assess the availability of aircraft, the aviation market and pricing, and assess the best types of procurements and contractual arrangements to meet expected demands for the season and for emergent events.

4.1.6 Outdated Technical Guidance Leaves Local Governments and Communities Less Equipped to Manage Water-Related Natural Hazards

A series of natural hazard technical guides were developed and approved by the Natural Resources Ministry between 1996 and 2009 to support municipalities, First Nations and conservation authorities in the

implementation of policies for floods, drought, erosion and soil/bedrock instability. Refer to **Appendix 8** for a list of technical guides and bulletins issued by the Ministry for its assigned Order in Council hazards (that is, for water-related hazards and dam failures).

We noted that components of some current technical guides and associated standards are outdated, and in some cases, not publicly available online. This leaves local governments, First Nations and conservation authorities without direction and guidance on managing flood-susceptible land, meeting provincial standards in defining flood hazards through mapping, and conducting land-use planning and management that addresses shoreline flooding, erosion and other water-hazard problems—all of which can potentially lead to increased risk of flooding.

An example of an outdated guide is the Technical Guide – River and Stream Systems: Flooding Hazard Limit, which provides guidance on managing flood-susceptible land. This guide does not consider current technologies in climate and/or hydrological/hydraulic modelling, which aids in understanding and predicting flood flows and levels, and does not consider the effects of climate change on flood hazards.

According to the Ministry, to compensate for the lack of current guidelines, some conservation authorities have developed their own policies and technical guides.

RECOMMENDATION 6

So that local governments and conservation authorities have technical guides and bulletins that reflect current provincial standards and best practices with respect to flooding, erosion, soil and bedrock

instability (discussed in **Section 4.7.3**), and dam failures (discussed in **Section 4.4.4**), we recommend that the Ministry of Natural Resources and Forestry review and update its technical guides and bulletins regularly, as needed, and make all guides publicly available.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry will review and update its natural hazard technical guides and bulletins related to flooding, erosion, and soil and bedrock instability as needed, and will make all updated guides available to the public once the updates are complete.

4.2 Forest Fires

4.2.1 Ministry's Response Time to Fires between 2017 and 2021 Took Longer than the Maximum Target Time

The Aviation, Forest Fires and Emergency Services Branch (a branch of the Natural Resources Ministry) employs an alert system for the Province's initial response to forest fires. This sets a standard level of readiness for fire crews to respond to a fire. There are three levels: Red alert (immediate dispatch of fire crews required as soon as a fire is reported); Yellow alert (fire crews must dispatch within 30 minutes of reported time); Blue alert (fire crews must dispatch within four hours of reported time).

Fire indices and weather conditions are used to develop the alert status each day. For example, if there are already several fires in a district and the weather conditions indicate there is an increased risk of lightning storms, fire crews may be required to be on Red alert. The region communicates its updated alert status daily to fire crews so they are aware of their required dispatch times (the time from when the fire is reported to the Ministry to the time a fire crew leaves the station/current location to attend to the fire).

From our review of the 11 declared forest-fire emergencies in 2017–2021, seven were declared as a Red alert and required an immediate full response.

A full response involves an aggressive initial attack and sustained action until the fire is fully contained or extinguished. We noted that the Ministry has not defined the minimum time required for an immediate response under a Red alert. For our purposes, we defined “immediate” as dispatch efforts within 15 minutes of notification.

As seen in **Figure 9**, the median actual time taken to respond to a fire on a day with a Red-alert status was nine minutes. However, two fires took longer than the required “immediate” time frame for dispatch; it took seven hours to dispatch a crew to one of the fires and 15 hours to dispatch a crew to the other. The fire with the longest response time (at Wabaseemoong First Nation) had impacted 192 hectares of land by the time fire crews arrived on site. The Ministry had not fully documented the reason for the delays in its response efforts. The Ministry told us that the seven-hour delay happened on a day when there was only one crew available at fire headquarters; that crew had already been dispatched to another fire, and there were over 20 other new fires that day. Regarding the fire with the response time of 15 hours (at Bearskin Lake First Nation), the Ministry told us that it chose not to attempt to put out the fire on the same day because it was burning aggressively and would be unsafe to attack, the Ministry was short on fire fighters, and the location was far away from headquarters.

We further noted that in our review of the 11 declared emergencies, more of the forest was impacted by fire when the decision was made to initially just monitor the fire rather than send a crew. As seen in **Figure 9**, the three fires that the Ministry chose to monitor (which occurred at Red Lake, Wabaseemoong First Nation and Deer Lake First Nation in the summer of 2021) resulted in 281,400 hectares being burned. According to Ministry staff, forest fires are initially monitored based on a combination of factors, such as whether there is a low risk of loss of ecological, social and economic resources, anticipated suppression costs are high, or work conditions for staff are particularly hazardous.

Of the 3,873 fires from 2017–2021 that required a full response, it took longer than the maximum amount

Figure 9: Time Taken to Dispatch a Fire Crew and Extinguish Fires for all Declared Forest Fire Emergencies (2017 to 2021) and Related After-Action Reviews

Source: Ministry of Natural Resources and Forestry

Fire Location	District	Date	Alert Status	Full Response Required?	Required Dispatch Time	Actual Time to Dispatch Fire Crew (Hours and Minutes) ²	Time Taken to Get to Fire Site and Begin Fighting the Fire (Hours and Minutes) ³	Time Taken to Put Out Fire (in Days) ⁴	Hectares Impacted
Henvey Inlet First Nation	Parry Sound	Jul 18, 2018	Red	Yes	Immediate ¹	0:09	0:56	105.19	11,363
Ginoogaming First Nation	Nipigon	Jul 10, 2020	Red	Yes	Immediate	0:09	1:14	1.03	0.1
Fort Hope First Nation (Eabametoong)	Nipigon	Aug 9, 2020	Red	Yes	Immediate	0:15	1:37	37.89	6,678
Red Lake ⁵	Red Lake	Aug 10, 2020	Red	Yes	Immediate	0:03	0:07	24.89	552
Red Lake	Red Lake	Jun 8, 2021	Red	No – monitor	n/a ⁶	n/a ⁶	n/a ⁶	91.89	36,038
Wabaseemoong First Nation ⁵	Kenora	Jun 30, 2021	Red	No – monitor	n/a ⁶	n/a ⁶	n/a ⁶	144.90	191,811
Deer Lake First Nation	Red Lake	Jul 5, 2021	Red	No – monitor	n/a ⁶	n/a ⁶	n/a ⁶	97.11	53,522
Bearskin Lake First Nation	Sioux Lookout	Jul 7, 2021	Red	Yes	Immediate	14:57	22:17	18.89	257
Pikangikum First Nation	Red Lake	Jul 12, 2021	Red	Yes	Immediate	0:02	0:09	0.39	0.1
North Spirit Lake First Nation	Red Lake	Jul 17, 2021	Blue	Yes	Up to 4 Hours	0:10	0:55	0.92	0.7
Cat Lake First Nation	Sioux Lookout	Jul 20, 2021	Red	Yes	Immediate	7:07	19:47	2:15	1.3
Median actual response times for “Red alert” events						0:09	1:14	24:89	

1. “Immediate” response time is not defined, but we have defined it as 15 minutes.
2. Time from fire detection to when fire crew leaves Fire Management Headquarters.
3. Time from fire detection to arrival at the site to begin firefighting operations.
4. Time from fire detection to fire extinction.
5. After-action report prepared (discussed in [Section 4.2.7](#)).
6. This information was not recorded by the Ministry because the initial response was only to monitor the fire.

of response time of four hours to dispatch fire crews to 15% of the fires. For forest fires in 2021 that required a full response, the average time to dispatch a fire crew was greater than four hours in 20% of districts: namely, Dryden (13.6 hours), Cochrane (11.0 hours), Fort Frances (10.4 hours), Sioux Lookout (8.2 hours), and Thunder Bay (6.4 hours). In comparison, the average time to dispatch a crew was greater than four hours in 16% of districts in 2020 and 2019, and 20% of districts in 2018.

We noted that the Ministry does not track and fully document the reasons for the delays in dispatch time, nor does it calculate and track the average time it takes to dispatch a crew or to extinguish a fire. According to the Ministry, it does not track the average time it takes to dispatch a crew because of variables such as the availability of fire crews; alert status; and mode of transportation. The Ministry also does not track the amount of time to extinguish a fire because of variables such as, the size, location, and behaviour of the fire; the time of year; resource availability; and response objective. However, tracking of such information would help identify operational issues that need to be addressed in order to meet the response times set for forest fires.

We noted that the Ministry does track the results of the initial attack success rate in the case where the Ministry is the first responder. The success rate is measured by the percentage of forest fires that require a full response and whether the fire met one of two criteria: (1) the size of the fire was less than four hectares; or (2) the fire was contained by noon the next day. The Ministry's target success rate is 96%. British Columbia has a similar metric, but it measures fires that are contained by 10 a.m. the following day and has a target of 94%. We noted that the Ministry did not attain its target of 96% in the past five years, and has not performed any assessments to understand the rationale for the times it underperformed. The initial attack rate achieved in 2020/21, the last fiscal years for which we have information, was 90%. Further information regarding key performance indicators is discussed in **Section 4.10**.

RECOMMENDATION 7

So that forest fires are responded to under the maximum target times, we recommend that the Ministry of Natural Resources and Forestry:

- track whether required response times are met based on alert levels;
- where response times are not met, identify and fully document the reasons for delays; and
- take corrective actions to improve future response times.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry will track response times against established Alert Levels. The Ministry will also identify and fully document the factors affecting response times. As well, the Ministry will review those findings to determine and take corrective actions as appropriate. Response times are dependent upon a number of factors in addition to Alert Levels.

The Ministry will review the information technology and business intelligence system enhancements that may be required to support the identification of aggregate trends in response times and any associated corrective actions.

4.2.2 Lessons Learned from Past Responses to Forest Fires and Practice Exercises Are Not Fully Identified or Incorporated into Ministry Emergency Response Plans

As noted in **Section 4.1.2**, Ministry staff are responsible for conducting a post-mortem and completing an after-action report following significant incidents and all exercises to identify opportunities for improvement and corrective actions. A significant fire incident is not defined in the Ministry's Emergency Response Plan; however, for the purposes of our audit we treated all fires that were declared an emergency to be a significant incident.

For the 11 declared emergencies for forest fires from 2017–2021, we found that the Ministry had prepared after-action reports for only two. One of the post-mortems was done almost seven-and-a-half months after the incident. The Ministry was unable to provide us with after-action reports for the remaining nine emergencies. According to the Ministry, the declaration of an emergency is not considered a trigger for a post-mortem. The Ministry told us a review could be triggered in cases where a fire being fought gets out of control, results in significant damage or results in high costs to control. While the Ministry did not have a list of fires that met these criteria, we received and reviewed several after-action reports of non-declared emergencies, and found that they were often brief in nature, with little detail as to what went well and what could be improved. According to the Ministry, informal reviews are also performed verbally by fire crews. However, because these are not documented, we could not confirm if this was the case, what problems were noted and whether corrective action was taken.

From the after-action reports we reviewed, we found the following concerns noted by participants:

- expectations and priorities could be better communicated upon arrival to a fire;
- dispatch times were delayed;
- truck fleets required more maintenance; and
- there were issues with mobile communication infrastructure and technology, especially in the far north.

However, in the reports there were no details on how the concerns would be addressed for the future.

The Ministry also completed an end-of-year after-action report for the 2018 fire season in November 2018. We were told that this end-of-year review was a one-off, as the Ministry responded to more than the average number of fires that year (1,300 versus the annual 20-year average of 1,000 fires) that impacted 266,000 hectares. We noted that more recent post-mortem was not timely. For example, while the 2021 fire season included 1,200 fires that impacted 785,000 hectares, the Ministry was still working on completing the after-action report one year after the end of the fire season which was October 2021.

Provincial regulation mandates that an annual exercise for a simulated emergency incident should be conducted by the Ministry Action Group to evaluate the Ministry’s emergency plans. In the 2017–2021 period, one practice exercise related to forest fires was completed by the Ministry Action Group in 2017. This was only a table-top exercise rather than a simulated emergency. An after-action report was completed for this practice exercise; however, the recommended improvements were not assigned to specific individuals and instead attributed to the entire Emergency Management Unit. In addition, the Ministry told us it does not formally track the completion and status of the recommendations. Without an effective strategy of incorporating lessons learned from past events and practice exercises, recurring issues may continue to arise during future emergencies.

RECOMMENDATION 8

To improve future response to forest fires, we recommend that the Ministry of Natural Resources and Forestry:

- develop criteria to identify which forest fires are considered “significant” for the purpose of performing an after-action review;
- conduct after-action reviews for “significant” forest fires and formally document the findings in a standardized and timely manner;
- conduct practice exercises with fire crews and emergency management staff on an annual basis, and complete an after-action review after each exercise; and
- take timely action to address areas needing improvement from past forest fires and practice exercises, and ensure that progress is tracked, followed-up and reported on until fully implemented.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry agrees to develop a protocol for after-action reviews for wildland fires based on the incident type/severity. The Ministry will also

conduct timely after-action reviews for wildland fires and practice exercises in accordance with that protocol. The Ministry will identify areas needing improvement in these reviews, and ensure that progress is tracked, followed up and reported on until fully implemented.

The Ministry will also undertake a multi-year review to modernize natural resource disaster management within the Ministry. This review may establish new policy and program frameworks that may impact the process of after-action reviews.

4.2.3 FireSmart Planning and Implementation Does Not Align with Best Practices

FireSmart, a planning tool designed to reduce the likelihood of uncontrollable wildfires near communities and infrastructure, is one of the Natural Resources Ministry's key fire prevention strategies. The national program is built on partnerships between government, industry and homeowners across Canada.

We noted that over the last three fiscal years (2019/20–2021/22), the Ministry budgeted \$1 million for the FireSmart Program, but only spent \$452,500. The Ministry told us that this was primarily due to the impact of COVID-19. As a result, we noted that few communities were receiving provincial funding to help them reduce the risk of wildfires.

Between 2019/20 and 2021/22, funding was allocated to wildfire protection plans (\$195,000), marketing for prevention and mitigation (\$168,000), French-language services (\$61,000), advisory/out-reach services for FireSmart (\$2,000), FireSmart Community Preparedness Day Grants (\$8,500) and publishing FireSmart manuals and prevention materials (\$18,000). However, funding was not targeted to districts that were assessed as having an extreme or high risk of fires. In addition, no funding was allocated to unorganized territories, including those in high-risk districts.

Wildfire Protection Plans are intended to help communities assess their wildfire risk and make recommendations to lessen the threat and impact from

forest fires. We noted that as of August 2022, only 15 municipalities in Northern Ontario had a Wildfire Protection Plan in place. This represents about 10% of 144 municipalities in Northern Ontario. The Ministry did not know how many would benefit from Wildfire Protection Plans. In comparison, 22% (23 of 106) First Nations communities in Northern Ontario had a Wildfire Protection Plan in place as of August 2022. Further, we noted 63% of districts with a rating of extreme or very high risk of fire had no municipalities with Wildfire Protection Plans.

We noted that Ministry staff have not followed up with municipalities to see if they are following the recommendations included in their Wildfire Protection Plans. In contrast, British Columbia fire-mitigation staff told us that they follow-up with and support all of the communities that complete wildfire plans.

We also noted that there has been little focus on the FireSmart Recognition program in Ontario. This program is designed to encourage neighbourhoods to implement solutions for wildfire safety. FireSmart recognition status is earned when communities meet criteria including creating a Neighbourhood Plan to mitigate the risk of fire, conducting FireSmart events annually, and submitting an annual report to FireSmart Canada that documents compliance with the program. At the time of our audit, only one community in Ontario had ever been granted FireSmart recognition status (the Elliot Lake Lakeshore FireSmart Committee in 2016). In comparison, British Columbia has over 150 recognized communities.

RECOMMENDATION 9

To align its fire prevention activities with best practices, we recommend that the Ministry of Natural Resources and Forestry:

- broaden the scope, awareness and adoption of FireSmart initiatives at the local community level;
- engage communities, especially unorganized territories, in FireSmart programs such as the FireSmart Neighbourhood Recognition; and

- prioritize and target funding to communities and unorganized territories in districts that are assessed as having an extreme or high risk of fires.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry accepts this recommendation and will work with federal, provincial, and territorial partners to develop a national prevention and mitigation strategy that includes the development of a whole-of-society approach to prevention and mitigation. This work will raise awareness nationally and within Ontario to promote prevention including the promotion of FireSmart.

The Ministry is also in the early stages of a natural resource disaster management program review where a complete analysis of its wildland fire prevention and mitigation program (such as FireSmart) is planned with the aim of establishing future program strategic direction, updated implementation strategies and enhanced support requirements.

4.2.4 Key Prevention and Mitigation Strategy Documents Have Not Been Updated in Many Years

We reviewed the Ministry's key prevention and mitigation strategy documents, including the Ontario Wildland Fire Management Strategy and the FireSmart Strategy and Implementation Plan, and noted that the documents had not been updated in several years and may not meet emerging needs.

The Ontario Wildland Fire Management Strategy (2014) provides strategic direction for the Ministry's management of wildland fires within the province with a focus on prevention, mitigation, response, awareness and gaining the support of Ontarians regarding the ecological role of wildland fire. The strategy has not been updated in eight years. While the strategy emphasizes a mitigation approach based on the promotion and implementation of FireSmart initiatives, it was

written before the Province started to provide funding to communities for the FireSmart program. In addition, although climate change is mentioned in two sentences, it has not been built into the strategy.

The FireSmart Strategy and Implementation Plan (2015–2020) was established at the beginning of the FireSmart program in Ontario, but the plan has not been updated since.

The drafting of an updated prevention and mitigation strategy is currently on hold, although the Ministry reported that it is in the midst of reviewing the program. Yet, unlike other jurisdictions such as Alberta and British Columbia, there has not been any widespread community and homeowner survey or consultation toward the development of a strategic plan. In British Columbia, for example, a comprehensive research program was established to inform the British Columbia FireSmart Committee's long-term strategy; this included a survey of 1,000 British Columbians and interviews with 40 informed stakeholders and partners.

We also noted that the British Columbia FireSmart Committee initiated an examination of the lethal June 2021 Lytton wildland-urban fire disaster. Many of the recommendations are applicable to Ontario. Of particular importance is the need to: focus on proactive mitigation activities to directly reduce the susceptibility of homes, businesses and critical infrastructure to fire; engage residents and local/provincial emergency management personnel in a long-term partnership to raise awareness of fire hazards; develop a functional framework for action, and promote fire-risk reduction activities.

RECOMMENDATION 10

So that the Ministry of Natural Resources and Forestry's prevention and mitigation strategy for forest fires reflects and meets emerging needs, we recommend that the Ministry update its Wildland Fire Management Strategy and FireSmart Strategy and Implementation Plan with input from experts, community stakeholders, and best practices employed by other provinces.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry accepts this recommendation, and is in the early stages of a natural resource disaster management program review where a complete analysis of its wildland fire policies (e.g., Wildland Fire Management Strategy), and prevention and mitigation strategic policies and programs (such as FireSmart) are planned, with the aim of establishing future program strategic direction, updated implementation strategies and enhanced support requirements. During this process the Ministry plans to consult with experts and community stakeholders, and identify best practices employed by other provinces.

4.2.5 Not All Firefighters Have Completed Required Training

The Natural Resources Ministry has established physical performance standards and minimum training requirements for fire crew members involved in battling forest fires. Depending on the position, required training can include up to nine courses, such as Forest Fire Fighter Training; Ontario Fire Ranger Crew Proficiency; Bear Encounter Safety; and Standard First Aid. Certain courses also need to be re-taken periodically, generally every three years, to maintain proficiency.

We tested whether a sample of fire crew members from 10 Fire Management Headquarters across the province were up to date on their required training as of May 2022. During the course of our audit, we found that the Ministry's Personnel Information Management System, which is used to store training records electronically, was not up to date. We found that electronic training records were not up to date for 20% of the fire crew members we sampled. Overall, as of May 2022, 10% of the fire crew members sampled had not completed all required training.

We further noted that the Ministry's Personnel Information Management System does not automatically alert the firefighters or their supervisors when a firefighter's training is about to expire. Without looking

at everyone's individual record, supervisors at the local office would have difficulty identifying which fire crew members have completed all required training.

RECOMMENDATION 11

So that firefighters are compliant with required training, we recommend that the Ministry of Natural Resources and Forestry:

- track all required training courses taken by wildland firefighters within the Personnel Information Management System; and
- have the IT system alert firefighters and their supervisors when a firefighter's training is approaching expiry.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry agrees with the recommendation to track all required training courses taken by wildland firefighters within an appropriate human resource/training management system. The Ministry has identified the application system responsible for tracking training information for renewal within its multi-year information technology (IT) modernization plan, and will include features that will alert firefighters and their supervisors, when a firefighter's training is approaching expiry.

4.2.6 Evacuation Figures Misrepresented to Treasury Board Secretariat

In March 2022, Emergency Management Ontario (EMO) submitted an application to the Treasury Board Secretariat to enter into three non-competitive agreements for an estimated \$91.7 million to plan and implement two emergency models for First Nations evacuees from floods and forest fires. To support its request, EMO included an appendix that summarized the number of First Nations evacuees from floods and forest fires over the past 10 years.

However, we noted discrepancies between the figures reported in the Treasury Board Secretariat

submission and the detailed breakdown we later obtained from EMO. For example, the submission said there had been 4,120 evacuees in 2018. When we requested additional details to support this figure, we learned that only 1,799 individuals were evacuated, while the remaining individuals were on alert but never evacuated.

When we asked about the apparent discrepancy, EMO responded that the intent of including these numbers in the Treasury Board Secretariat submission was to demonstrate the potential scale of evacuation and that, in retrospect, a note should have been included explaining that the numbers represented were a combination of actual and potential evacuees.

Of additional concern was the lack of information gathered by EMO with respect to evacuations. We noted that it does not maintain statistics on the method of evacuation (e.g., aircraft, road, self-evacuation) which would be useful information to better understand costs and prepare for future evacuations.

RECOMMENDATION 12

To improve the decision-making process for future evacuations during emergency situations, we recommend that Emergency Management Ontario:

- collect additional data on evacuees, including the method of evacuation and related costs; and
- review data in submissions to senior management and the Treasury Board Secretariat to ensure that factually accurate and complete information is submitted.

EMERGENCY MANAGEMENT ONTARIO RESPONSE

The Treasury Board Secretariat, through Emergency Management Ontario, will continue to support decisions by First Nations communities to evacuate and will plan for and report on evacuations using actual and projected data on a contingency basis.

Emergency Management Ontario remains committed to continuous improvement in data collection with relevant partners that support

emergency management and response. This includes collecting data on the methods of provincially coordinated evacuation and related costs, and disaggregating actual and projected data in Treasury Board submissions to better assist in contingency planning.

4.3 Abandoned Mines

4.3.1 Most Abandoned Mine Sites Have Not Been Rehabilitated

Based on our analysis of the mines database, Abandoned Mines Information System, 3,942, or 69%, of the 5,746 abandoned mine sites in Ontario are known to have mine features that were considered a hazard as of April 2022. The majority of these mines are owned by the private sector, as shown in **Figure 10**.

At the time of our audit, only 111 (or 3%) of sites had been partially rehabilitated, 2,335 (59%) sites had not been rehabilitated, and the rehabilitation status of the remaining 1,496 sites was unknown.

For the 2,335 sites that have not been rehabilitated, closure plans were in place for only 41 of these sites. Mines Ministry staff told us this could be due to owners of privately held mine sites undertaking rehabilitation of the mine hazards through “progressive rehabilitation” and not notifying the Ministry so that the database could be updated. The *Mining Act* defines progressive rehabilitation as “rehabilitation done continually and sequentially during the entire period that a project or mine hazard exists.” The *Mining Act* allows the mine owner to progressively rehabilitate a mine hazard or site with or without a closure plan having first been filed. In addition, if the hazards are on, in and/or under mine sites on Crown lands, according to the Ministry, it does not prepare a closure plan because the entire Act is not binding on the Crown.

According to Ministry staff, the “unknown” rehabilitation status of the 1,496 abandoned mine sites could be due to inaccurate or insufficient information on a mine feature that prevented the Ministry from determining the hazard status for the mine. A mine feature may be man-made (such as a mine shaft) or natural (such as a trench) and can have an impact on public

Figure 10: Type of Ownership of Abandoned Mine Sites in Ontario and Their Rehabilitation Status

Source: Ministry of Mines

Ownership	Mines with Hazards									
	Total Abandoned Mines		Partially Rehabilitated		Not Rehabilitated		Unknown Rehab Status		Total	
	#	%	#	%	#	%	#	%	#	%
Private	3,247	57	66	60	1,311	56	990	66	2,367	60
Crown	2,324	40	37	33	940	40	448	30	1,425	36
Mixed	175	3	8	7	84	4	58	4	150	4
Total	5,746	100	111	100	2,335	100	1,496	100	3,942	100
Breakdown of Rehabilitation Status (%)			3		59		38		100	

health, safety and/or environment. We were told mine features with an “unknown” rehabilitation status in the database either stem from historic records that did not contain the information required to determine the rehabilitation status or a site assessment that could not locate the feature in the field because it had already been rehabilitated without record.

According to Ministry data, between 2011/12 and 2021/22, \$103 million was spent to rehabilitate 47 abandoned mine sites.

RECOMMENDATION 13

To protect public health, safety and the environment from abandoned mine hazards that have not been rehabilitated, we recommend that the Ministry of Mines:

- determine the status of all abandoned mines;
- prioritize and rehabilitate abandoned mines with hazards; and
- take steps to ensure mine owners notify the Ministry when owners have fully rehabilitated their abandoned mines.

MINISTRY OF MINES RESPONSE

The Ministry of Mines will continue to update information and the status of all abandoned mines in the Abandoned Mines Information System database (AMIS) as new information becomes available.

The Ministry will accelerate the prioritization and rehabilitation of high-risk abandoned mine sites based on available resources.

The Ministry will review the current reporting process and will consider education and outreach improvements and other tools for rehabilitation reporting.

4.3.2 The Process for Selecting Mines for Inspections Is Not Documented

The first step toward rehabilitating hazards in abandoned mines is to conduct an inspection at the mine site. Both operating and abandoned mines on Crown and private lands are inspected by the Mines Ministry to ensure compliance with mining regulations and to minimize the impact of mine hazards on public health, safety and the environment. Ministry inspections are generally conducted from mid-May to mid-October, depending on the weather particularly in the Far North.

We analyzed the mines database to determine the number of inspections planned for and conducted from 2016/17 to 2021/22. As seen in **Figure 11**, for fiscal years 2016/17–2021/22, the Ministry planned to inspect 125 of the 3,942 (or 3%) of the abandoned mine sites with known hazards. However, only 70 of these mine sites ended up being inspected.

Figure 11: Number of Abandoned Mine Site Inspections Planned and Completed, 2016/17–2020/21

Source: Ministry of Mines

Fiscal Year	Planned	Completed	% Completed
2016/17	18	9	50
2017/18	17	13	76
2018/19	24	14	58
2019/20	27	15	56
2020/21	29	14	48
2021/22	10	5	50
Total	125	70	
Annual Average	21	12	56

We also analyzed inspection data recorded in the Ministry's mines database and found that 72% of the abandoned mines were last inspected more than 10 years ago (before 2011), and another 25% of the abandoned mines had no known inspection date. We also found that 44% of operational mines were last inspected more than 10 years ago (before 2011), and another 25% of operational mines had no known inspection date (see **Figure 12**).

At the time of our audit, the Ministry did not have a documented process for selecting mines for inspection. We were told that abandoned mine sites were selected for inspection based on complaints, prior knowledge of the hazards on site, or other factors, such as whether an inspector was conducting an inspection of another mine site in the same area.

In 2020/21, the Ministry developed a risk-based methodology for selecting for inspection operating mine sites with closure plans. Sites were assigned a score based on risk factors such as an outdated closure plan, insufficiency of financial assurance to cover rehabilitation costs, or an unfavourable compliance history on the part of the operator. A mine site that scored 120 and above was targeted for inspection every five years, while sites scoring below 120 were to be inspected every 10 years.

Prior to 2022, the Ministry was not using a risk-based approach to select abandoned mines for inspection. Starting in the 2022/23 fiscal year, the

Ministry adopted a risk-based methodology in which abandoned mine sites are scored every year based on certain risk factors. These factors include unprotected mine openings, derelict and deteriorating buildings on-site, waste rock piles on-site, or proximity to a community or a body of water. The Ministry expects to obtain information on these risk factors from previous site inspections.

RECOMMENDATION 14

To enable inspectors to carry out their duties and responsibilities efficiently and effectively, we recommend the Ministry of Mines:

- follow a risk-based approach to selecting both abandoned and operational mines for inspection;
- properly document the result of the selection process; and
- conduct planned inspections on a timely basis.

MINISTRY OF MINES RESPONSE

The Ministry of Mines will develop guidance on the selection of abandoned mine inspections for a risk-based approach comparable to the approach currently in use for operational mines.

The Ministry will develop a procedure that documents the results of the inspection selection process for both operational and abandoned mines. The Ministry has recently adopted a Digital Compliance Platform that will improve efficiencies for tracking, documenting and reporting outcomes of inspections.

The Ministry will strive to conduct all planned inspections of high-risk abandoned and operational mines under its jurisdiction. The Ministry has recently adopted a digital tool for inspectors to take on-site and record inspection results in real time. This is expected to improve efficiencies for tracking, documenting and reporting outcomes of inspections, as well as allow for the completion of more planned inspections. The Ministry will review resources and the scope of inspections in efforts to increase planned inspections.

Figure 12: Last Known Year of Inspection for All Mines

Source: Ministry of Mines

Year of Last Inspection	# of Mines		Total
	Abandoned	Operational ¹	
2021	0	7	7
2020	5	5	10
2019	8	9	17
2018	4	7	11
2017	6	19	25
2011–2016	149	115	264
2000–2010 ²	2,335	128	2,463
1999–1970 ²	1,603	58	1,661
Prior to 1970 ²	217	5	222
Unknown ³	1419	82	1,501
Total Mines	5,746	435	6,181

1. Includes advanced exploration projects; producing mines; operations being closed (in the final stages of closure with all requirements of a filed closure plan complied with); mines in a state of inactivity (indefinite suspension of a project in accordance with a filed closure plan and the site is not continuously being monitored); and temporary suspension (planned or unplanned suspension of a project in accordance with a filed closure plan, with the site being monitored continuously by the owner).

2. 72% of abandoned mines were inspected prior to 2011.

3. 25% of abandoned mines have no known inspection date.

4.3.3 Public Awareness Program to Alert People to the Hazards of Abandoned Mines Offers Little Protection

Mining activity is governed by the *Mining Act*, which makes the Mines Ministry responsible for minimizing the impact of mining activities on public health, safety and the environment. One way the Ministry has attempted to do this is by creating public awareness of the hazards of abandoned mines through its Stay Out! Stay Alive! public education program. This initiative, which began in 2012, consists of a one-page bulletin that briefly touches on the dangers of abandoned mines in Ontario and offers the public general tips, such as paying attention to mine hazard warning signs.

At the time of our audit, this bulletin was not posted on the Ministry's website nor was it available on any other social media outlet. The Mines Ministry has no other public education programs on abandoned mines.

We were informed by senior ministry management that the effectiveness of the program is not being measured, and that statistics are not maintained regarding

abandoned mine incidents involving the public because there is no legislative requirement to do so.

We also noted that the Mines Ministry has not taken steps to counter potentially dangerous information available online regarding abandoned mines. We were able to access several videos online that instead promoted the adventure and thrill of exploring abandoned mines in Ontario.

RECOMMENDATION 15

To protect and better educate the public on the dangers of abandoned mines, we recommend the Ministry of Mines:

- review and update the Stay Out! Stay Alive! program for current relevance and ways to publicly communicate the dangers of abandoned mines;
- review online videos that encourage exploring abandoned mines in Ontario and take steps to have them removed from online access; and

- measure and report on the effectiveness of the Stay Out! Stay Alive! program.

MINISTRY OF MINES RESPONSE

The Ministry of Mines will review current practices to publicly communicate the dangers of abandoned mines and will develop a communications strategy and strengthen its Stay Out! Stay Alive! program as a key educational/outreach tool.

The Ministry will consider the appropriate action when it becomes aware (e.g., via online videos) that trespassing may have occurred or have been encouraged on an abandoned mine site. Currently there are no legislative tools that provide the ability for the Ministry to legally request the removal of online content that encourages exploration of abandoned mines or to prevent access to public Crown lands with abandoned mines. Through its Stay Out! Stay Alive! program, the Ministry will develop educational materials to distribute online and also explore encouraging online platforms to consider the dangers and request removal of online videos.

The Ministry will develop performance measures and report on the effectiveness of the Stay Out! Stay Alive! program.

4.4 Dam Hazards

4.4.1 Half of Ministry Dams Will Reach End of Useful Life Within 20 Years

As dams age and deteriorate, the likelihood of dam failure increases. According to Ministry documents, the serviceable life expectancy of the existing dam infrastructure in Ontario is 75 years, while the life expectancy of a new dam is 100 years. Almost half, or 146 of 316, of the Natural Resources Ministry's dams will reach the end of their serviceable life within 20 years and will either need to be replaced, require major rehabilitation, or need to be decommissioned (see **Figure 13**). This number may be higher as the age of an additional 59 dams is unknown. However, the Ministry has assessed the replacement value of only 64, or 31%,

of those dams and valued the cost of replacement to be \$321 million. Therefore, actual replacement costs may be three times that amount.

RECOMMENDATION 16

In order to prevent and address the risk of dam failure proactively, we recommend that the Ministry of Natural Resources and Forestry:

- complete the assessment of dams that will reach the end of their serviceable life within 20 years to determine the amount that will be needed to rehabilitate, reconstruct or decommission these dams; and
- prioritize and rehabilitate, reconstruct or decommission dams approaching the end of their serviceable life.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry agrees with this recommendation. A new inventory tracking tool is in development that will help support this recommendation. The Ministry will assess 20% of its dams annually to complete the inventory over the next five years. The Ministry will use the assessment to prioritize the rehabilitation, reconstruction or decommissioning of dams.

4.4.2 Ministry Missing Key Information Needed to Properly Monitor Dams

The Natural Resources Ministry has developed a Long-Term Infrastructure Plan to undertake capital projects with respect to its dams. This is a 10-year plan which is updated annually. The following are types of capital projects undertaken on dams:

- Major rehabilitation—repairs that can extend the useful life of a dam by an estimated 40–50 years.
- Replacement or reconstruction of a dam.
- Dam divestment—transferring the ownership or operation to another party. In such cases, the

Figure 13: Age of Dams and the Current Replacement Value for those Assessed

Source: Ministry of Natural Resources and Forestry

Age of Dams (years)	# of Dams in Total	# of Dams with Assessment Replacement Costs	Value of Current Assessed Replacement Costs (\$ million)
0-25	8	6	39.8
26-55	103	45	121.5
56-75	120*	54	257.3
76-100	22*	4	59.7
> 100	4*	0	0
Unknown	59*	6	3.8
Total	316	115	482.1

* 146 dams (or 46% of the total) are over the age of 55 and will reach the end of their serviceable life within 20 years. An additional 59 dams (or 19%) may also be over the age of 55. The Ministry has assessed the replacement value for only 64 (31%) of those 205 dams, estimating that value at \$321 million.

Ministry must often update, upgrade or repair the asset before it is accepted by the receiving party.

- Dam decommissioning—full or partial removal of a dam.

According to the Ministry, its long-term infrastructure plan is developed with input from ministry engineers and takes into consideration the Ministry's constrained resources. As such, it prioritizes capital projects using information regarding the state of each dam and the possible impact should a specific dam fail. Inspections conducted by a professional engineer provide the Ministry with the data needed to prioritize construction projects.

We reviewed information in the Ministry's IT system used to prioritize the 316 dams it owns for rehabilitation, reconstruction and/or other capital projects, and noted that important information was missing. For example:

- For 205 of the 316 dams (or 65%), the Ministry did not have sufficient information to assign a Facility Condition Index, which is used to determine the condition of the dam. This index compares the estimated cost to rehabilitate a dam to its estimated current replacement value.
- The Ministry had not calculated the Total Failure Index for 142 of the 316 dams (or 45%). This index is used to measure the likelihood of a dam failure and is a key consideration when

determining which dam should be prioritized for rehabilitation.

- The year of construction was missing for 59 of the 316 dams (or 19%), which meant the age of the dam was unknown.
- 101 of the 316 dams (or 32%) had an unknown Hazard Potential Classification Score. This score is used to measure the impact of a dam failure and to determine the type and frequency of inspections (see **Figure 14**).
- 167 of the 316 dams (or 53%) did not have an assigned priority marker to prioritize which dams should undergo rehabilitation. Any dams missing either a Total Failure Index Score or a Hazard Potential Classification Score would also be missing a priority marker.

We also noted that the Ministry was not tracking the type of capital projects undertaken, that is, whether the dams were rehabilitated or replaced, or whether they were divested or decommissioned. Between 2017 and 2021, the Ministry undertook 15 capital projects on average each year, and spent \$30 million in total, with annual capital costs ranging from \$2.4 million in 2018 to \$10.75 million in 2019.

RECOMMENDATION 17

In order to better plan for, prioritize and manage the capital spent on rehabilitation, reconstruction

Figure 14: Type and Frequency of Dam Inspections

Source: Ministry of Natural Resources and Forestry

Type of Inspection	Description	Frequency
Dam Safety Reviews	Carried out by external qualified engineers	Every 10 years, for dams whose Hazard Potential Classification category is high to very high
Engineering Inspection	Carried out by Ministry engineers or external qualified engineers	Every 5–10 years, depending on each dam's Hazard Potential Classification Score
Visual Inspections	Carried out by Ministry staff	Frequency not specified in Ministry documents

and/or other capital projects for all of its dams, we recommend that the Ministry of Natural Resources and Forestry, on a regular basis:

- evaluate the condition of each dam, or as per industry best practices;
- determine and update the Facility Condition Index, Total Failure Index and Hazard Potential Classification Score for each dam;
- update the Long-Term Infrastructure Plan based on the new information; and
- track the status of each dam, that is, whether the dam has been rehabilitated, replaced, divested or decommissioned.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry agrees with this recommendation and will use the assessment to prioritize the rehabilitation, reconstruction or decommissioning of dams. The Ministry will also determine and update the missing key dam information. The Long-Term Infrastructure Plan will be updated based on the key information obtained and the Ministry will track the rehabilitation status of each dam.

A new inventory tracking tool is in development that will help support this recommendation.

4.4.3 Ministry Not Regulating/Inspecting Dams Owned by Other Parties

The Natural Resources Ministry estimates that there are about 3,500 dams located in Ontario, and only about 10% are Ministry-owned. The remaining dams

are owned by the Ministry of the Environment, Conservation and Parks, Ontario Power Generation, the federal government and private operators. The Ministry indicated to us that, although it is assigned responsibility for hazards resulting from dam failures, it does not know the exact number of dams in the province.

The Ministry is also responsible for administering the *Lakes and Rivers Improvement Act* and its associated regulations. Under this Act, its responsibilities include conducting periodic compliance monitoring and enforcement (including Minister's Orders) with respect to dams. However, the Ministry does not conduct periodic inspections or reviews of dams, except for those that it owns. The Ministry argues that its role as a regulator of privately owned dams under the Act is limited to providing approvals for construction of new dams and changes to dams.

We obtained a legal opinion on whether the Ministry can conduct ongoing inspections of privately owned dams and were informed that the Ministry has broad regulatory authority and enforcement powers under the *Lakes and Rivers Improvement Act* that allow it to inspect privately owned dams, and to audit dam owners and review their records. The Ministry also has powers to issue binding orders to ensure that dam owners are complying with all applicable laws, approvals, plans, and agreements, not only during the design and construction phases, but also on an ongoing basis after a dam has been built.

Not inspecting privately owned dams increases the risk of a dam failure. It is also contrary to the roles and responsibilities of the Natural Resources Ministry as laid out in the Administrative Guide to the *Lakes and*

Rivers Improvement Act, which states that the Ministry is responsible for “conducting periodic compliance monitoring (e.g., inspections, selective reviews and investigations) and enforcement (including Minister’s Orders) to ensure the intent of the (Act) is being met.” As a point of comparison, the Mines Ministry inspects mine tailings dams even when they are privately owned.

RECOMMENDATION 18

To reduce the risk of unexpected dam failure and to better warn the public about potential dam failures, and prevent dam-related emergencies, we recommend that the Ministry of Natural Resources and Forestry:

- develop and maintain a registry of all dams, both public and privately owned; and
- develop a program to identify all high-risk dams and conduct timely inspections accordingly.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

Dam owners are responsible for the safe operation and maintenance of their structures and for ensuring they remain in compliance with the *Lakes and Rivers Improvement Act*, and any approvals issued thereunder.

The Ministry assists dam owners in carrying out their responsibilities by providing them with guidance on conducting Dam Safety Reviews and encouraging them to follow industry standards for ongoing inspection and maintenance produced by the Canadian Dam Association. The Ministry will review and update the current Dam Safety Review Best Management Practices to ensure that it aligns with industry best practices.

OFFICE OF THE AUDITOR GENERAL OF ONTARIO RESPONSE

The Ministry of Natural Resources and Forestry has not committed to develop and maintain a registry of all dams in the province that includes privately

owned dams, and to identify high-risk dams and ensure they are inspected on a timely basis. As noted above, the Ministry has broad regulatory authority and enforcement powers under the *Lakes and Rivers Improvement Act* that allow it to inspect privately owned dams, and to audit dam owners and review their records.

4.4.4 Ministry Has Not Updated Most Technical Bulletins for Dams Since 2011

The Natural Resources Ministry is responsible for issuing Technical Bulletins that specify the requirements for dams. While it has done so, two-thirds of applicable Technical Bulletins were issued or updated more than 10 years ago, as seen in **Appendix 8**, and may be outdated due to changes to risk assessments and construction standards. These Technical Bulletins are in place to support the administration of the *Lakes and Rivers Improvement Act* and are intended to cover mandatory requirements as well as technical guidance and best practices to inform application reviews and approvals for new dams and changes to existing dams. They also are meant to encourage dam owners to adopt industry best practices for dam safety.

We also noted that none of the Technical Bulletins reference the impact of climate change and increased precipitation and flooding on requirements for new dams. As well, only four bulletins (Maintaining Water Management Plans; Dam Decommissioning and Removal; Location Approval for Dams; and Alterations, Improvements and Repairs to Existing Dams) refer to consultations with First Nations and Indigenous peoples. This is an important step that should also be included in the Classification and Inflow Design Flood Criteria bulletin, which addresses issues pertaining to cultural heritage sites.

RECOMMENDATION 19

So that the Ministry’s guidance for dam owners reflects best practices, we recommend that the Ministry of Natural Resources and Forestry regularly review the Technical Bulletins that support

the construction, operation, safety and removal of dams, and if required, update them to reflect new changes in industry standards and best practices.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

On an as needed basis, the Ministry will review and if required, update the policies, technical bulletins and best management practices and make all updated documents available to dam owners and the public.

4.5 Petroleum Industry Activities

4.5.1 Few Oil and Gas Wells Are Being Inspected Annually

Proactive inspections of oil and gas wells prevent and mitigate the potential for spills and damage to the environment. Staff at the Natural Resources Ministry's Petroleum Operations Section (Petroleum Group) are responsible for conducting inspections of oil and gas wells, under the *Oil, Gas and Salt Resources Act*.

With more than 27,000 petroleum wells and associated works recorded in Ontario's petroleum wells database, and only five inspectors to carry out inspections, the Natural Resources Ministry has not been able to assess the condition of all recorded wells on a regular basis. The Ministry told us that it annually plans to conduct 400 inspections through a combination of proactive inspections of active wells, selected through a risk-based approach, and reactive inspections of all types of wells, including active and inactive commercial wells, and abandoned wells. The active wells selected for proactive inspections are chosen on the basis of the age of the well, time since last inspection, and the operators' compliance history.

During the period from 2016/17–2020/21, we noted that the Ministry inspected fewer than 400 oil and gas wells in two of those five years. The Ministry told us that the majority of inspections were reactive in nature. We could not confirm the number of proactive and reactive inspections as the Ministry did not document the nature of inspections in its IT system.

We analyzed inspection data recorded in the Ministry's database for all 27,000 oil and gas wells and found that only 19% of the oil and gas wells in the province had been inspected by the Petroleum Group since 2005. Of those, 38% were last inspected more than a decade ago (before 2011). See **Figure 15** for the years when oil and gas wells were last inspected.

RECOMMENDATION 20

To prevent oil and gas well emergencies, we recommend that the Ministry of Natural Resources and Forestry:

- establish a policy on how often high-risk oil and gas wells should be inspected;
- review inspection capacity to ensure high-risk wells are inspected on a timely basis, according to plan; and
- conduct more inspections.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry acknowledges the concerns related to the Ministry's Oil and Gas well inspection program. Our current regulatory framework avoids and mitigates potential hazards through measures like minimum design requirements and, in addition to inspections carried out by the Ministry, ongoing requirements for commercial operators to have wells inspected on a weekly and annual basis.

Over the next three years, the Ministry will review its inspection framework as part of a comprehensive long-term action plan to address the complex challenges associated with legacy oil and gas wells.

4.5.2 High-Risk and Leaking Wells Have Not Been Plugged

Improperly constructed, maintained or abandoned wells present a safety risk to people and a potential risk to groundwater resources. Wells, especially poorly maintained and improperly plugged wells, are some of

Figure 15: Year of Last Inspection for Each Oil and Gas Well in the Province

Source: Ministry of Natural Resources and Forestry

Year of Last Inspection	# of Oil and Gas Wells Inspected			Total	%
	Commercial ¹	Private ²			
2022 (January–April)	123	15		138	3
2021	209	12		221	4
2020	175	11		186	4
2019	201	8		209	4
2018	145	30		175	3
2017	245	51		296	6
2011–2016	1,752	230		1,982	38
2005–2010	1,108	858		1,966	38
Total Wells Inspected	3,958	1,215		5,173	100

1. Wells that have been licenced by the Ministry and are actively producing.

2. Wells that have not been licenced by the Ministry and may be producing for private use.

the most likely pathways for contaminants to enter the groundwater or to rise from a well to the land surface.

We noted that, for the wells the Ministry has information on, 6% (or 1,625 wells) are not in use and have not been plugged. A further 30% (or 8,011) were plugged prior to 1970 when materials used to plug them included logs, gravel and lead which can lose their integrity over time. As a result, almost 36% of wells could pose a danger. We were informed that the gas explosion that took place in Wheatley, Ontario in August 2021, was in part due to a well that had been plugged in the 1960s, where the materials used to plug the well had deteriorated over time.

We asked the Natural Resources Ministry to indicate the number of wells considered high-risk that have been plugged, and high-risk wells that still need to be plugged. This information was not available. Based on our review of Ministry inspection reports we found one well in Southern Ontario has been leaking oil since at least 2018 and is scheduled to be plugged in 2022/23. Two other wells, also in Southern Ontario, are at a high risk of leaking gas. At the time of our audit, the Ministry did not have a timeline for plugging these wells. See **Figure 16** for the identity, details and status of these wells.

RECOMMENDATION 21

To minimize the risk to public safety and the environment from leaking oil and gas wells, we recommend that the Ministry of Natural Resources and Forestry:

- proactively identify high-risk wells, including previously plugged wells;
- establish an up-to-date registry of high-risk wells;
- immediately plug leaking wells; and
- plug other wells in a timely manner in order of their risk rating, or take other mitigative measures.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry will assess the risk of documented gas wells across the province and will use funding through the Abandoned Works Program to plug eligible high-risk wells. The Ministry will also report annually on its inspection activities and plugging program, including:

- the number of high-risk wells that were identified and inspected and criteria used in the assessment;

Figure 16: Details on High-Risk Unplugged Wells

Source: Ministry of Natural Resources and Forestry

Last Inspection Date	County	Township	Original Risk Rating Score*	Status
August 20, 2017	Haldimand	Sherbrooke	255	No plan to plug because of lack of land access; well is located in Lake Erie
May 17, 2018	Kent	Tilbury East	195	No plan to plug because no longer leaking; re-evaluation needed
July 6, 2018	Norfolk	Middleton	195	Plan to plug 2022/23

* A score equal to or greater than 190 is high risk.

- changes to the list of active and legacy high-risk wells that were identified through proactive and reactive inspections;
- the number of high-risk wells that were plugged; and
- an outlook for next fiscal year's inspection activities.

4.5.3 The Ontario Petroleum Data System Has a Limited Ability to Process Data and Produce Reports

The Ontario Petroleum Data System (wells database) was developed in 2001 by the Natural Resources Ministry and is the primary database used to manage petroleum operations in the province. The wells database contains technical data pertaining to wells regulated under the *Oil, Gas and Salt Resources Act*. It is considered a business-critical application because it is used to enter, edit, view and process data and produce reports and approvals, including licences for petroleum wells.

We found that the database has a limited ability to perform complex queries on data or produce reports. During our audit, we requested information on the number of well inspections conducted and their outcomes; the number of complaints, leaks, and follow-up visits to wells to ensure compliance; and other pertinent data. But the Ministry was unable to generate accurate reports from the wells database to respond to our queries. Further the Ministry told us not all

information is tracked in the database; some information is tracked manually on a separate spreadsheet.

The Ministry has been looking to transition to another application, and has submitted three business cases since 2019 to the Land Resources IT Cluster. We requested copies of the business cases from both the Ministry and the Land resources IT Cluster, but both were unable to locate the documents. The new application has since been incorporated into a larger plan to develop the Natural Resources Information Portal, a new online cloud-based service on the Ministry's website where people and businesses can access natural-resource management activities, including those related to the petroleum industry. Work on integrating the wells database into the information portal is expected to begin in September 2022.

4.5.4 Geographical Data on Wells Is Missing and the Ministry Does Not Share Risk Assessments of Oil Wells with Its Districts

While staff of the Ministry's Petroleum Operations Section (Group) are responsible for licensing, conducting inspections of wells and associated works regulated under the *Oil, Gas and Salt Resources Act*, and rehabilitating abandoned wells through the Ministry's Abandoned Works Program, district staff are responsible for completing the risk assessments for all hazards in their area of responsibility, including oil and gas wells. As part of our audit, we asked the Natural Resources Ministry to identify where wells were

located by district and reviewed Ministry and district risk assessments for oil wells.

The Group said it had determined that 12 of its 25 districts in Ontario do not have any wells regulated under the Act. However, of the 27,695 wells the Group had data on, it did not know exactly where 1,049 of these wells were located. The Group also acknowledged that there may be thousands of additional wells for which it did not have any information. Of the remaining wells for which the Group had geographical data, the districts with the most wells were Aylmer, with 9,508 abandoned wells and 3,259 active wells, and Guelph, with 5,233 abandoned wells and 1,071 active wells.

When we requested an overall risk assessment from Aylmer district about its active and inactive wells, we noted the district assessed the overall risk as low, while the Ministry had assessed it as moderate. When we inquired as to how the district rating was made, we were told by Ministry staff that the individuals who had completed the assessment at the district were no longer with the Ministry due to staff turnover and retirement and that the district staff had not been involved or collaborated with the Group on assessing the risk.

We also noted that of the 13 districts that had wells, six of them reported that they were unaware there were any wells in their area even though, for example, Cochrane had 178 wells according to the Group. This raises a concern that potentially high-risk wells are not being inspected. In our audit, we found no evidence that any inspections had been carried out in any districts other than Aylmer, Aurora and Guelph.

RECOMMENDATION 22

To address oil well risks both provincially and by district, we recommend that the Ministry of Natural Resources and Forestry:

- arrange for inspectors from its Petroleum Operations Section to meet annually with district office staff to assess the risk of oil wells in each district, collaboratively assign risk ratings and maintain documentation that supports each rating;

- educate district staff on the signs of abandoned wells and potential leaks, and have them contribute to enhancing an up-to-date inventory of oil wells; and
- based on the assessed risk, establish timely mitigation strategies that can be carried out provincially and at the district-level, such as targeted public safety messaging and local response plans.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry commits to have the Petroleum Operations Section meet annually with district office staff to assess and document the risk of active oil and gas wells in each district.

District staff will be educated on how to recognize petroleum wells that they may encounter while in the field. The information and accurate location can be established to allow for a petroleum inspector to follow up with a comprehensive evaluation and the proper personal protective equipment.

4.6 Drought

4.6.1 Outdated Low Water Response Strategy Leaves Ontario Without a Current Strategy for Mitigating Drought and Low-Water Conditions

The Ontario Low Water Response strategy was last updated in 2010. Its intent is to ensure provincial preparedness for drought/low-water conditions, to provide long- and short-term strategies to manage water supply and demand, and to support local response efforts in case of a drought/low-water event.

The Natural Resources Ministry is responsible for ensuring that conservation authorities collect, analyze and interpret data on water levels in their jurisdictions, and develop appropriate water resource management strategies to deal with drought/low-water conditions. The Ministry is also required to provide policy and direction to assist local authorities with managing water issues on a local level.

The Ontario Low Water Response strategy provides guidance on the measurement and reporting of low-water results to the Ministry, as well as recommended mitigation measures for severity levels. Three low-water condition levels and their corresponding recommended mitigation measures are described in the strategy:

- Low Water Level I – Early indication of a potential drought (conservation needed)
- Low Water Level II – Increased likelihood of drought (conservation and restrictions needed)
- Low Water Level III – High likelihood of drought (conservation, restrictions and regulation needed)

The low-water condition levels are determined by information collected from the Ministry's Surface Water Monitoring Centre and water monitoring stations operated by the conservation authorities. Emergencies with respect to low-water conditions are declared by municipalities and/or First Nations communities.

The Ontario Low Water Response strategy has not been updated since 2010. We found that some components of the strategy are outdated or no longer relevant, which could potentially lead to unclear roles and responsibilities. For example, the current strategy references the Ontario Water Directors' Committee, comprised of representatives from the ministries of Natural Resources and Forestry; Environment, Conservation and Parks; Agriculture, Food and Rural Affairs; and Municipal Affairs and Housing, as well as conservation authorities. The Committee was responsible for overseeing implementation of low-water mitigation and response strategies, and facilitating the sharing of information and best practices. However, it was disbanded in 2011, after only one year, and the responsibility for overseeing the implementation of low-water mitigation and response strategies has since been delegated to conservation authorities and municipalities. At the time of our audit, the Ministry had no timetable for the review and update of the strategy.

RECOMMENDATION 23

In order to strengthen the province's preparedness in case of drought or low-water conditions, we recommend that the Ministry of Natural Resources and Forestry review and update the current Ontario Low Water Response strategy to reflect current objectives and best practices.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry will continue to monitor watershed conditions through the Surface Water Monitoring Centre. Recent changes in 2021 to the Permit to Take Water Program, administered through the Ministry of Environment, Conservation and Parks (MECP), allows MECP to put restrictions on Permit to Take Water holders when needed to mitigate drought and low water conditions.

The Ministry will also review and update the current Ontario Low Water Response plan to ensure it is relevant and reflects current objectives and best practices. The Ministry will communicate the updated plan to municipalities, conservation authorities and First Nations.

4.6.2 Some District Risk Assessments Do Not Reflect Actual Low Water Conditions in Ontario

Natural Resources Ministry districts are required to complete district risk assessments for drought and low-water conditions, as well as update the assessments at least annually or as additional information becomes available.

When we reviewed the Ministry's district risk profiles, we found that some district risk assessments did not reflect current and changing conditions such as recent low-water activity within their watersheds.

A 2014 study published by the Water Policy and Governance Group at the University of Waterloo, in partnership with Conservation Ontario and the Ontario Ministry of Agriculture, Food and Rural Affairs, examined the frequency and duration of low-water

conditions tracked by conservation authorities over the 13-year period of 2001 to 2013. The study encompassed a review of the average number of weeks per year that each conservation authority experienced low-water conditions consistent with the Ministry's criteria for Level I, II or III severity levels. The study found that 23 of Ontario's 36 conservation authorities experienced at least some fluctuations in the average yearly duration of low-water conditions in the period.

To determine whether there were any changes in low-water conditions within Ontario watersheds in the seven years since the 2014 study, we compared the total number of weeks that conservation authorities experienced low-water levels in 2021, using data from the Ministry's Surface Water Monitoring Centre, with historical data from the 2014 study. Based on our comparative analysis, we found that some conservation authorities experienced a significant shift in the duration of low-water conditions in their watersheds in 2021, as compared to the average annual duration from 2001 to 2013.

Specifically, we found that 52% (12/23) of conservation authorities had a higher number of weeks of low-water conditions in 2021 as compared to the prior period studied (2001–2013). Of those 12, we found that nine conservation authorities were located in districts where the Ministry decreased the risk rating for drought/low water between 2014 and 2021. Refer to **Figure 17** for a summary of the results. This suggests district risk assessments may not reflect actual low-water conditions.

RECOMMENDATION 24

So that measures are developed to prepare for and mitigate drought/low-water emergencies, we recommend that the Ministry of Natural Resources and Forestry:

- work with District Offices to review district risk assessments on an annual basis, taking into consideration drought and low-water conditions experienced in recent years; and
- leverage risk assessments to set priorities and implement best practice mitigation strategies.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry agrees with this recommendation and will use all available data and best scientific practices to assess the risk of drought and low water, including the use of existing mitigation strategies as it reviews its Provincial Low Water/Drought Strategy.

Further, the Ministry, as part of its review of the hazard identification and risk assessment process, will review the processes for communicating hazard-related information to stakeholders, including conservation authorities, municipalities, unorganized territory residents and First Nation partners.

4.7 Erosion and Soil/Bedrock Instability

4.7.1 Ministry Has Taken Little Action to Mitigate the Risk to Properties in Areas Susceptible to Erosion

The combination of a changing climate, settlement patterns along waterways, and an increase in seasonal property investments is exposing more properties and assets to shoreline erosion. This has affected parts of Ontario, including the Lake Erie coast, where there is significant coastal/shoreline erosion and wave action. Locations on Lake Ontario and Lake Huron have also experienced significant erosion. A 2020 study by an environmental consulting firm hired by the Municipality of Chatham-Kent found that without proper intervention, a 58-square kilometre area around Chatham-Kent on Lake Erie is at risk of potential damage to 478 buildings and financial losses of up to \$66 million due to erosion. Our audit found that the Natural Resources Ministry has not taken steps to proactively reduce the risks to residents and properties located in areas that are susceptible to erosion.

The Special Advisor's Report on the 2019 flood events points out that shoreline protection structures such as stone break walls have been erected in some areas along the Lake Erie shoreline to slow erosion rates. However, these structures do not stop erosion of

Figure 17: Change in Total Weeks of Low-Water Conditions in Select Conservation Authorities

Prepared by the Office of the Auditor General of Ontario

Conservation Authority	District	Total Weeks of Low-Water Levels in 2021	Change ^{1,2}	Ministry Risk Rating by District (2014) ³	Ministry Risk Rating by District (2021) ³	Change in Ministry Risk Rating by District ²
Credit Valley	Aurora	16	↑	Low	Low	n.c.
Halton	Aurora	4	↓	Low	Low	n.c.
Lake Simcoe Region	Aurora	20	↑	Low	Low	n.c.
Toronto and Region	Aurora	8	n.c.	Low	Low	n.c.
Central Lake Ontario ⁴	Aurora	8	n.c.	Low	Low	n.c.
Lower Thames Valley	Aylmer	12	↑	High	Very Low	↓
St. Clair Region	Aylmer	16	↑	High	Very Low	↓
Upper Thames Valley ⁴	Aylmer	12	↓	High	Very Low	↓
Hamilton	Guelph	20	↑	High	Very Low	↓
Ausable Bayfield	Guelph	8	↓	High	Very Low	↓
Grand River	Guelph	16	n.c.	High	Very Low	↓
Mississippi Valley	Kemptville	4	↓	Extreme	Very Low	↓
Raisin Region	Kemptville	8	↑	Extreme	Very Low	↓
Rideau Valley	Kemptville	12	↑	Extreme	Very Low	↓
South Nation	Kemptville	8	↑	Extreme	Very Low	↓
Saugeen Valley	Midhurst	4	n.c.	Moderate	Low	↓
Northbay-Mattawa	North Bay	8	↑	Low	Low	n.c.
Ganaraska Region	Peterborough	8	↓	High	Moderate	↓
Otonabee	Peterborough	8	n.c.	High	Moderate	↓
Cataraqui Region	Peterborough	24	↑	High	Moderate	↓
Lower Trent	Peterborough	12	↑	High	Moderate	↓
Quinte	Peterborough	20	↑	High	Moderate	↓
Lakehead	Thunder Bay	12	n.c.	Moderate	Moderate	n.c.

1. Compared to the average number of weeks of low-water conditions reported from 2001 to 2013, as determined by a 2014 study published by the Water Policy and Governance Group at the University of Waterloo, in partnership with Conservation Ontario and the Ontario Ministry of Agriculture, Food and Rural Affairs.
2. n.c. indicates there was no change.
3. Based on the risk rating recorded for districts in the relevant Hazard Identification Risk Assessment prepared by the Ministry's Head Office.
4. Total weeks shown includes four weeks of Level II low-water levels. The rest experienced Level I low-water levels only. Level I low-water indicates conditions that meet one or more of the following criteria: precipitation is less than 80% of the three-month or 18-month monthly averages; and stream flow is less than 70% of the average spring or summer flow. Level II indicates low-water conditions that meet one or more of the following criteria: precipitation is less than 60% of the one-month, three-month, or 18-month monthly averages; more than one week with less than 7.6 mm of precipitation; and stream flow is 50%–70% of the average spring or summer flow.

the lake bottom in front of the structures, which results in a deeper nearshore, lake-bottom slope that impacts the shoreline.

In any case, these short-term structures are a reactive measure for dealing with shoreline erosion that will not address the problem in the long-term. Some jurisdictions with a high risk of erosion, such as the US states of New Jersey, Florida and Minnesota, have implemented property buy-back programs. When we asked the Ministry whether it has considered this option for high-risk properties in Ontario, the Ministry told us it had not considered implementing a buy-back program as a means of reducing harm to people and property resulting from erosion, and that it had not conducted any studies to identify high-risk properties.

The Ministry informed us that municipalities and conservation authorities have been updating shoreline management plans on Lake Ontario, Lake Erie and Lake Huron, as well as the St. Lawrence River in recent years. However, the Ministry does not track or compile provincial hazard mapping created by municipalities or conservation authorities for shoreline erosion.

Municipalities and conservation authorities also regulate development in and around erosion hazard limits. Beyond giving conservation authorities the power to regulate development in areas susceptible to erosion hazards and to maintain shoreline management plans, no other short- or long-term mitigation strategies are in place in the province.

Public awareness is key to implementing mitigative strategies for emerging hazards such as erosion. For example, in the United States, members of a coastwide environmental group monitor the progress of shoreline changes at “erosion hot spots.” Such projects can improve public understanding of coastal processes, and lead to greater buy-in and ownership of erosion-management strategies. In contrast, the Ministry’s only public outreach on erosion was a short video campaign in March 2021 posted on the Ministry’s website.

We asked the Ministry whether it had considered programs to educate residents or had developed programs requiring notices to be included with real estate transactions so that new or potential property owners

were made aware of identified erosion risks. The Ministry told us it had no plans to engage in these types of initiatives. The Ministry further told us that conservation authorities may provide this service to speculative buyers and real estate agents, and that homebuyers and agents should take reasonable steps to complete their own due diligence.

RECOMMENDATION 25

To mitigate the risk to properties located in areas susceptible to erosion, we recommend that the Ministry of Natural Resources and Forestry:

- work collaboratively with other government ministries, agencies and environmental experts to identify and map properties located in areas susceptible to erosion, and develop a provincial map to assist in developing priorities and strategies; and
- identify and implement community-based erosion-awareness and education programs, especially for residents in high-risk areas.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry does not collect information about areas at potential high risk for erosion, and municipalities are not required to share erosion risk information with the Province, provincial agencies or the public. Conservation authorities identify and map areas susceptible to erosion as part of administering their development, interference with wetland and alterations to shorelines and watercourses. The Ministry will work with conservation authorities and municipalities to provide the public with any information or maps that they have, identifying areas that may be at high risk for erosion. The Ministry will review and update its erosions hazard technical guides and will make all updated guides available to the public once the updates are complete.

4.7.2 Inadequate Risk Assessment and Preparation for Sinkholes

Sinkholes can happen when bedrock—the rocky material found under soil, sand and gravel—is unstable. Some sinkholes are the result of natural causes such as water erosion, while others are caused by human activities, such as broken watermains, collapsing sewers, or abandoned mines. Naturally occurring sinkholes may also be as a result of geo-features such as karst (a form of soluble rock such as limestone) or marine clay (a form of soft soil due to its high moisture content).

Natural Resources Ministry staff told us that it does not consider “soil and bedrock instability” under Order in Council (1039/2022) to include sinkholes, and therefore regards them as outside the Ministry’s scope of responsibility. Consequently, at the time of our audit the Ministry had no plans to undertake land-subsidence and sinkhole risk assessments or to revisit its existing risk assessments. Yet we noted that the Ministry’s website specifically covers discussion of landslide and sinkhole emergencies. Additionally, its 2021 media campaign included coverage of sinkholes among other hazards under its purview of responsibility.

Sinkholes have occurred in Ontario in recent years, for example, in Toronto (most recently in 2021), Ottawa (2016, 2017, 2018 and 2019), Thunder Bay (2013 and 2016), and Timmins in June and July 2022. However, the Ministry does not track sinkhole events or their cause, whether it be human activity or a naturally occurring event. This has been the case even in instances where the cause was a leaking gas well for which the Ministry is assigned responsibility under Order in Council. This was the case in Norfolk County.

We contacted the Ministry of Forests in British Columbia and were informed that they respond to potential or actual landslides, erosion, sinkholes and land-subsidence threats on Crown land, and to threats to public safety on private land, municipalities and regional districts. As well, we were told that one of British Columbia’s main research activities is to gain a better understanding of the increased risk of landslides and erosion after wildfires.

Given Ontario’s increasing number of floods and wildland fires, its recent sinkhole occurrences, the impacts of climate change, increases in population and the existence of almost 27,000 oil and gas wells and 6,000 abandoned mines in the province, it is important for the Ministry to clarify its mandate. It should undertake targeted risk assessments in conjunction with municipalities and conservation authorities to identify potential land-subsidence hazards and sinkholes.

RECOMMENDATION 26

To reduce the risks associated with sinkholes and other land-subsidence incidents, we recommend that the Ministry of Natural Resources and Forests, in conjunction with Treasury Board Secretariat/ Emergency Management Ontario:

- clarify the Ministry’s responsibilities under the Order in Council (1039/2022) as it relates to sinkholes;
- collect the data needed to properly assess the risk for soil and bedrock instability, including sinkholes and other land-subsidence incidents, across all districts; and
- develop prevention and mitigation measures to prioritize and address at-risk areas for sinkholes, in conjunction with foresters and other experts.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry considers naturally occurring sinkholes to be a component of its Soil Erosion and Bedrock Instability Order in Council and will consider this within its consultations with Emergency Management Ontario on defining sinkholes within its existing Order in Council Definitions. Further the Ministry will assess the risk of sinkholes where there is known risk of occurrence in consultation with subject matter experts while undertaking its Hazard Identification Risk Assessment process. The Ministry will review and update its natural hazard technical guides and bulletins related to hazardous sites, including soil and bedrock instability, as

needed, and will make all updated guides available to the public once the updates are complete.

4.7.3 Ministry Technical Guides for Erosion Prevention and Mitigation Require Updating

In 2020, the Professional Geoscientists of Ontario submitted a letter to the Ministry recommending that technical guidelines for erosion be updated “to reflect current science and technology advancements,” specific technical issues, and guidelines for policy application. More specifically, it recommended that the Ministry revisit and update two erosion hazard assessment technical guidelines:

- Understanding Natural Hazards: Great Lakes – St. Lawrence River System and Large Inland Lakes, River and Stream Systems and Hazardous Sites (2001)
- Technical Guide – River & Stream Systems: Erosion Hazard Limit (2002)

The Ministry told us that in 2021 it engaged an external environmental consultant to conduct a comprehensive review of the first technical guide listed above, and expects the review to be complete by March 2023. At the time of our audit, the Ministry did not have plans to update the second guide.

For further information on other outdated technical guides and our related recommendation, see **Section 4.1.6**.

4.8 Hazard Identification and Risk Assessments

4.8.1 The Hazard Identification and Risk Assessment Process Is Not Always Timely or Co-ordinated Across the Province

According to the Natural Resource Ministry’s Emergency Response Plan, each of the Ministry’s 25 districts is expected to maintain a current district assessment for all hazards it is assigned to monitor. The risk assessments provide context for districts to respond to hazards in their geographic areas of responsibility. During our review of district risk assessments,

we found that 16 districts had not updated their assessments since 2018. According to the Ministry’s Emergency Response Plan, districts are required to revisit their assessments each year in order to maintain a current assessment.

We identified issues with the approach used by districts to conduct risk assessments. For example, we found that districts in the Northeast and Northwest regions of Ontario used four levels of risk rankings when completing their risk assessments, while the Southern region used six levels of risk rankings. Using different approaches does not allow for a comparison or consistent assessment of risks for similar hazards across the province.

Further, contrary to best practices, we found that districts were not consulting with hazard experts (including those within the Ministry such as the Aviation, Fire and Forest Emergency Services group), municipalities, First Nations communities and local stakeholders during the risk assessment process to ensure the districts were appropriately informed. Additionally, there was no documentation showing who completed the risk assessment, and at least two districts reported that, as a result of retirements and staff turnover, they could not identify who had participated in the assessment or explain why certain ratings were assigned.

In addition to district risk assessments, a provincial hazard risk assessment was completed by the Natural Resources Ministry’s Aviation, Fire and Forest Emergency Services Branch in 2018. We were told that the provincial assessment is used to prioritize programs and resources for emergency management and response. We noted differences between the Ministry’s provincial risk assessment ratings for districts and the districts’ own self-assessed ratings. For example, the provincial risk assessment listed the risk for floods in Bancroft as “extreme” and fire risk “very high”, while the district rated the risk of floods as “moderate” and fire risk as “low.” We also noted that, where the provincial risk assessment used maps of historical fires updated as of 2018, only seven districts used those same maps; two districts used 2011 maps and seven used 2003 maps to assess fire risk. Having both

the district offices and the Aviation, Fire and Forest Emergency Services Branch complete risk assessments independently for each type of hazard assigned to the Ministry, is a duplication of effort.

RECOMMENDATION 27

So that risk assessments for assigned hazards are updated periodically and are consistently completed at all levels using a co-ordinated approach, we recommend the Ministry of Natural Resources and Forestry:

- update district risk assessments at least every three years in consultation with hazard experts, First Nations communities, conservation authorities and local stakeholders. These assessments should consider impacts of climate change and population growth, and include documenting progress on mitigation strategies, developing new mitigation strategies, and revising ratings as appropriate;
- provide training to district staff, local stakeholders and First Nations communities on how to complete a standardized risk assessment according to the Ontario Hazard Identification and Risk Assessment process and how to develop specific, measurable mitigation strategies; and
- revise current practices so that provincial risk assessments are compiled from district risk assessments in a bottom-up approach with local input.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry accepts this recommendation and will leverage all available data, best practices, and provincial program direction to assess current hazards and their associated current risks, with appropriate consideration for risk mitigation opportunities.

The Ministry will conduct an internal review using a dedicated team, to assess and improve its hazard identification and risk assessment methodologies and ensure they are updated periodically.

The Ministry will also work with partners and stakeholders to complete all applicable risk assessments with local input to develop risk mitigation strategies, as appropriate.

4.9 Unorganized Territories

4.9.1 Ministry Mandate Is Unclear Regarding Emergency Response for Unorganized Territories

Based on the Statistics Canada 2021 census, about 35,000 Ontarians live in unorganized territories (an increase of 5% from 2016). Under the *Municipal Act, S.O. 2001*, an unorganized territory is a geographic area without municipal organization. The legislative requirements under the *Emergency Management and Civil Protection Act* do not apply to unorganized areas and they are not required to establish emergency plans to govern emergency response activities. As a result, when residents within unorganized territories are unable to look after their own emergency needs, the Province may be called upon for emergency response support.

The Natural Resources Ministry was not called to assist with any emergency response efforts in unorganized areas during the period 2017 to 2021. Nevertheless, Ministry staff told us that its mandate regarding emergency response and evacuations in unorganized areas is ambiguous and unclear to both the Ministry and Emergency Management Ontario (EMO). The Ministry told us that based on references in legislation and various emergency response and support plans, it recognizes that it has a leadership role in responding to hazards in unorganized territories where its Order in Council mandate applies. What is less clear to the Ministry is who is legally required to assume the lead in all other aspects of emergency response such as, arranging for evacuations and securing host communities and related supports. In cases of emergencies impacting First Nations communities, EMO typically leads and co-ordinates evacuations and services with host communities.

We further noted that the *Emergency Management and Civil Protection Act* addresses municipal emergency

planning and response, as well as the Ontario Public Service's planning and response, but does not consider the "in-betweens" such as unorganized territories.

RECOMMENDATION 28

In order to provide an effective and co-ordinated response to emergencies and evacuations in unorganized territories, we recommend that the Ministry of Natural Resources and Forestry, in conjunction with Emergency Management Ontario:

- clarify and formalize legal roles and responsibilities for emergency response and evacuations in unorganized territories; and
- determine whether existing regulation, policies and plans (for example, the Ministry's Emergency Response Plan) contain gaps that should be addressed for improved clarity and understanding of respective roles and responsibilities for emergency response and evacuations in unorganized territories.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry agrees with this recommendation and will actively work to improve its emergency planning and preparedness in support of unorganized territories. This work will build upon identified lessons learned and the needs of partners and the public, as well as entail a review of existing regulations, policies, and processes to clarify roles and responsibilities. This work will also endeavour to enhance emergency preparedness and response, such as reviewing local evacuation capacity.

Further, Emergency Management Ontario is committed to reviewing roles and responsibilities related to supporting unorganized territories, and intends to implement internal working groups that will address gaps in policy and regulatory frameworks, in order to improve understanding of the respective roles and responsibilities for emergency response and evacuations in unorganized territories.

4.10 Performance Indicators

4.10.1 Natural Resources Ministry and Mines Ministry Have Few Key Performance Indicators to Measure Success of Emergency Management Program

The Natural Resources Ministry only has four key performance indicators in place to assess its emergency management program. While there is one indicator to measure success for each of floods, forest fires, and petroleum operations, there are no other indicators to evaluate the other hazards that the Ministry is responsible for addressing, namely: drought/low water, erosion and soil and bedrock instability, and dam failures. Further, while the Ministry's annual report outlines its key program objectives and initiatives, including initiatives such as continuing to promote its FireSmart program, providing active emergency management training, and implementing Ontario's Flooding Strategy, there are no associated measures and targets in place to evaluate the progress of these initiatives. Measuring and reporting on performance can inform management and other stakeholders on the progress of the emergency management program and whether program objectives are being met sufficiently. **Figure 18** summarizes the indicators, intended outcomes, target, and the results for the past five years.

We also identified gaps in the existing measures. For example, while the intended outcome for flood response is the timely and effective notifications of potential flooding, the indicator only measures the number of flood messages issued and does not examine whether they were issued in a timely manner. In addition, while the measure for fire response is comparable to that of other jurisdictions (British Columbia measures the percentages of fires contained by 10 am the following day; Ontario measures the percentage of fires that are either smaller than four hectares in size or contained by noon the following day), the metric was not attained in the last five years. The Ministry has not evaluated the rationale for the shortcomings and what actions could be taken to improve its metrics.

We also found that although the Ministry has met its target for the completion of the Emergency

Figure 18: Key Performance Indicators Used by Ministry of Natural Resources and Forestry, 2016/17–2020/21

Source: Ministry of Natural Resources and Forestry

Indicator	Outcome	Target	Results ¹
Number of flood messages issued when required ²	Timely and effective notifications for potential flooding and response to wildland fires	116 flood messages (2020/21) ³	97 (2020/21) 110 (2019/20) 102 (2018/19) 85 (2017/18) 84 (2016/17)
Percentage of initial attack success for wildland fires response ⁴		96% initial attack success rate (2020/21) ³	90% (2020/21) 95% (2019/20) 92% (2018/19) 92% (2017/18) 94% (2016/17)
Satisfactory inspections of petroleum operations	Increased environmental and public safety	400 inspections (2016/17–2020/21)	339 (2020/21) 455 (2019/20) 444 (2018/19) 385 (2017/18) 429 (2016/17)
Completion of emergency management program legislative requirements (Emergency Management Ontario compliance review)	Ontario is prepared for emergencies and provision of critical government services	100% compliance (2016/17–2020/21)	100% (2020/21) 100% (2019/20) 100% (2018/19) 100% (2017/18) 100% (2016/17)

1. The years when the target was met are in **bold**. In years when there was no target set, the results were compared against the 2020/21 target.

2. This measures how often the Surface Water Monitoring Centre issues flood messages when certain thresholds are breached. There are numerous reporting thresholds, such as when 50 millimetres of rainfall is forecast to fall in less than 24 hours.

3. This indicator was a new Key Performance Indicator for 2020/21; the Ministry does not have target information available for previous years.

4. Initial attack success is defined as fires that meet the following conditions: the Ministry was the initial response agency, the fire was deemed to require a Full Response, and it was either put out before it grew to more than four hectares, or it was contained by noon the day after the first report. The number of fires meeting these criteria is divided by the total number of Full Response fires where the Ministry was the first responder, for an annual percentage.

Management Ontario compliance review for the last five years, the measure does not examine the quality of the Ministry's emergency management program. The Ministry simply indicates if they have met certain requirements with a brief explanation of how the requirement was met, such as having an emergency response plan and having performed practice tests for these response plans. This type of self-evaluation does not assess whether these plans and tests will help ensure that an organization is prepared to respond to a real-life emergency. Further, Emergency Management Ontario does not assess whether the Ministry's plans contain all the critical components they should have, or if the practice tests focused on high-risk areas and included all relevant parties. This issue was also noted in our 2017 audit report on Emergency Management in

Ontario and in our 2020 Special Report on Emergency Management in Ontario—Pandemic Response.

With regards to abandoned mine hazards, we noted that the Mines Ministry had not developed performance measures to evaluate and report on its efforts in managing this hazard.

RECOMMENDATION 29

So that management and other stakeholders are informed on the progress of the emergency management program, and whether program objectives are being achieved, we recommend that the Ministry of Natural Resources and Forestry and the Ministry of Mines:

- establish appropriate key performance indicators and targets for all hazards for which it is responsible, as well as its key programs and initiatives; and
- compile indicator results annually to assess whether the targets have been met and, in the case where a target was not met, implement actions for improvement.

MINISTRY OF NATURAL RESOURCES AND FORESTRY RESPONSE

The Ministry accepts this recommendation and will review and enhance its performance measurement framework, including the design of key performance indicators, to support the reporting of program effectiveness and take actions as required to support continuous improvement.

MINISTRY OF MINES RESPONSE

In addition to the Ministry continuing to track a key KPI that 100% of all Emergency Management Program legislative requirements are addressed, the Ministry will clarify overall program objectives and establish further KPIs and targets for the rehabilitation of abandoned mine hazards, aligned with the site prioritization assessments.

For the fiscal 2022/23 year-end, the Ministry will complete an assessment of key indicators that helps inform progress toward achieving targets identified above.

RECOMMENDATION 30

So that the emergency management programs in place at Ontario's ministries include all delegated responsibilities and are sufficiently preparing ministries to respond to emergencies, we recommend that Emergency Management Ontario implement an oversight process that routinely assesses the quality and sufficiency of the emergency management programs in place.

EMERGENCY MANAGEMENT ONTARIO RESPONSE

Treasury Board Secretariat, through Emergency Management Ontario, is committed to the continued implementation of the recommendations made in the Auditor General's 2017 and 2020 reports, and reiterated in this report, relating to an oversight process for assessing the quality and sufficiency of emergency management programs.

Appendix 1: Hazard Risk Rating by Type of Hazard and District

Source: Ministry of Natural Resources and Forestry

Ministry of Natural Resources and Forestry (Ministry) ¹							
District Name	Wildland Fire	Flooding	Drought/ Low Water	Dam Failure	Erosion	Soil and Bedrock Instability	Crude Oil and Natural Gas Exploration
1. Red Lake	Extreme	Low	Low	Low	Low	Low	n/a
2. Kenora	Extreme	High	Moderate	Moderate	Low	Low	n/a
3. Sioux Lookout	Extreme	Moderate	Moderate	Low	Low	Low	n/a
4. Dryden	High	High	High	Moderate	Moderate	Low	n/a
5. Fort Frances	Moderate	Extreme	Moderate	Moderate	Moderate	Low	n/a
6. Thunder Bay	High	Extreme	Moderate	Moderate	Extreme	Low	n/a
7. Nipigon	Extreme	Moderate	Low	Moderate	Moderate	Low	n/a
8. Wawa	Extreme	Extreme	Moderate	Low	Moderate	Low	n/a
9. Hearst	High	Low	Low	Moderate	Moderate	Low	n/a
10. Cochrane	High	Extreme	Moderate	Low	Low	Low	n/a
11. Chapleau	Extreme	Moderate	Low	Moderate	Low	Not Known ²	n/a
12. Timmins	High	High	Low	High	Moderate	Low	n/a
13. Kirkland	High	Low	Low	High	Moderate	Moderate	Low
14. Sault Ste. Marie	High	Extreme	Not Completed ²	High	Extreme	Not Completed ²	n/a
15. Sudbury	High	Low	Low	Low	Low	Not Completed ²	n/a
16. North Bay	Extreme	Moderate	Low	Moderate	Low	Not Completed ²	n/a
17. Parry Sound*	High	High	Low	Moderate	Low	Low	n/a
18. Pembroke*	Low	Low	Very Low	Very Low	Moderate	Low	Very Low
19. Bancroft*	Very High	Extreme	Very Low	Low	Very Low	Very Low	Very Low
20. Midhurst*	Very Low	Moderate	Low	Very Low	Very Low	Very Low	Very Low
21. Guelph*	Very Low	Low	Very Low	Very Low	Very Low	Very Low	Very Low
22. Aurora*	Moderate	High	Low	Moderate	Low	Low	n/a
23. Peterborough*	Low	Very High	Moderate	Low	Very Low	Very Low	Very Low
24. Kemptville*	Very Low	Low	Very Low	Very Low	Very Low	Very Low	Very Low
25. Aylmer *	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Moderate

1. The Ministry's district offices are grouped into three regions. The two districts in the North use a four-level risk rating scale (Extreme, High, Moderate and Low), while the districts in the Southern region (*) use a six-level risk rating scale (Extreme, Very High, High, Moderate, Low and Very Low).

2. According to the Ministry, efforts are under way by districts to determine the extent of hazards identified as "Not Known" or "Not Completed."

Appendix 2: Mitigation and Preparedness Activities Related to Assigned Hazard

Source: Adapted from the Ministry of Natural Resources and Forestry and Ministry of Mines

	Mitigation Activity	Preparedness Activity
Floods	<ul style="list-style-type: none"> Directing habitable areas and structures away from high-risk areas through technical guidance with floodplain mapping Maintaining existing legacy structural measures (such as flood-proofing structures, dams) and non-structural measures (such as monitoring stream flows) 	<ul style="list-style-type: none"> Sandbagging operations to protect Ministry infrastructure and to supply municipalities when needed The Surface Water Monitoring Centre evaluates flood potential daily through the Province's network of more than 600 water-monitoring stations and issues water-condition reports to Ministry districts and conservation authorities The Ministry Emergency Operations Centre provides daily weather briefings
Forest Fires	<ul style="list-style-type: none"> Wildfire protection planning programs; these include FireSmart, which is intended for homes, cottages and subdivisions that are built within the forest landscape and provides access to tools to assess their risk of fire and identify activities they can take to mitigate risk Conducting prescribed burns—which involves setting planned fires at a time when the fire will not pose a threat to the public—to maintain the health of the forest 	<ul style="list-style-type: none"> Performing daily weather briefings and fire behaviour analysis Developing an emergency response plan Facilitating and managing 168 forest fire suppression agreements in place with municipalities, the federal government, First Nations, etc. to help assist with or receive assistance in putting out fires
Abandoned Mine Hazards	<ul style="list-style-type: none"> Inspecting mine sites, including both active and abandoned mines, whether Ministry-held or private Rehabilitating abandoned mine sites held by the Province Reviewing and approving mine closure plans Delivering public education programs to keep people away from dangerous sites 	<ul style="list-style-type: none"> Maintaining the Abandoned Mine Information System used to store information on all known active and abandoned mine sites, whether held by the Province or privately Development of an emergency response plan
Dam Failures	<ul style="list-style-type: none"> A risk assessment strategy to identify dams representing the highest risks in order to address these sites on a priority basis as resources are available Guiding legislation, policies and standards: <ul style="list-style-type: none"> <i>The Lakes and Rivers Improvement Act</i>—Gives the Ministry the legislative authority to govern the design, construction, operation, maintenance and safety of dams in Ontario. Ontario Regulation 454/96 (Construction) outlines circumstances in which Ministry approval is required to construct a new dam or alter an existing dam. Ontario Dam Safety Guidelines, 1999 (updated in 2011)—Defines requirements and outlines guidelines so that the safety of existing dams can be evaluated in a consistent and adequate manner across Ontario, and new dams can be designed and constructed to be safe. 	

Mitigation Activity	Preparedness Activity
<ul style="list-style-type: none"> • Bulletins and Best Management Practices—Produced by the Ministry to support the administration of the <i>Lakes and Rivers Improvement Act</i>, the bulletins specify requirements for such things as dam structural design and factors of safety; and dam decommissioning and removal. • The Ministry’s Structural Design and Factors of Safety Technical Bulletin—Outlines the minimum structural standards a dam should meet after repairs. It provides direction and guidance to dam owners in meeting standards for structural design and factors of safety for concrete gravity dams and is to be used when considering dam applications for approval under the <i>Lakes and Rivers Improvement Act</i>. Repairs to the concrete extends the useful life of the dam by an estimated 40–50 years, whereas complete reconstruction has a life expectancy of 100 years due to improved quality control, standards and advances in material quality. 	
Oil/Natural Gas <ul style="list-style-type: none"> • Inspecting petroleum wells and works on both Crown and private land • Development of technical standards for the safe design, construction, operation, maintenance and decommissioning of wells • Administering the Abandoned Works Program • Taking compliance action to address issues at wells of concern 	<ul style="list-style-type: none"> • Managing exploration and production records for internal compliance and enforcement activity and emergency management purposes. Certain information is also publicly accessible to stakeholders for land use and resource management
Erosion and Soil/Bedrock Instability <ul style="list-style-type: none"> • Constructing erosion control structures • Directing properties and developments away from high-risk areas through technical guidance on erosion and dynamic beaches and land-use planning • Constructing shoreline protection structures (such as sheet pile walls and stone break walls) 	<ul style="list-style-type: none"> • Risk assessments supplemented with maps to identify potential at-risk areas for erosion or soil/bedrock instability • Development of a district-level emergency response plan
Drought/Low Water <ul style="list-style-type: none"> • Responding to low-water conditions by activating water restrictions and/or conservation under the Ontario Low Water Response Plan 	<ul style="list-style-type: none"> • The Surface Water Monitoring Centre evaluates drought potential daily and provides water condition reports to Ministry districts and conservation authorities

Appendix 3: Listing of Significant Flood Events from 2017 to 2021 and Related Details, Sorted by District

Sources: Emergency Management Ontario and the Ministry of Natural Resources and Forestry

Location ¹	Year of Event	District ²	Jurisdiction Type	Date of Event	First Nation/ Municipality Declared an Emergency	Ministry of Natural Resources and Forestry Assisted with Response Efforts	Nature of Assistance Provided by Ministry			Costs Associated with the Ministry's Response (\$ million) ^{3,4}
							Evacuation Flights	Reparation Flights	Sandbag Operations	
1. Municipality of Clarington	2017	Aurora	Municipality	May 8, 2017	✓					
2. Middlesex County	2021	Aylmer	Municipality	Sep 22, 2021	✓					
3. City of Brantford	2018	Aylmer	Municipality	Feb 21, 2018	✓					
4. City of Windsor	2017	Aylmer	Municipality	Aug 29, 2017						
5. Municipality of Chatham-Kent	2020	Aylmer	Municipality	Feb 28, 2020	✓					
6. Municipality of Chatham-Kent	2019	Aylmer	Municipality	Feb 8, 2019	✓					
7. Municipality of Chatham-Kent	2018	Aylmer	Municipality	Feb 23, 2018	✓					
8. Municipality of Chatham-Kent	2018	Aylmer	Municipality	Sep 27, 2018						
9. Municipality of Learnington	2019	Aylmer	Municipality	Oct 3, 2019						
10. Township of Mapleton	2017	Aylmer	Municipality	Jun 23, 2017	✓					
11. Township of St Clair	2021	Aylmer	Municipality	Mar 4, 2021	✓					
12. Hastings County	2019	Bancroft	Municipality	May 2, 2019						
13. Township of Minden Hills	2019	Bancroft	Municipality	Apr 24, 2019	✓					
14. Township of Minden Hills	2017	Bancroft	Municipality	May 6, 2017	✓					
15. Kashechewan First Nation	2020	Cochrane	First Nation	May 1, 2020	✓			✓		1.3
16. Kashechewan First Nation	2019	Cochrane	First Nation	Apr 29, 2019	✓			✓		1.4
17. Kashechewan First Nation	2018	Cochrane	First Nation	May 7, 2018	✓			✓		0.9
18. Kashechewan First Nation	2017	Cochrane	First Nation	Apr 14, 2017	✓			✓		
19. Six Nations of the Grand River First Nation	2018	Guelph	First Nation	Feb 21, 2018	✓					
20. City of Clarence-Rockland	2019	Kemptville	Municipality	Apr 26, 2019	✓					
21. City of Clarence-Rockland	2017	Kemptville	Municipality	May 4, 2017	✓					

Location ¹	Year of Event	District ²	Jurisdiction Type	Date of Event	First Nation/ Municipality Declared an Emergency	Ministry of Natural Resources and Forestry Assisted with Response Efforts	Nature of Assistance Provided by Ministry			Costs Associated with the Ministry's Response (\$ million) ^{3,4}
							Evacuation Flights	Repatriation Flights	Sandbag Operations	
22. City of Ottawa	2019	Kemptville	Municipality	Apr 25, 2019	✓	✓			✓	
23. Township of Alfred and Plantagenet	2019	Kemptville	Municipality	Apr 27, 2019	✓					
24. Township of Champlain	2017	Kemptville	Municipality	May 7, 2017	✓					
25. Township of Greater Madawaska	2019	Kemptville	Municipality	Apr 28, 2019	✓					
26. Township of Horton	2019	Kemptville	Municipality	Apr 26, 2019	✓					
27. Township of McNab-Braeside	2019	Kemptville	Municipality	Apr 26, 2019	✓					
28. Township of Machin	2019	Kenora	Municipality	Jul 10, 2019	✓					
29. Wabaseemoong First Nation	2019	Kenora	First Nation	Oct 22, 2019						
30. Municipality of Meaford	2019	Midhurst	Municipality	Nov 1, 2019						
31. Town of Minto	2017	Midhurst	Municipality	Jun 23, 2017	✓					
32. City of Temiskaming Shores	2019	North Bay	Municipality	May 9, 2019	✓					
33. Municipality of West Nipissing	2019	North Bay	Municipality	May 9, 2019	✓					
34. Municipality of West Nipissing	2017	North Bay	Municipality	Jan 19, 2017						
35. District of Muskoka	2019	Parry Sound	Municipality	Apr 28, 2019	✓					
36. Town of Bracebridge	2019	Parry Sound	Municipality	Apr 23, 2019	✓					
37. Town of Huntsville	2019	Parry Sound	Municipality	Apr 25, 2019	✓					
38. Township of Muskoka Lakes	2019	Parry Sound	Municipality	Apr 28, 2019	✓					
39. City of Pembroke	2019	Pembroke	Municipality	May 9, 2019	✓					
40. Renfrew County	2019	Pembroke	Municipality	Apr 28, 2019	✓					
41. Town of Mattawa	2019	Pembroke	Municipality	May 6, 2019	✓					
42. Town of Petawawa	2019	Pembroke	Municipality	Apr 28, 2019	✓					
43. Township of Killaloe, Haggarty and Richards	2019	Pembroke	Municipality	Apr 29, 2019	✓					
44. Township of Laurentian Valley	2019	Pembroke	Municipality	Apr 27, 2019	✓					
45. Township of Whitewater Region	2019	Pembroke	Municipality	Apr 25, 2019	✓					

Location ¹	Year of Event	District ²	Jurisdiction Type	Date of Event	First Nation/ Municipality Declared an Emergency	Ministry of Natural Resources and Forestry Assisted with Response Efforts	Nature of Assistance Provided by Ministry			Costs Associated with the Ministry's Response (\$ million) ^{3,4}
							Evacuation Flights	Repatriation Flights	Sandbag Operations	
46. Mohawks of the Bay of Quinte First Nation	2017	Peterborough	First Nation	May 11, 2017	✓					
47. Prince Edward County	2017	Peterborough	Municipality	May 9, 2017	✓	✓			✓	
48. Township of Frontenac Islands	2017	Peterborough	Municipality	May 16, 2017	✓					
49. Township of Macdonald Meredith and Aberdeen	2019	Sault Ste Marie	Municipality	Jun 10, 2019						
50. Bearskin Lake First Nation	2019	Sioux Lookout	First Nation	Nov 10, 2019	✓	✓		✓		0.8
51. Kasabonika Lake First Nation	2020	Sioux Lookout	First Nation	Jun 23, 2020						
52. Municipality of French River	2019	Sudbury	Municipality	May 26, 2019	✓	✓			✓	
53. Township of Nolalu	2019	Thunder Bay	Municipality	Jun 4, 2019						
Total					43	7	4	4	3	4.4

Note: The Ministry also responded to declared flood emergencies and assisted with evacuations in the Kashechewan, Fort Albany and Attawapiskat First Nations in April/May 2022.

1. According to Emergency Management Ontario and the Ministry of Natural Resources and Forestry, none of the significant events, including declared emergencies, resulted in any fatalities or injuries to local residents or Ministry emergency response staff.
2. District boundaries as designated by the Ministry of Natural Resources and Forestry.
3. The Ministry only tracks costs incurred to evacuate/repatriate residents, which are reimbursed by Indigenous Services Canada. The costs incurred for sandbagging are unknown.
4. The Province does not track the cost of damage to the impacted communities.

Appendix 4: List of Significant Fire Events from 2017 to 2021 and Related Details, Sorted by District

Sources: Emergency Management Ontario and Ministry of Natural Resources and Forestry

Location	District	Jurisdiction Type	Fire Start Date	Duration (days) ¹	Cause	First Nation/ Municipality Declared an Emergency	Hectares Impacted ²	Nature of Assistance Provided by the Ministry of Natural Resources and Forestry			Costs Incurred by the Ministry for Flights (\$ million)	Costs Incurred by EMO for Host Communities (\$ million)
								Fighting Fires ³	Evacuation Flights	Repatriation Flights		
1. Weenusk First Nation	Cochrane	First Nation	Jun 11, 2018	23	Human		122.0	✓				
2. Wabaseemoong First Nation	Kenora	First Nation	Jun 8, 2021	146	Lightning	✓	191,810.6	✓				0.8 ⁴
3. Fort Hope First Nation (Eabametoong)	Nipigon	First Nation	Aug 9, 2020	39	Lightning	✓	6,678.0	✓	✓		0.5	
4. Ginoogaming First Nation	Nipigon	First Nation	Jul 10, 2020	2	Lightning	✓	0.1	✓				
5. Nibinamik (Summer Beaver) First Nation	Nipigon	First Nation	Jul 27, 2017	62	Lightning		6,999.4	✓				
6. Temagami First Nation	North Bay	First Nation	Jul 5, 2018	41	Lightning		221.0	✓				
7. Henvey Inlet First Nation	Parry Sound	First Nation	Jul 18, 2018	106	Human	✓	11,362.5	✓				
8. Deer Lake First Nation	Red Lake	First Nation	Jun 30, 2021	98	Lightning	✓	53,521.9	✓	✓		* ⁵	** ⁴
9. Keewaywin/North Spirit Lake First Nation	Red Lake	First Nation	Jun 15, 2019	102	Lightning		96,535.9	✓				
10. North Spirit Lake First Nation	Red Lake	First Nation	Jul 17, 2021	2	Lightning	✓	0.7	✓	✓		* ⁵	** ⁴
11. Pikangikum First Nation	Red Lake	First Nation	Jul 12, 2021	1	Lightning	✓	0.1	✓	✓		* ⁵	3.3 ⁴
12. Pikangikum First Nation	Red Lake	First Nation	Jun 30, 2019	67	Lightning		43,308.3	✓				
13. Pikangikum First Nation	Red Lake	First Nation	Jul 13, 2018	62	Lightning		5,477.8	✓				
14. Poplar Hill First Nation	Red Lake	First Nation	May 6, 2018	7	Human		16.5	✓				
15. Red Lake	Red Lake	Municipality	Jul 5, 2021	93	Lightning	✓	36,037.8	✓				
16. Red Lake	Red Lake	Municipality	Aug 10, 2020	25	Human	✓	552.0	✓				

Location	District	Jurisdiction Type	Fire Start Date	Duration (days) ¹	Cause	First Nation/ Municipality Declared an Emergency	Hectares Impacted ²	Nature of Assistance Provided by the Ministry of Natural Resources and Forestry			Costs Incurred by the Ministry for Flights (\$ million)	Costs Incurred by EMO for Host Communities (\$ million)
								Fighting Fires ³	Evacuation Flights	Repatriation Flights		
17. Bearskin Lake First Nation	Sioux Lookout	First Nation	Jul 7, 2021	20	Lightning	✓	256.5	✓	✓	✓	* ⁵	** ⁴
18. Cat Lake First Nation	Sioux Lookout	First Nation	Jul 20, 2021	3	Lightning	✓	1.3	✓	✓	✓	* ⁵	2.1 ⁴
19. Pickle Lake	Sioux Lookout	Municipality	Jun 6, 2019	19	Human		824.2	✓				
20. Gogama/Mattagami First Nations	Timmins	Municipality/ First Nation	Jun 6, 2019	54	Human		4,645.0	✓				
Total⁶						11		20	6	6	8.6	6.2

1. Number of days lapsed from the date the fire is detected to the date the fire is extinguished.

2. There were no reported injuries or fatalities in the impacted communities.

3. There were no reported fatalities of firefighters involved in the response efforts.

4. EMO started to incur costs for host communities and related supports in 2021. However, it only provided us with cost information for three of the six evacuations which occurred in 2021. Costs noted with an ** were not provided.

5. Costs incurred by the Ministry to evacuate communities (noted with an *) totaled \$8.1 million.

6. EMO listed nine additional fires from 2017 to 2021 without providing specific details. These events do not relate to one specific forest fire, and could include events reported in this list.

Appendix 5: Significant Incidents Involving Abandoned Mines, 2017–2021

Prepared by the Office of the Auditor General of Ontario

Mine Site	Year	District	Region	Nature of Event	Rehabilitation Cost to Ministry	Rehabilitation Measure
1. Capitol	2019	Kirkland Lake	Northeast	Ministry inspection noted a significant deterioration of shaft cap, snow fencing and signs around shaft posing a threat to public safety (i.e., potential for an individual to fall into an open shaft)	\$124,238	Long-term secure fencing was placed around mine hazards
2. Clavos	2019	Timmins	Northeast	Mine owner went into receivership in July 2018, with owner abandoning site in early January 2019, leaving unrehabilitated hazards (such as mine openings to surface, used fuel, and chemicals) unsecured and posing a threat to public safety	NIL	In late January 2019, third party was appointed by a court to provide site security to secure hazards until sale to new owner was finalized
3. Howey Mine	2019	Red Lake	Northwest	Ministry inspection noted a slumping of rock layer between ground surface and underground mine and breaching of fence around open hole, posing a threat to public safety (i.e., potential for a cave-in or for an individual to fall into open hole). The mine owner was not accepting responsibility for rehabilitation	NIL	Minister ordered mine owner to rehabilitate the mine hazards
4. Crown Point	2018	Thunder Bay	Northwest	Two local persons entered the mine and discovered old and unstable explosives estimated to be between 60–90 years old	\$106,480	Access to the mine openings was blocked
5. Eagle River	2019	Thunder Bay	Northwest	Ministry inspection noted an instability of the tailings facility that posed a significant risk of dam failure, which would be detrimental to the environment	NIL	Minister ordered mine owner to stabilize the dam
6. Silver Mountain East	2019	Thunder Bay	Northwest	Several individuals entered the mines, exposing themselves to the hazard of an unstable rock layer between the ground surface and the underground mine that could lead to a potential cave-in	\$1,062,372	Mine openings were backfilled and fencing and bat gates were installed
7. Silver Mountain West	2019	Thunder Bay	Northwest	Contains additional hazards such as shafts, failed rock layer between the ground surface and the underground mine, pits and open stopes to surface that are likely to pose a threat to public safety	Included in above	Mine openings were backfilled
8. Kearney Graphite	2020	Parry Sound	Southern	Mine owner went into creditor protection leaving hazards at the site such as waste rock pile, tailings area, and polishing pond that have resulted in chemicals leaching into groundwater and impacting local waterbodies	\$2,542,250	Ongoing mine water management and treatment at tailings facility and polishing pond
Total					\$3,835,340	

Note: There were no deaths or injuries resulting from any of the abandoned mine incidents.

Appendix 6: Breakdown of Oil and Gas Wells, as of May 2022

Prepared by the Office of the Auditor General of Ontario

Well Mode	Definition	Number of Wells
Abandoned	A well that is officially plugged and abandoned	15,187
Abandoned and whipstocked	A well drilled and plugged back with another hole that has been drilled out of the same well bore (using a curved steel wedge, i.e., a whipstock, to start off the drilling of the new hole)	26
Abandoned and junked (lost)	A well abandoned because of mechanical difficulties in the hole	111
Active	A well that is in operation in accordance with the purpose for which it is licensed	3,417
Capped	A well capable of producing that has not yet been put into production	6
Not drilled	A location for which a well licence has been issued but the well has not been drilled	54
Potential	A newly drilled or recompleted well in which suitability for production, injection or storage is assumed but not proven	6
Suspended	A well that failed to achieve, or is no longer being used for, its licensed purpose, and the well has not been plugged	931
No well found	A well that could not be located in the field by a petroleum inspector	817
Unknown	A well for which there is no available information on mode in Ministry records	6,465
Total		27,020

Appendix 7: Audit Criteria

Prepared by the Office of the Auditor General of Ontario

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- 1. Mitigation:** Processes are in place to mitigate the effects of an emergency or disaster involving an assigned hazard.

 - 2. Preparedness:** A plan is in place prior to an emergency or disaster involving an assigned hazard that would ensure an effective response.

 - 3. Response:** The response to an emergency involving an assigned hazard is effective, rapid, controlled and co-ordinated.

 - 4. Recovery:** Activities following an emergency or disaster involving an assigned hazard are effective in helping individuals, businesses and communities return to a state of normalcy.

 - 5. Oversight, Governance and Coordination:** Effective governance and accountability structures are in place to oversee the Ministry's emergency management and response to assigned hazards. There also is effective co-ordination between partners, stakeholders and the Ministry during emergency management and emergency response activities.

 - 6. Measurement and Reporting of Performance:** Meaningful performance measures exist for the Ministry's emergency management program to evaluate and report on its response efforts and, where necessary, corrective action is taken on a timely basis.

 - 7. Staffing:** Emergency management and emergency response activities are adequately staffed with qualified, well-trained individuals.

 - 8. Procurement:** Adequate processes are in place to ensure that goods and services utilized by the Ministry in its management of emergencies (including information technology, consultant services, employee expenses and contractors) are acquired in accordance with government guidelines and directives.

 - 9. Information Systems:** Emergency-management information systems should provide timely, accurate, relevant and complete information to assist with emergency management and performance measurement and reporting.
-

Appendix 8: List of Technical Guides and Bulletins for Assigned Hazards¹

Source: Ministry of Natural Resources and Forestry

Title of Document	Last Updated	Floods	Drought / Low Water	Erosion	Soil/Bedrock Instability	Dam Failure ²
Technical Guide - Hazardous Sites	1996				✓	
Technical Guide - Large Inland Lakes and Shorelines: Flooding, Erosion and Dynamic Beaches	1996	✓		✓		
Great Lakes-St. Lawrence River System and Large Inland Lakes [Technical Guides for Flooding, Erosion, and Dynamic Beaches in Support of Natural Hazards Policies 3.1 of the Provincial Policy Statement (1997) of the <i>Planning Act</i>]	2001	✓		✓		
Technical Guide - Understanding Natural Hazards	2001	✓		✓	✓	
Technical Guide - River and Stream Systems: Erosion Hazard Limit	2002			✓		
Technical Guide - River and Stream Systems: Flooding Hazard Limit	2002	✓				
Technical Guide - Special Policy Areas (Updated Appendix 5) [Procedures for Approval of New Special Policy Areas (SPAs) and Modifications to Existing SPAs Under the Provincial Policy Statement, 2005]	2009	✓				
Technical Bulletin - Classification and Inflow Design Flood Criteria	2011					✓
Technical Bulletin - Dam Decommissioning and Removal	2011					✓
Technical Bulletin - Geotechnical Design and Factors of Safety	2011					✓
Technical Bulletin - Seismic Hazard Criteria, Assessment and Considerations	2011					✓
Technical Bulletin - Spillways and Flood Control Structures	2011					✓
Technical Bulletin - Structural Design and Factors of Safety	2011					✓
Technical Bulletin - Location Approval for Dams	2015					✓
Technical Bulletin - Maintaining Water Management Plans	2016					✓
Technical Guide - Alterations, Improvements and Repairs to Existing Dams	2016					✓

1. There are no technical guides or bulletins related to forest fires.

2. The Ministry has also produced two guides on best management practices regarding dams: Public Safety Around Dams (2011) and Dam Safety Reviews (2011).



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