Office of the Auditor General of Ontario

Value-for-Money Audit:

Setting Indicators and Targets, and Monitoring Ontario's Environment

November 2020

Setting Indicators and Targets, and Monitoring Ontario's Environment

1.0 Summary

Ontario's natural environment provides many benefits, including water, food, energy, resources and medicines. The environment, natural resources and agriculture can be affected by pollution, resource extraction, development, a changing climate and other pressures. Damage to the environment can have an impact on Ontarians' health, economic productivity and quality of life.

Decision-makers and the public need an adequate picture of the state of the environment, knowledge of whether the environment is improving or deteriorating, and awareness of underlying environmental problems and risks. To have this picture, there needs to be thorough monitoring of Ontario's environment, natural resources, wildlife, and agriculture, and clear public reporting.

Effective environmental protection requires establishing targets, monitoring the environment and analyzing collected data:

- Setting targets based on scientific evidence and with time frames is needed for the province to accomplish its environmental goals such as reducing toxins in products and protecting Ontario's Far North.
- Monitoring alerts the relevant ministries when harm has occurred, such as the presence of an invasive species that could threaten the health of forests or the rise in algae levels that could reduce oxygen in lakes and pose a threat to fish. Monitoring is also needed for the province to assess whether its programs have lessened environmental damage and to what degree.
- Plans for managing data need to be established before the data is collected—otherwise, there are risks around the ownership, security and future use of the data.

The province has made strong commitments to protect the natural environment. Legislation and related regulations, policies and programs are meant to protect against environmental degradation in Ontario and support better health and quality of life for future generations. Responsibility for environmental monitoring to confirm that these commitments are met is shared among three lead ministries. The ministries have mandates related to protecting, conserving and sustaining Ontario's environment, natural resources and agriculture:

- The **Ministry of the Environment, Conservation and Parks** (Environment Ministry) is responsible for protecting Ontario's air, land, water and species at risk and their habitat; managing provincial parks and conservation reserves; and co-ordinating the province's response to climate change.
- The **Ministry of Natural Resources and Forestry** (Natural Resources Ministry) is the provincial lead for conserving Ontario's biological diversity (biodiversity) and managing Ontario's natural resources, including forests; aggregate, oil and gas resources; fish and wildlife; and Crown lands.

- The **Ministry of Agriculture, Food and Rural Affairs** (Agriculture Ministry) has a priority to ensure the sustainability of Ontario's agriculture, oversees the province's managed honey bee sector, and has released action plans and strategies to improve the health of pollinators and agricultural soils.

Our audit found that the Environment Ministry's air and water monitoring programs are extensive, and respond to legislative and regulatory requirements, inter-jurisdictional agreements and other commitments. However, we found that the three lead ministries have not put into place effective systems and processes for setting targets, carrying out effective monitoring practices, and ensuring data quality and data sharing for certain aspects of Ontario's environment.

Targets

Our audit found that some environmental protection targets lack deadlines and are not evidence-based. We also found that when the ministries had set targets, they did not always make them public.

- **The three ministries have not set targets to achieve some goals within their area of responsibility:**
  - The Environment Ministry has not set targets for conserving water; decreasing hazardous and toxic substances in products; improving the water quality of lakes (other than Lake Simcoe and Lake Erie); or protecting and recovering species at risk.
  - The Natural Resources Ministry has not set public targets to protect and restore aquatic ecosystems; protect the Niagara Escarpment (an ecologically significant landform); or prevent and control the spread of invasive species.
  - The Agriculture Ministry has not yet set any targets to improve the health of Ontario's soil; however, the Ministry recognizes the importance of establishing environmental targets and is drafting an Agri-Food Environment Plan to improve its ability to report on environmental outcomes. This may include establishing baselines and setting quantitative targets to improve the environmental performance of Ontario's agricultural sector.
- **The province itself has not set short-term targets to achieve the longer-term target of reducing Ontario's greenhouse gas emissions by 30% below 2005 levels by 2030**. The *Cap and Trade Cancellation Act, 2018* requires the province to establish targets to reduce Ontario's emissions. But without interim, short-term targets to be monitored and benchmarked against—well in advance of 2030—the province could find in the late 2020s that it is not on track to achieve this longer-term target. Insufficient time would remain to take necessary action to get back on track.
- **The Agriculture Ministry cancelled the targets and action plan to improve the health of Ontario's pollinators and did not notify the public**. Species like bees, flies, wasps, and butterflies that pollinate crops and wild vegetation, are critical to sustaining Ontario's agriculture and natural ecosystems. Over one-third of our food comes from insect-pollinated plants. Despite their importance—and signs that the world's pollinators are in decline—the Agriculture Ministry cancelled the overarching framework of the 2016 *Pollinator Health Action Plan* and its associated targets sometime after July 2018 without notifying or consulting the public or pollinator researchers.
- **Some targets do not have time frames and supporting evidence**. The Treasury Board Secretariat (Secretariat) has advised ministries that, to be effective, targets should be specific, measurable, achievable, realistic and have set deadlines. However, environment-related targets fail to meet these criteria. For example, targets to establish a complete

system of protected areas, such as provincial parks and conservation reserves, do not have time frames. The Environment Ministry's targets to reduce the amount of waste disposed per capita and increase dissolved oxygen levels in Lake Simcoe also lack publicized time frames for driving and measuring progress. Likewise, the Natural Resources Ministry's target in the *Far North Act, 2010* to include 225,000 square kilometres of the most northern part of Ontario in a network of protected areas does not have a time frame for achievement. The Agriculture Ministry's cancelled target to restore, enhance and protect one million acres of pollinator habitat not only did not have a time frame, but was based on an unsubstantiated proposal by the Grain Farmers of Ontario.

- **Although key performance indicators and targets are required for all ministries, many for the three ministries have been maintained internally and are not shared with the public**. Since 2016/17, ministries have been required to submit information every year to the Secretariat on key performance indicators and associated targets to measure progress toward desired outcomes and priorities. However, we found that many of these key performance indicators and targets in the three ministries we audited have not been shared with the public, have been inconsistent over time, and few relate to outcomes to improve Ontario's environment, natural resources or agricultural sustainability.

Monitoring

Monitoring is critical for detecting threats to Ontario's environment, natural resources and agriculture, informing management decisions, and assessing the effectiveness of programs at achieving their goals and objectives. However, our audit found that some areas of the environment are not effectively monitored.

- **There is no long-term, broad-scale monitoring of Ontario's biodiversity**. In 2012, the government recognized that, while many independent monitoring programs collect data related to biodiversity, there is a need for an integrated, broad-scale monitoring program for all aspects of Ontario's biodiversity. Without this, impacts on populations, species, habitats and ecosystems could be occurring without detection. With this in mind, in 2012, the province committed to developing such a program, with the Natural Resources Ministry as the lead. The Ministry has taken some steps in this direction; however, eight years since the commitment was made, it has not yet developed the necessary monitoring program.
- **Monitoring protocols and programs have not been developed for several endangered species**. Under the *Endangered Species Act, 2007*, the government must identify and prioritize actions to protect and recover threatened and endangered species. However, we found that the Environment Ministry does not have a database to track the assignment and implementation of these actions, hindering progress in monitoring and recovering species at risk. For a sample of 16 endangered species, we found that monitoring protocols had not been developed and implemented for 12 (or 75%) of these species, despite being identified as high-priority actions as long as 10 years ago.
- **Monitoring in Ontario's protected areas is not required or consistent**. The Environment Ministry is responsible for maintaining and restoring ecological integrity in provincial parks and conservation reserves. However, the Environment Ministry does not have a monitoring program to systematically monitor native species, invasive species, or other aspects of ecological integrity across its network of protected areas. Although the Ministry has draft guidelines and methodologies, these are not applied consistently and do not

provide specific direction on what to monitor. We reviewed the park management directions for the 328 provincial parks that have them and found that 160 (or 49%) lack monitoring direction of any kind. Of those parks that do have management direction to conduct monitoring, only 93 (or 28% of all parks) have management direction that specifically relates to the state of the environment.

- **There is no provincial monitoring of wild pollinator health**. In Ontario, insect pollination is needed for at least 30 economically important crops, including many fruits and vegetables. However, information on the contribution of pollinators to Ontario's crops is dated or lacking for many crops, and the Agriculture Ministry does not monitor these impacts nor the health of wild species that contribute to pollination. While the Agriculture Ministry does have an apiary (beehive) inspection program, there are opportunities to expand surveillance to provide a more informed view of the pests and diseases that affect managed honey bees, and their potential effects on wild species. Furthermore, little information is collected on wild pollinators and their fertilization of wild plants, especially in Northern Ontario. Although the Natural Resources Ministry started some monitoring on wild pollinators in 2016, the data has not yet been processed, and monitoring is limited to eight sites in two counties.
- **The Agriculture Ministry has made little progress developing Ontario-specific indicators and monitoring of soil health**. Healthy soil is essential for the sustainability of Ontario's agricultural system. However, Ontario's soils face challenges, such as decreasing organic matter and increasing risk of erosion. In its 2018 Soil Health Strategy, the Agriculture Ministry noted that province-wide soil assessment tools are not well developed, and that creating Ontario-specific indicators would be more useful than using only the federal Agri-Environmental Indicators that the Ministry currently depends on. However, two years later, little progress has been made to implement foundational actions within the Soil Health Strategy, including a collaborative implementation plan, annual work plans and a schedule for reporting on progress.
- **A lack of standardized monitoring protocols jeopardizes the consistency and comparability of collected data**. Monitoring protocols are meant to be detailed plans that explain how data is to be collected, managed, analyzed and reported. Comprehensive, standardized protocols are critical for ensuring that changes detected by monitoring are actually occurring in nature rather than the result of differences in how the data was collected, processed and analyzed. We found that the Environment Ministry and Natural Resources Ministry do not have standards or direction for the required content or format of their monitoring protocols. As a result, we found great variability in the existence, content and quality of protocols used to monitor Ontario's environment. Many protocols describe only the process for collecting data in the field—they lack details on monitoring objectives, site selection, survey design, personnel requirements, data management, performance measurement, and the protocol review and revision process. In other cases, monitoring programs rely on protocols that have remained in draft form for several years or methods described in journal articles, or have no protocol at all.
- **Few environmental monitoring programs are evaluated to ensure that they are effective**. The Secretariat has long advised ministries to develop performance measurement frameworks—consistent processes to collect, analyze and report information on how programs are performing and whether they are achieving their intended outcomes. However, our audit found that few of the

three ministries' monitoring programs have performance measurement frameworks in place. Furthermore, the Secretariat has repeatedly provided guidance on conducting program evaluations to assess the effectiveness, efficiency, relevance and sustainability of programs. We found that only a few monitoring programs have undergone formal, documented evaluations with findings, conclusions and recommendations.

Data Quality and Data Sharing

Many of the three ministries' environmental monitoring programs that we reviewed lacked data and information management plans, which jeopardizes the integrity, security and effective use of collected data.

- **Few environmental monitoring programs have data management plans**. The Natural Resources Ministry released a Data Management Policy in April 2019, requiring that program areas prepare data management plans; however, we found that few of the three ministries' environmental monitoring programs had plans. Collecting data without a plan in place can result in unclear ownership, inappropriate use and access, and insufficient security and storage. For example, Ontario's natural heritage data—including highly sensitive information about the location of vulnerable species—is stored on servers in the United States. Yet, the Natural Resources Ministry has no third-party, independent assurance over the system's information technology. We also found that not all monitoring data that would be suitable for public release had been released to the public in a timely manner in accordance with the Management Board of Cabinet's Open Data Directive.

Overall Conclusion

Overall, our audit found that the Environment, Natural Resources and Agriculture ministries do not have effective systems and processes for setting targets, carrying out effective monitoring practices, and ensuring data quality and data sharing for certain aspects of Ontario's environment. These are needed for effective longer-term monitoring of Ontario's environment, natural resources and agriculture.

The three ministries have not established targets to achieve goals in many areas of their responsibility, hindering the ministries' and the public's ability to gauge progress. Moreover, some established targets do not have time frames and supporting rationales, and many of the ministries' key performance indicators and targets are not shared with the public and change over time.

Our audit found that the Environment Ministry's air and water monitoring programs are extensive, and respond to legislative requirements, interjurisdictional agreements and other commitments. However, our audit also found that several areas are not being effectively monitored. For example, the Natural Resources Ministry has not fulfilled a commitment to establish a long-term, broad-scale program to monitor Ontario's biodiversity. Furthermore, we found that monitoring protocols have not been developed for several endangered species, monitoring in Ontario's protected areas is not required or consistent, and there is no provincial monitoring of the soils and wild pollinators that sustain Ontario's crops and natural habitats.

We found that the three ministries collect a wealth of data but they lack standardized, documented processes for collecting, analyzing, managing and sharing data. As a result, there is great variety in the existence and quality of monitoring protocols, and there are no content requirements to ensure the consistent collection of comparable data over many years and decades. Likewise, few monitoring programs have data management plans to ensure the security, integrity and quality of collected data. Finally, there are no requirements that

monitoring programs have performance measurement frameworks or undergo program evaluations to ensure that they are effective at meeting monitoring goals and objectives.

This report contains 15 recommendations, with 27 action items, to address our audit findings (see **Appendix 1** for a summary of report recommendations).

OVERALL ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks thanks the Office of the Auditor General for its review of the Ministry's environmental targets, indicators and monitoring.

We agree that Ministry targets for key environmental commitments are important to measure progress toward environmental goals and objectives and we will continue to use monitoring data to support them.

The Ministry will explore opportunities to improve how we track progress and measure effectiveness of Ministry programs and how best to share program results publicly. We will also review our data management approaches and look to improve the practice and application of performance measurement in our monitoring programs.

OVERALL NATURAL RESOURCES MINISTRY RESPONSE

The Ministry would like to thank the Auditor General and staff for their work on the audit and welcomes the Auditor General's insightful observations and recommendations. The Ministry agrees that environmental monitoring is important to detect changes in the environment, measure progress towards environmental goals, and support evidence-based decision-making. The Ministry also agrees that target-setting, performance measurement and evaluation, and information-sharing drive progress and help to ensure program effectiveness.

The Ministry has a long history of maintaining specific monitoring programs to inform policy development and decision-making related to its mandated responsibilities for sustainable management of fish, forests and wildlife. As noted in this report, the Ministry implements more than 20 monitoring programs to address its resource management science needs. Environmental indicators from these programs and other data sources are reported to the public in products such as Ontario's State of the Forest and State of Biodiversity reports; they are also reported internally through the State of Ontario's Natural Resources Report, which is available to Ontario Public Service staff, and which the Ministry intends to make public. In addition, as noted in the report, 76% of the Ministry's datasets have already been made available online through the Ontario Data Catalogue.

The Ministry appreciates the Auditor General's recognition of progress made in many areas through the Integrated Monitoring Framework and related efforts. The Ministry values and strives for continuous improvement; it is foundational to delivering innovative science with integrity. In responding to these recommendations, the Ministry will continue to set management objectives and improve its monitoring and information sharing efforts in a manner that is fiscally responsible and aligned with the Ministry's mandate, priorities and corporate direction. The Ministry will continue to modernize environmental monitoring to utilize the best available science, ensure quality results, and optimize delivery.

OVERALL AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) thanks the Auditor General for the observations and recommendations in the report.

A healthy environment is a priority for the Ministry, and we are committed to improving our associated performance metrics. We agree that indicators and targets need to be science-based, with data being open and accessible.

Much of the Ministry's environmental research and scientific investments are focused on measuring environmental outcomes. This includes data relating to the adoption of best management practices such as the ONFARM Applied Research and Monitoring initiative and Agri-Food Innovation Alliance.

Ontario's soil is a valuable natural asset and must be protected to remain productive. That is why the Ministry, in collaboration with many partners, developed and released New Horizons: Ontario's Agricultural Soil Health and Conservation Strategy, a long-term framework that sets a vision, goals and objectives for soil health and conservation. The Soil Action Group, comprising representatives from the Ministry, farm organizations, conservation authorities, other levels of government and academia, is in place to lead and monitor the implementation of the Strategy.

Healthy pollinators are also important for a healthy environment and sustainable agriculture. The Ministry has maintained its support to pollinators, particularly managed honey bees. The Ministry's Apiary Program conducts inspections and works with industry to monitor managed honey bee colonies for diseases and pests. In addition, the Ministry administers research programs to study the health of managed honey bees and inform best management practices.

In collaboration with our partners, the Ministry will begin implementing our commitments to the recommendations provided in this report.

2.0 Background

2.1 A Healthy Natural Environment

Ontario's natural environment supplies Ontarians with many and varied benefits, such as water, food, energy, resources and medicines. Through ecological processes and cycles, nature distributes and filters water, produces oxygen, regulates climate, provides pollination of crops, controls pests, provides natural resources (e.g., wood, minerals, aggregates and energy), and breaks down waste. Overall, healthy ecosystems sustain the quality of air, water and soils, and provide habitat and resources to support wildlife, humans and agriculture.

However, the state of Ontario's environment can be negatively affected by many different pressures and factors, including pollution, resource extraction, development and a changing climate. Degradation and damage of functioning ecosystems can, in turn, have impacts on Ontario's economic productivity and Ontarians' health and quality of life.

To help prevent and respond to these impacts, Ontario has a range of laws, regulations, policies and programs that recognize the benefits and intrinsic value of healthy ecosystems, aim to protect against environmental degradation, and support better health and quality of life for current and future generations. Many Ontario laws have high-level goals to protect, restore and/or improve the state of the environment. These goals relate to a wide variety of environmental areas, including air quality; water quality and quantity; land and natural resources; nature and wildlife; and greenhouse gas emissions, which contribute to a changing global climate. Under these broad goals, more specific, tangible and measurable indicators, objectives and targets can detail how to achieve the overarching goals (see **Figure 1**).

Figure 1: Definitions and Examples Helpful for Understanding the Terms in This Report
Prepared by the Office of the Auditor General of Ontario

Term and Definition	Examples
ACHIEVING A DESIRED FUTURE STATE	
GOAL A **Goal** is a long-term desired outcome. Goals tend to be broad in scope, general in intention, intangible, abstract and difficult to measure. Goals are often broken into more specific Objectives.	• Clean water
OBJECTIVE An **Objective** is a more specific, tangible and measurable outcome toward achieving an overarching Goal.	• Bring mercury levels in a lake below 0.2 micrograms/litre
TARGET A **Target** is a future desired value of an Indicator. A Target is a time-bound benchmark for driving and measuring progress toward meeting an Objective.	• Bring mercury levels in a lake below 0.5 micrograms/litre by July 2022 • Bring mercury levels in a lake below 0.3 micrograms/litre by July 2024
MEASURING PROGRESS	
INDICATOR An **Indicator** is a variable or metric to describe or measure a condition, phenomenon or dynamic. A Goal may have many Indicators.	• Levels of mercury in a lake
KEY PERFORMANCE INDICATOR A **Key Performance Indicator** is a measure that quantifies progress toward desired outcomes. It measures how well the actions we take are affecting our chosen Indicator—in other words, how our actions are performing with respect to the Indicator.	• Percentage decrease in mercury levels annually

2.2 Environmental Monitoring

Provincial financial monitoring and public reporting on the state of the province's financial affairs demonstrates transparency and accountability and facilitates informed decision-making.

Likewise, environmental monitoring and public reporting is equally critical for demonstrating transparency and accountability about whether the quality of Ontario's environment is getting better or worse, and whether environmental objectives and their overarching goals are being met. Monitoring is also critical to developing and implementing policies, programs and actions for improvement.

With information gathered through monitoring, the government can make informed decisions about how the environment will affect Ontarians, and how Ontarians are affecting the environment. Environmental monitoring also generates information for designing effective environmental management programs, allocating resources efficiently, and identifying problems and opportunities for improvement.

Outside the provincial government, information collected through environmental monitoring can be used—and is used when available—by many people. These include municipal engineers, Indigenous communities, health professionals, emergency

responders, resource managers and users, researchers, scientists and concerned members of the public.

Without effective environmental monitoring and reporting, decision-makers and the public do not have an adequate picture of the state of the environment, knowledge of whether the environment is improving or deteriorating, or awareness of underlying environmental problems and risks. Improper monitoring by municipal staff in Walkerton, for example, contributed to the contamination of drinking water in May 2000 that killed seven people and sickened more than 2,300.

2.2.1 Using Indicators and Targets to Monitor the Environment

To assess the state of the environment, and ensure that environmental objectives and overarching goals are being met, Ontario would ideally track all species, pollutants, risks and measures of environmental quality across the province. However, this would be impossibly time-consuming and expensive. Instead, monitoring programs use a number of direct and indirect measures, or indicators (e.g., mercury levels in water), to track the state of the environment and potential impacts on human health over time. Where targets have been established, regular monitoring of environmental indicators provides data and information to track progress in meeting those targets.

Indicators and targets can measure driving forces (e.g., human activities that increase pressures on the environment, such as manufacturing, forestry and mineral extraction), the stressors or pressures that result (e.g., use of toxic substances, air and water pollution, land-use changes and waste), and the effects these pressures have on the state or condition of the environment (e.g., air, water and soil quality, and natural habitat). In turn, indicators can also be selected to measure the impacts of environmental degradation (e.g., on wildlife populations and human health), and responses by governments and society (e.g., conservation programs and regulations) to the environmental situation. Ministries also set goals and targets, and collect information, on many different outputs from their programs (e.g., number of permits issued or inspections made, rate of compliance with regulations, and number of education and outreach activities), and priorities (e.g., economic development and recreational opportunities).

Best practices recommend that, to effectively drive and measure progress, environmental targets should be specific, measurable and time-bound (having a deadline for achievement). Several Canadian and international jurisdictions (e.g., Australia, Germany, the United Kingdom and United States) use environmental indicators to report publicly on the state of the environment and progress toward meeting environmental objectives, goals and targets.

2.2.2 Responsibility for Monitoring Ontario's Environment

The Ministry of the Environment, Conservation and Parks (Environment Ministry) is responsible for protecting Ontario's air, land, water and species at risk and their habitat; tackling climate change; and managing provincial parks and conservation reserves. The Environment Ministry administers laws, regulations and programs related to air pollution, water use and pollution, climate change, contaminated lands and spills, waste management, pesticides, toxic substances, endangered species, protected areas and conservation authorities. The Environment Ministry conducts environmental monitoring to provide scientific data to track the state of the environment to inform policy and program development and assessment, to support the Ministry's compliance, enforcement and emergency response programs and to inform Ontarians on the state of their environment. Conservation authorities, which are established under legislation administered by the Environment Ministry, monitor surface and groundwater quality and water levels and flows, and in some cases other natural resources, in their jurisdiction.

The Ministry of Natural Resources and Forestry (Natural Resources Ministry) is the lead provincial body responsible for the conservation of Ontario's biological diversity and for the government's Biodiversity Plan. The Natural Resources Ministry also has primary responsibility for managing Ontario's natural resources, including forests; aggregate, oil, gas and salt resources; fish and wildlife; and Crown lands. To achieve its mandate, the Ministry conducts monitoring, research, and planning for the management and use of Ontario's natural resources.

The Ministry of Agriculture, Food and Rural Affairs (Agriculture Ministry) includes ensuring the sustainability of Ontario's agriculture as one of its specific priorities. With respect to this priority, the Agriculture Ministry released *Ontario's Pollinator Health Action Plan* (2016) to help improve the health of pollinators that support a strong agri-food sector and a healthy environment, and *New Horizons: Ontario's Agricultural Soil Health and Conservation Strategy* (2018) to support agricultural soil management practices. The Agriculture Ministry's Apiary Program also monitors the health of managed honey bees, including their pests and diseases. With a priority to ensure the sustainability of Ontario's agriculture, the Agriculture Ministry has a role to play in the monitoring and reporting on the state and health of the pollinators and soils that sustain Ontario's crops.

2.2.3 Provincial Programs to Monitor Ontario's Environment

Environmental monitoring and reporting has been undertaken in Ontario for several decades, with some current monitoring programs beginning over 40 years ago (see **Appendix 2** for key ministry programs to monitor the state of the environment, natural resources and environmental sustainability of Ontario's agriculture). In some cases, the data collected from monitoring and reporting programs directly informs progress toward meeting targets and goals outlined in legislation, regulations and various government policies and strategies. In others, the data is collected and analyzed to verify that environmental conditions and quality are maintained at acceptable levels (e.g., to monitor the presence of contaminants in fish to ensure that there are no health risks associated with fish consumption).

Means of data collection include field measurements and collection of samples, automated measurements, as well as reporting by those responsible for environmental discharges or resource use (e.g., water use). Collected samples are tested at the Environment Ministry's laboratory and science facility in Toronto, other ministry labs, as well as external labs to a lesser degree. The collected data, subject to quality assurance and privacy restrictions, are published in the Ontario Data Catalogue, other government websites (e.g., Ontario GeoHub for geospatial data), peer-reviewed publications, as well as technical reports (e.g., annual Air Quality in Ontario reports).

The Environment Ministry has more than a dozen monitoring programs, including monitoring related to air, drinking water, Great Lakes and inland lakes. The Environment Ministry also has six reporting programs, including the air emissions umbrella category, through which it receives reported information. Several of the Ministry's monitoring programs (e.g., related to air, drinking water, fish contaminants, Great Lakes, groundwater, and stream water) are undertaken, in part, due to obligations specified in inter-jurisdictional agreements (e.g., the draft ninth *Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health*, the *Canada-Ontario Lake Erie Action Plan* (2018), and the *Memorandum of Understanding Respecting the National Air Pollution Surveillance Program*). Similarly, of the six reporting programs, air emissions and water use also have inter-jurisdictional agreements that commit the province to monitoring and reporting.

The Natural Resources Ministry has more than 20 monitoring programs, including composite programs related to Great Lakes fisheries, large and small game, and species at risk. Related to the environmental sustainability of Ontario's agricul-

ture, the Agriculture Ministry has a program to inspect apiaries (managed beehives) and a joint program with the Environment Ministry to monitor pesticide levels in streams, and had an Enhanced Apiary Monitoring Project to help improve the health of managed honey bees.

See **Figures 2, 3** and **4** for organizational charts showing the division of monitoring activities within these three ministries.

3.0 Audit Objective and Scope

The objective of our audit was to assess whether the Ministry of the Environment, Conservation and Parks (Environment Ministry) has effective systems and procedures in place to:

- establish indicators and targets to help achieve goals and objectives to protect and improve Ontario's natural environment;
- compile the qualitative and quantitative information for established indicators needed to monitor the achievement of goals and objectives against targets; and
- monitor and publicly report on the state of the environment and provincial progress toward meeting these goals, objectives and targets.

In addition, we assessed whether the Ministry of Natural Resources and Forestry (Natural Resources Ministry) has effective systems and procedures in place to:

- establish indicators and targets to help achieve goals and objectives to sustainably manage Ontario's natural resources;
- compile the qualitative and quantitative information for established indicators needed to monitor the achievement of goals and objectives against targets; and
- monitor and publicly report on the state of Ontario's natural resources and provincial progress toward meeting these goals, objectives and targets.

We also assessed whether the Ministry of Agriculture, Food and Rural Affairs (Agriculture Ministry) has effective systems and procedures in place to:

- establish indicators and targets to help achieve goals and objectives to ensure the environmental sustainability of Ontario's agriculture;
- compile the qualitative and quantitative information for established indicators needed to monitor the achievement of goals and objectives against targets; and
- monitor and publicly report on the environmental sustainability of Ontario's agriculture and provincial progress toward meeting these goals, objectives and targets.

In planning our work, we identified the criteria (see **Appendix 3**) we would use to compare practices against. These criteria were established based on a review of applicable legislation, policies and procedures, internal and external studies and best practices. Senior management at each of the three ministries reviewed and agreed with the suitability of our audit objectives and associated criteria.

The scope of our audit was the three ministries' indicators, targets, monitoring and reporting related to the state of the environment, natural resources and the environmental sustainability of agriculture.

Our audit is being conducted in two stages. Stage 1, found here, covers the ministries' indicators, targets and monitoring. Stage 2, which will be released in 2021, will review the ministries' reporting to the public on the state of the environment and progress toward meeting their objectives, goals and targets.

We conducted Stage 1 of our audit between January 2020 and August 2020. We obtained written representation from management of the three ministries that, effective October 22, 2020 (Environment Ministry and Agriculture Ministry) and October 23, 2020 (Natural Resources Ministry), they had provided us with all the information they were aware of that could significantly affect the findings or the conclusions of this report.

Figure 2: Environmental Monitoring Responsibilities at the Ministry of the Environment, Conservation and Parks

Prepared by the Office of the Auditor General of Ontario

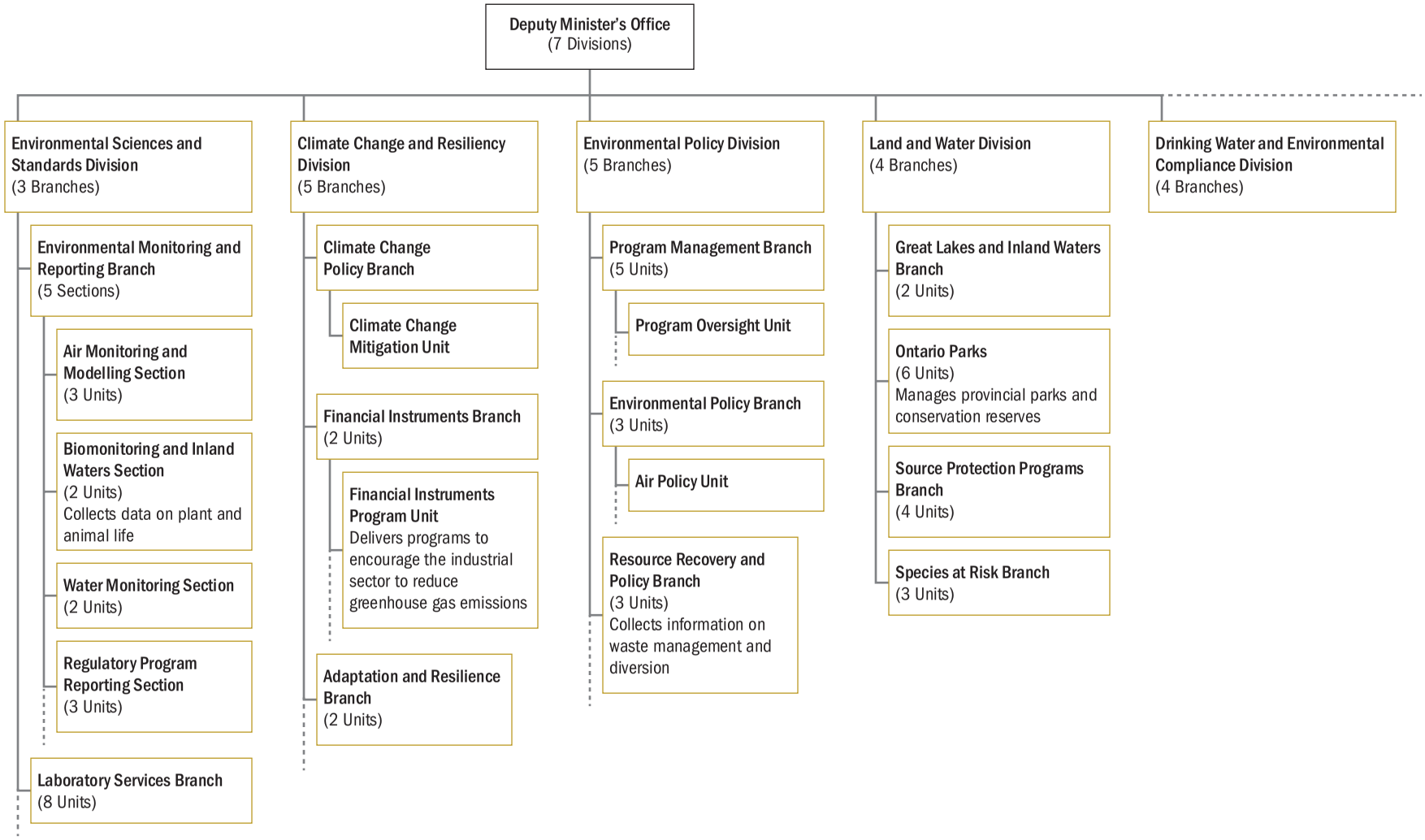
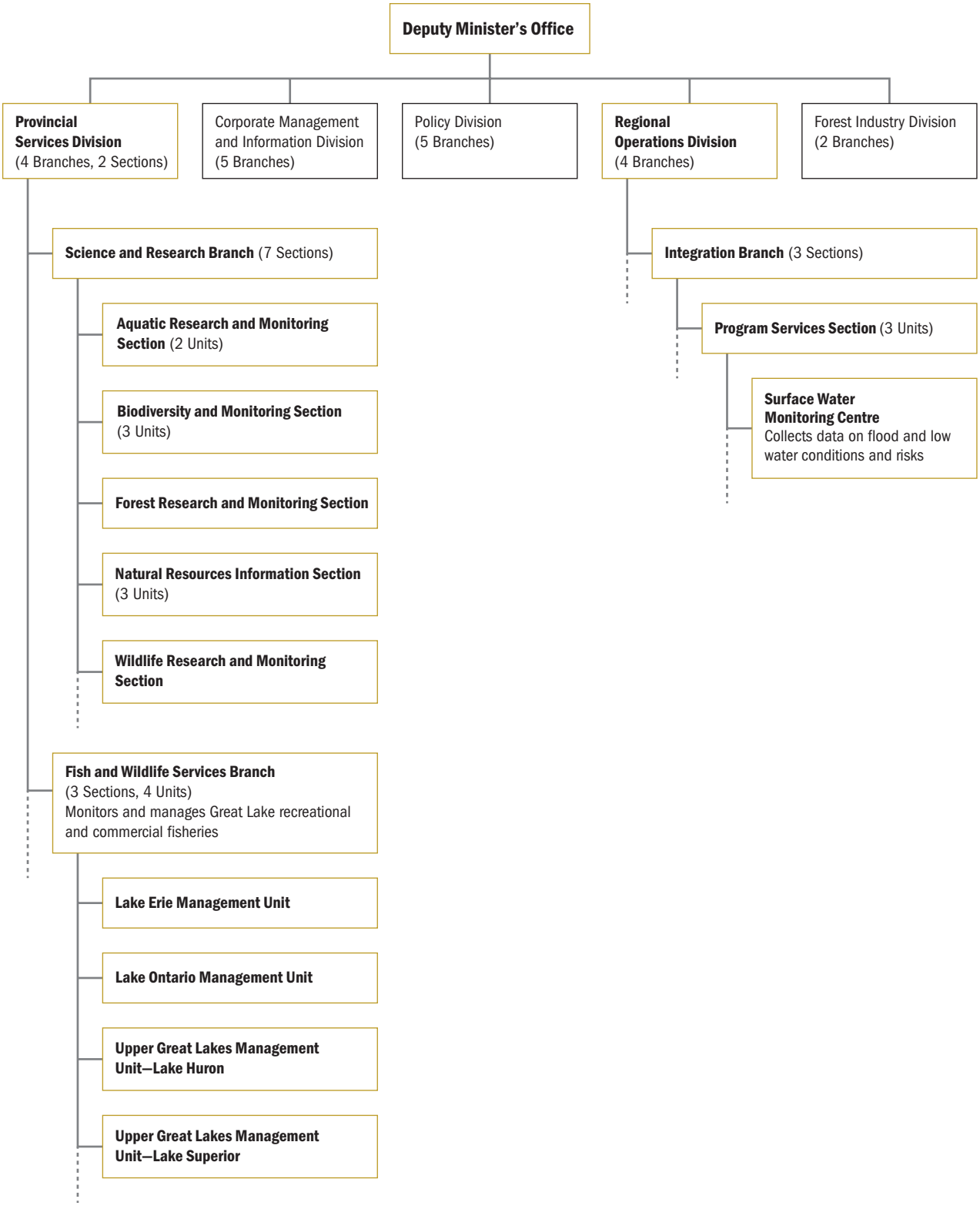


Figure 3: Environmental Monitoring Responsibilities at the Ministry of Natural Resources and Forestry*

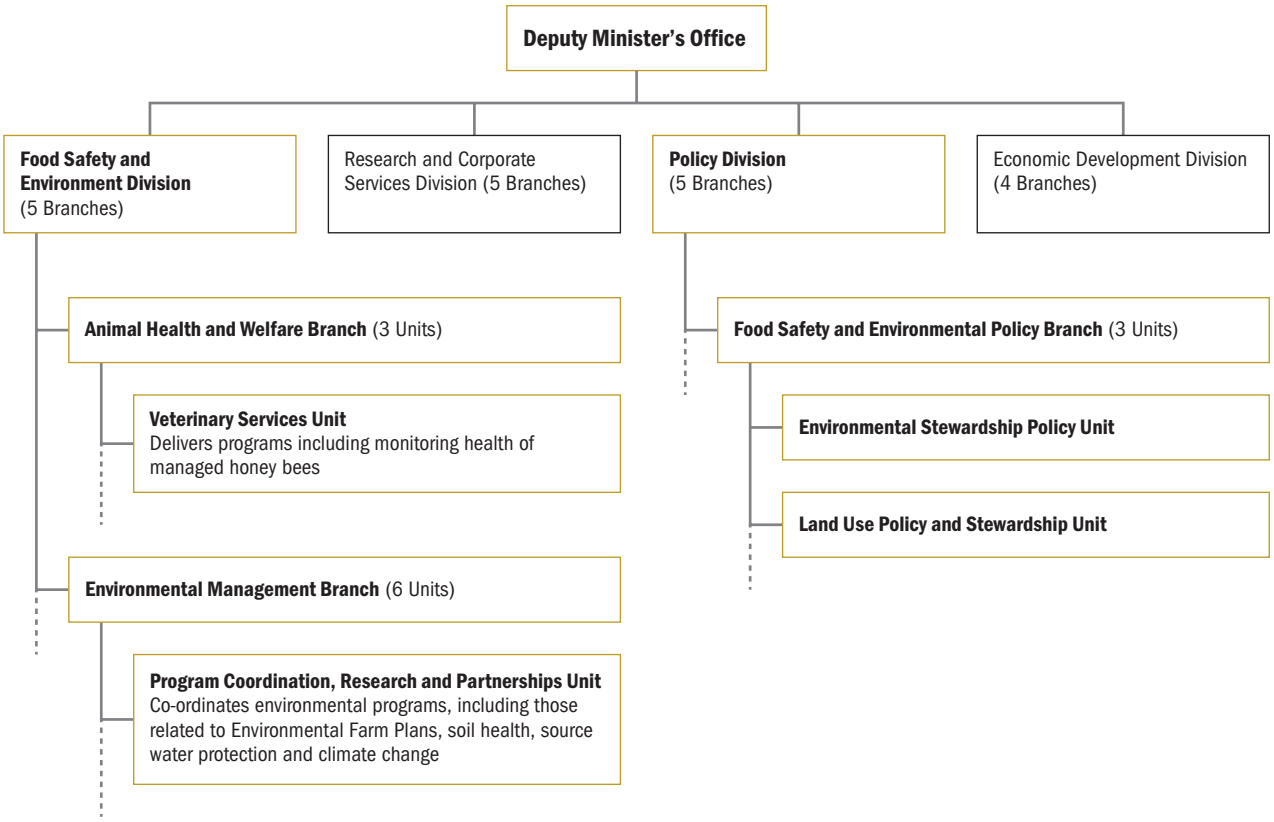
Prepared by the Office of the Auditor General of Ontario



* Divisions, branches, sections and units with environmental monitoring responsibilities are outlined in gold.

Figure 4: Environmental Monitoring and Programming Responsibilities at the Ministry of Agriculture, Food and Rural Affairs*

Prepared by the Office of the Auditor General of Ontario



* Divisions, branches, sections and units with environmental monitoring responsibilities are outlined in gold.

We interviewed senior management and staff, and examined relevant data, protocols, research and other documents from the Environment Ministry, Natural Resources Ministry and Agriculture Ministry to obtain an understanding of each entity's involvement in setting indicators, targets, and monitoring. We also interviewed and reviewed information provided by other ministries and agencies, including the Ministry of Health, Ministry of Municipal Affairs and Housing, Ministry of Transportation, and Public Health Ontario, as well as Agriculture and Agri-Food Canada, Environment and Climate Change Canada, and Health Canada.

We also interviewed scientists and subject matter experts from various other organizations and institutions, including the Canadian Wildlife Federation, Ontario Biodiversity Council, University of Guelph, Wildlife Conservation Society Canada and York University.

Further, we conducted research related to environmental target-setting and monitoring used by other provinces and states, countries and international organizations, including the European Environment Agency, the Organisation for Economic Co-operation and Development, and the United Nations.

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: Establishing and Sharing Environmental Performance Indicators, Targets and Timelines

The Treasury Board Secretariat (Secretariat), which establishes policies and standards for organizational practices across the provincial government, has provided guidance to ministries emphasizing the importance of developing key performance indicators (see definitions in **Figure 1**) and targets to track performance, report on progress and drive continuous improvement. In several guidance documents, including its *Program Evaluation Reference & Resource Guide* (2007), *A Guide to Outcome-based Performance Measurement in the OPS* (2016), and *Making Smart Decisions: Embedding Evidence-Based Decision Making in the Ontario Public Service* (2019), the Secretariat has advised that key performance indicators and targets should be based on outcomes (changes that can be observed or measured, such as improved air quality) rather than outputs (the products or services generated by programs and activities, such as the number of inspections conducted). Generating outputs does not necessarily mean that the desired resulting changes have been achieved.

Noting that tracking progress from a baseline to a target is a fundamental element of performance measurement, the Secretariat has recommended that targets should be realistic, achievable and time-bound (to give a clear sense of the time when progress will be assessed). The Secretariat has noted that "while targets should motivate, you do not want to risk disappointment or inquiry if they are not achieved."

4.1 Targets Not Set in Some Important Environmental Areas, Including Water Conservation, Invasive and At-Risk Species, and Soil Health

Guidance from the Secretariat encourages ministries to set targets to measure program effectiveness. Moreover, some pieces of environmental legislation explicitly authorize or require ministers to set related targets. For example, a target to reduce the amount of phosphorus entering Lake Erie has been set under the *Great Lakes Protection Act, 2015* to reduce algal blooms. This Act allows any person to submit a request to the Minister to establish a Great Lakes target, and the Environment Ministry provides a template for submitting such a request.

However, several important environment-related goals of the Environment Ministry, Natural Resources Ministry, and Agriculture Ministry currently lack targets to achieve them (see **Appendix 4** for targets associated with environmental goals). While the ministries do not have their own documented procedures for developing and establishing indicators and targets, like all provincial ministries they receive guidance and direction on best practices from the Secretariat.

Water Conservation and Quality

One of the purposes of the *Water Opportunities Act, 2010* is to conserve and sustain water resources for present and future generations. Under this Act, the Environment Ministry may establish targets with respect to water conservation. Similarly, the *Clean Water Act, 2006* gives the Ministry authority to establish targets that relate to the use of the Great Lakes as a source of drinking water and that direct and co-ordinate action on a source-protection issue or emerging Great Lakes problem. No targets have yet been set under either of these acts.

Reducing Waste and Greenhouse Gas Emissions

While the Environment Ministry has set targets related to diverting waste, including food and organic waste, from landfills (see **Appendix 4**), it has not set targets to decrease hazardous and toxic substances in products and packaging, an aim articulated in the *Resource Recovery and Circular Economy Act, 2016*. Furthermore, while the *Cap and Trade Cancellation Act, 2018* requires the province to establish targets to reduce Ontario's greenhouse gas emissions, at the time of our audit, only one target had been established (see **Appendix 4**). This target, to reduce Ontario's emissions by 30% below 2005 levels by 2030, is so far in the future that it hinders a meaningful measurement of progress. Interim targets, particularly for pollution with long-term, cumulative impacts—like greenhouse gas emissions—can help the province and public track and assess progress against benchmarks.

Biodiversity

Ministries across the province have also not set any targets to drive and measure progress in protecting, restoring and conserving Ontario's biodiversity, or meeting the goals of their biodiversity-related legislation and strategies. Rather, the cross-ministry plan to conserve biodiversity (*Biodiversity: It's In Our Nature, 2012*) outlines actions and supporting activities the province will take to help achieve targets in *Ontario's Biodiversity Strategy, 2011: Renewing Our Commitment to Protecting What Sustains Us*, which was developed by the Ontario Biodiversity Council. Established by the province in 2005, the council comprises about 40 experts and stakeholders, and reports to the public every five years on the state of Ontario's biodiversity. Targets in this strategy include, by 2015, establishing a long-term biodiversity monitoring and reporting system, and improving the status of species and ecosystems of conservation concern; and, by 2020, conserving at least 17% of terrestrial and aquatic systems, through well-connected networks of protected areas and other conservation measures.

Species at Risk and Invasive Species

The Environment Ministry itself has not set any targets to drive and measure progress toward meeting the overarching goal of the *Endangered Species Act, 2007*: to protect and recover species at risk and their habitats – although some species-specific targets have been set. Nor has the Natural Resources Ministry set targets related to the underlying purpose of its *Invasive Species Act, 2015*: to prevent and control the spread of invasive species. Moreover, the Natural Resources Ministry has not set public targets to drive and assess progress in meeting goals and objectives of *Ontario's Provincial Fish Strategy: Fish for the Future*, including to protect and maintain aquatic ecosystem diversity, and to restore degraded fish populations and their ecosystems. Further, no specific targets have been set to meet provincial objectives to protect and maintain the Niagara Escarpment, an ecologically significant landform.

In fact, the Natural Resources Ministry has few publicly communicated targets related to the state of Ontario's natural resources. It has, however, tracked and reported on targets and indicators internally (see **Section 4.1.1**). For example, in 2015, the Ministry released an internal strategic plan, *Horizons 2020*, articulating five broad goals. Progress toward meeting these goals was tracked

by measuring results against targets on an internal Ministry dashboard. Targets included those related to fish species richness and abundance, forest management and regeneration, the restoration and rehabilitation of habitat and river tributaries, and wetland loss and protection. However, when *Horizons 2020* expired in April 2020, the Ministry replaced it with a new strategic plan, *Naturally Resourceful*, with no supporting dashboard of targets or indicators. The Natural Resources Ministry has informed us that work on developing targets and indicators was initiated in early 2020 but had not been completed at the time of our audit.

Soil Health

The Agriculture Ministry does not have any published targets related to the environmental sustainability of Ontario's agriculture. According to Agriculture and Agri-food Canada's Agri-Environmental Indicators (see **Section 5.2.5**), in 2011, 68% of Ontario's farmland was in an unsustainable erosion risk category and 53% of Ontario's cropland had low or very low soil cover. However, the Agriculture Ministry does not have any targets related to the measures of success outlined in *New Horizons: Ontario's Agricultural Soil Health and Conservation Strategy* (2018): increasing soil organic matter, increasing soil cover, and decreasing erosion risks. Nor does it have targets related to managing nutrients on farms and reducing the loss of nutrients to waterways.

However, the Agriculture Ministry recognizes the importance of establishing environmental targets. In October 2019, the Agriculture Ministry began drafting an Agri-Food Environment Plan to outline actions and investments to improve environmental outcomes and help deliver on the Made-in-Ontario Environment Plan. One of the key actions in this draft Agri-Food Environment Plan (dated March 9, 2020) is to improve the Ministry's reporting on environmental outcomes, which could include establishing baselines and setting quantitative targets for agri-food environmental performance. The draft Plan indicates that quantitative performance targets will be established, through consultation, across several metrics, including soil erosion risk, soil organic carbon, soil cover, agriculture greenhouse gas emissions, and hectares of farmland. The draft Plan does not include establishing targets related to improving pollinator health (see **Section 4.1.2**).

RECOMMENDATION 1

To track performance, report on progress and drive continuous improvement toward environmental goals, we recommend that the Ministry of the Environment, Conservation and Parks; Ministry of Natural Resources and Forestry; and Ministry of Agriculture, Food and Rural Affairs establish and implement a process for developing comprehensive, outcome-based targets to meet the legislated and strategic goals and objectives within their areas of responsibility.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation and the importance of tracking performance, reporting on progress and driving continuous improvement toward environmental goals. The Ministry will use Treasury Board Secretariat guidance to develop outcome-based targets to achieve the Ministry's legislated and strategic goals and objectives.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry agrees with this recommendation and recognizes that targets are important to measure program effectiveness, and to drive and assess progress toward meeting goals set out in legislation and strategic policy. The Ministry's new strategic plan for 2020-2025, *Naturally Resourceful*, establishes a strategic goal and outcomes for sustainably managing

Ontario's resources with a focus on: responding to immediate threats like invasive species; monitoring and engaging in activities that promote health of Ontario's natural resources; and using the best available science and public consultation to support decision-making. The Ministry will develop a performance measurement framework for this new strategic plan, with indicators and associated outcome-based targets that will link to the goals and objectives of existing Ministry legislation, strategies and programs, such as forestry, fisheries and wildlife.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and recognizes that comprehensive outcome-based metrics and targets are important for achieving our environmental goals.

The Ministry is committed to performance measurement and continuous improvement of our metrics and targets. A significant portion of the Ministry's environmental research and scientific investments, such as the ONFARM Applied Research and Monitoring initiative and Agri-Food Innovation Alliance, are focused on quantifying environmental improvements resulting from the adoption of best management practices. The Ministry is currently developing a performance measurement system to better assess and demonstrate the Ministry's impact on sustainability in the agri-food sector. In addition, the Ministry's Apiary Program, a specific environmental monitoring program, uses field inspection data to monitor overall bee health in the province, define Ontario's pest and disease status for honey bees, and for reporting purposes. The metrics captured at inspection are based on expert input from industry, academia and other regulatory jurisdictions. These metrics measure pest/disease levels and overwinter mortality rates to assess the health of managed honey bees.

The Ministry commits to improving our capacity to track performance measures and establishing a process for developing metrics and targets by fall 2022.

4.1.1 Ministries Inconsistent in Sharing Key Performance Indicators and Targets with Public

Despite key performance indicators and targets being required for all ministries, for the three ministries we audited, many are kept internal and not shared with the public (see **Appendix 5** for internal and published key performance indicators).

Since 2016/17, ministries have been required to submit information to the Secretariat on key performance indicators, some of which are ministry-identified and others that are government-directed. Key performance indicators measure progress toward desired outcomes and government priorities. The Secretariat has directed that all key performance indicators are to be accompanied by targets. The Secretariat reviews and approves ministries' key performance indicators, and shares an inventory on the Ontario Public Service intranet. These inventories serve as a resource for ministries to better understand performance measures across government, develop performance measures and apply evidence-based decision-making.

Despite guidance from the Secretariat recommending that ministry-level outcomes or key performance indicators be included in annual reports, for the three ministries we audited, several of these targets and key performance indicators have been kept internal, and not included in the three ministries' published annual plans we reviewed (2017/2018 to 2019/2020).

For example, the Natural Resources Ministry has not shared information in its published annual plans on key performance indicators and targets, including those related to wetland area lost in southern Ontario, natural resources sustainability, and providing recreational opportunities through hunting and fishing (see **Appendix 5**). No quan-

titative targets were provided in the Ministry's 2017/18 published plan, no plan was published in 2018/19, and no targets or key performance indicators were included in its 2019/20 published plan.

Despite having Secretariat-approved key performance indicators and targets, including those related to the adoption of environmentally beneficial best management practices (see **Appendix 5**), the Agriculture Ministry has not shared any with the public in its published annual plans. Instead, since 2015/16, the Ministry's annual plans have reported that it "… will develop key performance measures and metrics…"

Compared to the other two ministries, the Environment Ministry has shared more information in its published annual plans on key performance indicators and targets. Yet, it has not published internal key performance indicators and targets related to the percentage of residential drinking water tests that meet provincial standards, the amount of previously contaminated land deemed suitable for reuse, and the turnaround time for completing reviews of Environmental Compliance Approval applications (see **Appendix 5**). Moreover, the Ministry's published targets and key performance indicators have changed over time to reflect Ministry programs and priorities. Some categories for targets and key performance indicators have been added or dropped. For example, there are no longer any targets associated with specific types of air emissions, including sulphur dioxide, nitrogen oxide and volatile organic compounds, since the initial targets were met in 2015. In 2017/18, targets and key performance indicators related to the concentration of pollution in the air replaced those associated with the amount of pollution released but, with the exception of sulphur dioxide, addressed different contaminants. Although there was some consistency in the general target categories included in the Ministry's annual plans, new categories have been introduced (e.g., waste disposal) and others dropped (e.g., brownfield sites).

These changes have caused the overall number of Environment Ministry targets and key performance indicators to vary considerably between years as well. For example, the Ministry's 2015/16 and 2016/17 annual reports included 12 and 13 targets, and 13 and 14 performance measures, respectively. In the annual report for 2017/18, the number of targets and key performance indicators decreased to seven and four, respectively. In its 2019/20 published plan, the Ministry included five targets and five key performance indicators. While this year-over-year variability may reflect changes to key strategic priorities and goals, it hampers transparent, ongoing tracking of consistent measures for assessing performance.

We note, too, that the Secretariat has directed that all key performance indicators are to be outcome-focused, supported by valid and reliable measurement, and allow for timely tracking of progress toward intended results. Few of the Agriculture Ministry's and Natural Resources Ministry's Secretariat-approved key performance indicators relate to the state of Ontario's environment, natural resources or agricultural sustainability (see **Appendix 5**).

RECOMMENDATION 2

So that key performance indicators are meaningful, transparent and effective at assessing progress toward environmental targets and goals, we recommend that the Ministry of the Environment, Conservation and Parks; Ministry of Natural Resources and Forestry; and Ministry of Agriculture, Food and Rural Affairs:

- submit consistent, outcome-based key performance indicators to the Treasury Board Secretariat; and
- include all approved key performance indicators and targets in their published annual plans.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation, and that key performance indicators should be

meaningful, transparent and effective at assessing progress toward environmental targets and goals. The Ministry will continue to submit outcome-based indicators to the Treasury Board Secretariat consistent with its requirements. The Ministry will include approved key performance indicators and targets in its published annual plans, in alignment with direction provided by the Treasury Board Secretariat.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry agrees with this recommendation. The Ministry refines its key performance indicators as a part of its annual Multi-Year Plan submission to the Treasury Board Secretariat (Secretariat). The Ministry's key performance indicator assessment for the 2020-21 Multi-Year Plan was noted by the Secretariat as a strong performance measurement system, recommending the continuation of eight key performance indicators and refinement of one key performance indicator. In response to the Auditor General's recommendation, the Ministry will work with the Secretariat's Centre of Excellence for Evidence-Based Decision Making to refine its measures for environmental targets and goals and provide an update in its 2022-23 Multi-Year Plan in the fall of 2021.

The Ministry is required to follow the Secretariat's instructions when publishing its annual plans. To support consistent reporting across ministries, the Ministry will engage the Secretariat and discuss opportunities to include in its Estimates Briefing Book instructions a requirement to include approved key performance indicators and targets in their published plans. The Ministry will incorporate its approved key performance indicators in its 2021-22 Estimates Briefing Book.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and that key performance indicators are important in assessing environmental targets and goals.

As part of the Multi-Year Planning process and the development of its annual plan, the Ministry reports relevant key performance indicators to the Treasury Board Secretariat as instructed, and, where applicable, provides measures, baseline, trend, target and associated data values.

The Ministry commits to submitting approved key performance indicators and performance measures to the Treasury Board Secretariat annually to show progress toward environmental targets and goals, and to including approved environmental key performance indicators and targets in published annual plans.

4.1.2 Targets to Improve Pollinator Health Abandoned

Pollinators are critical to a healthy ecosystem, and play a crucial role in Ontario's agriculture sector (see **Section 5.2.4**). Recognizing that over one-third of our diet comes from insect-pollinated plants, and about 80% of wild, flowering plant species would not exist without pollination, the Agriculture Ministry released the *Pollinator Health Action Plan* (Pollinator Plan) in 2016, outlining actions to address stressors that affect pollinators. The plan identified ministries and organizations accountable for each action with an associated timeline for completion. The Pollinator Plan reaffirmed two previously set targets (see **Appendix 4**), and established a third: to restore, enhance and protect one million acres of pollinator habitat (see also **Section 4.1**). Although there were problems with the targets (see **Section 4.2**), the plan and its targets demonstrated a commitment to help ensure healthy pollinator populations that contribute to the sustainability

of Ontario's food supply and support resilient ecosystems and a strong economy.

During our audit, however, we found that the overarching framework of the Pollinator Plan and its associated targets are no longer in effect. The Agriculture Ministry did not notify or consult the public on this decision through the Environmental Registry, as required under the *Environmental Bill of Rights, 1993* (see our 2020 report on the *Environmental Bill of Rights*). As a result, pollinator researchers and the public, were unaware that the Pollinator Plan and its targets had been cancelled.

See Recommendation 32 in **Chapter 2** of our 2020 report on the *Environmental Bill of Rights*.

4.1.3 In the Absence of Ontario Targets, Standards, Guidelines or Criteria for Water Quality, Environment Ministry Informally Relies on Those of Other Jurisdictions

In the absence of setting its own targets, standards, guidelines or criteria, the Environment Ministry sometimes informally relies on those from other jurisdictions. There are a number of examples of this practice in Ministry assessments of the quality of water collected through the Great Lakes, inland waters (lakes, streams and rivers) and drinking-water monitoring programs. Although provincial benchmarks are available for hundreds of contaminants, not all contaminants with potential health and environmental impacts are covered. For the surveillance of emerging contaminants in drinking water, the Ministry uses an informal hierarchy of jurisdictions and organizations from which it obtains certain contaminant benchmarks for assessing drinking water quality (including those used for monitoring and setting conditions in approvals and permits). This informal hierarchy consists of, in descending order, Canada, the United States, the World Health Organization, Europe and Australia. The Ministry's process for assessing levels of emerging contaminants (where a provincial benchmark is unavailable) is to use the first available benchmark in this hierarchy. (Should no benchmark be available at a given tier, the standard from the next entity in this hierarchy is used.)

The Ministry could not provide us with a documented justification for using this hierarchy in its surveillance of emerging drinking water contaminants. Moreover, the assumption that all the assessment values from one jurisdiction or organization are superior to all those of another, without a separate review of the evidence for each contaminant, has not been substantiated. By contrast, the Ministry follows a well-defined process for using values from other jurisdictions in its assessments of local air quality under the E*nvironmental Protection Act*. This process is described in the Ministry's *Air Contaminants Benchmark List*. Air contaminant screening levels, used for those substances without standards or guidelines, may be set at levels based on the median of values from the 11 agencies included in the Environment Ministry's jurisdictional screening level list.

RECOMMENDATION 3

So that the values used in water quality assessments are transparent and adequately substantiated, we recommend that the Ministry of the Environment, Conservation and Parks establish a documented process, similar to that used for air quality, for evaluating the use of assessment values from other jurisdictions and organizations where provincial values do not exist.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation, and that values in water quality assessment should be transparent and adequately substantiated. The Ministry will review how environmental benchmarks are documented and used across air and water programs and look for opportunities to enhance consistency.

4.2 Some Targets Do Not Have Specific Time Frames or Are Not Based on Sound Evidence

Some of the targets set by the three ministries, including those related to protected areas, pollinators, and waste disposed per capita, do not have time frames for achievement or are not based on credible evidence.

The Secretariat has directed that, to motivate achieving specific results and give a clear sense when progress will be assessed, targets should have specific time frames. However, several targets set by the three ministries lack time frames (see **Appendix 4**). For example, since 1978, targets have been set to establish specific types of protected areas (e.g., wilderness class, natural environment and waterway class) in different areas of Ontario, and include life science features (e.g., representative ecosystems) and earth science features (e.g., significant examples of bedrock, fossils and landforms) in protected areas. None of these targets have time frames. Likewise, targets in the Environment Ministry's 2019/20 published plan, including targets to increase dissolved oxygen levels in Lake Simcoe and achieve a "decrease in amount of waste disposed per capita each year" lack publicized time frames for driving and measuring progress. Moreover, the latter target does not identify a desired percentage or absolute decrease in disposed waste. By contrast, the Canadian Council of Ministers of the Environment agreed to Canada-wide targets to reduce per capita waste disposal from 706 kilograms (kg) in 2014 to 490 kg by 2030 (a 30% reduction) and to 350 kg by 2040 (a 50% reduction).

Under the *Far North Act, 2010*, the Natural Resources Ministry has a target of including at least 225,000 square kilometres (22.5 million hectares) of the Far North—the most northern part of the province—in an interconnected network of protected areas. However, neither the *Far North Act, 2010* nor the Natural Resources Ministry has a time frame for achieving this target.

Further, some targets are not based on credible scientific evidence. For instance, a Habitat Target Task Team of science and policy representatives from the Agriculture Ministry, Natural Resources Ministry and Environment Ministry developed options in 2015 for an evidence-based pollinator habitat target. Options included committing to developing a target within one year of finalizing the *Pollinator Health Action Plan*, committing to a quantitative aspirational target (e.g., targeted restoration and enhancement of 26,000 hectares of pollinator habitat in southern Ontario by the end of 2021), and developing a qualitative target (e.g., increasing the amount of pollinator-friendly habitat across the landscape). The target ultimately included in the *Pollinator Health Action Plan* to restore, enhance and protect one million acres of pollinator habitat was first proposed by a group assembled by the Grain Farmers of Ontario. In March 2015, this organization, which represents corn, oat, soybean and wheat farmers, released its *Ontario Pollinator Health Blueprint* with the unsubstantiated target of protecting one million acres as an alternative to the government enacting regulations to limit the application of neonicotinoid pesticides, agricultural insecticides that have been shown to be detrimental to managed honey bees and other insect pollinators. Internally, the Habitat Target Task Team noted that there was no basis to support the one million acre target. Recent scientific research also suggests that one million acres of pollinator habitat is grossly insufficient to maintain wild bee communities.

Other targets are not based exclusively on scientific evidence but, instead, on negotiations, consensus and alignment with other parties. For example, while Ontario's Ambient Air Quality Criteria were developed by the Environment Ministry for use in various assessments, and set at levels deemed appropriate to the environmental or health effect they are intended to protect against, the Ministry also relies on the Canadian Ambient Air Quality Criteria for its air quality targets. The latter criteria, which were developed through the Canadian

Council of Ministers of the Environment, take into account not only scientific information, and standards and guidelines from other jurisdictions and organizations, but also minimum achievability.

RECOMMENDATION 4

So that set targets are effective at driving and measuring progress toward science-based environmental goals, we recommend that the Ministry of the Environment, Conservation and Parks; Ministry of Natural Resources and Forestry; and Ministry of Agriculture, Food and Rural Affairs review their existing targets, and ensure that these and new targets have meaningful achievement-focused time frames and are based on sound, scientific evidence.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation and that targets are important to measure progress toward science-based environmental goals and objectives. The Ministry will review the scientific basis and time frames of its existing environmental targets and consider the need for new targets based on scientific evidence, where appropriate.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry agrees with this recommendation and agrees that targets are important to drive and measure progress toward science-based goals. As recommended, the Ministry will review monitoring program targets to ensure that they have achievement-focused time frames that suit the timescales of the programs and are based on the best available science.

Also, as recommended, the Ministry will use guidance provided by the Treasury Board Secretariat's Centre of Excellence for Evidence-Based Decision Making to set science-based environmental targets.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and the importance of having effective measures to track performance, report on progress and drive continuous improvement. The Ministry also agrees that metrics and any applicable targets should be based on sound scientific evidence.

Measures and baselines must be developed before targets can be established. A strong foundation of research and knowledge is required to benchmark environmental conditions to ensure metrics and targets are meaningful. This is why a significant portion of our stewardship research and scientific investments are focused on quantifying environmental improvements that arise with the adoption of best management practices. A variety of measures, models and quantifiable data will be required to understand the complex relationship between agri-food practices and the environment. The Ministry recognizes that collaboration is a key component to improving our ability to access data, measure and report on environmental performance.

The Ministry commits to meet with subject matter experts to review existing metrics and targets and develop a process for establishing key performance indicators, baselines and setting new or more effective metrics and targets where sufficient evidence exists, by December 2021.

5.0 Detailed Audit Observations: Monitoring

5.1 Little Internal Awareness of or Co-ordination between Ministries' Environmental Monitoring Programs

The Environment Ministry and Natural Resources Ministry implement and administer dozens of programs to survey, inventory and monitor Ontario's air, water, land, wildlife and natural resources (see **Appendix 2** for a description of key monitoring programs). (Other than its inspection and monitoring programs related to managed honey bees, and its partnership with the Environment Ministry on stream water pesticide monitoring, the Agriculture Ministry does not lead any environmentally related monitoring programs.)

We found that there was inconsistent co-ordination of—or even ready access to information on—the monitoring conducted in other branches, divisions or ministries. We found cases where staff were unaware of what information was being collected within their own ministry or even branch, or of the termination of monitoring relevant to their work.

As a result of this lack of co-ordination and centralized information, our requests for information about ministries' monitoring programs and the types of data they collect took weeks for the ministries to compile and provide. The Environment Ministry and Natural Resources Ministry lack updated portals or databases to inform their own and other ministries' staff about the monitoring activities and results of their programs. Although the Natural Resources Ministry releases internal annual reports on science activities and has an online database to collect and share information on science activities across the Ministry (allowing for cross-divisional reporting and collaboration), there is no requirement for staff to upload and update information, the database is accessible only to staff within the Ministry, and the database does not include summary data or details on recent monitoring results.

Several United States agencies (e.g., the US Fish & Wildlife Service and the National Park Service) follow the best practice of including in their monitoring protocols documented procedures for summarizing and distributing environmental monitoring results. However, as discussed in **Section 5.3**, the Environment Ministry and Natural Resources Ministry lack guidance and requirements for the content of their monitoring protocols.

RECOMMENDATION 5

So that staff are able to co-ordinate, collaborate and draw on information collected through monitoring programs within their own and the other two ministries, we recommend that the Ministry of the Environment, Conservation and Parks; Ministry of Natural Resources and Forestry; and Ministry of Agriculture, Food and Rural Affairs:

- establish an internal means for sharing information on the objectives, activities and results of monitoring programs; and
- require staff to keep the information up to date.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation and that the ability for staff to co-ordinate and collaborate on monitoring information from across the Ministry is important to facilitate knowledge sharing. The Ministry will explore additional opportunities for sharing up-to-date data and information on the objectives, activities and results of environmental monitoring programs, subject to the limitations of its current information technology and information systems.

NATURAL RESOURCES MINISTRY RESPONSE

Once the Ministry of Natural Resources and Forestry (Ministry) has fully defined the objectives, activities and results of its monitoring programs, the Ministry will identify data sharing solutions, many of which already exist. Monitoring program results vary in format as they are used by a wide variety of clients in a wide variety of ways. The Ministry currently uses different platforms, such as Land Information Ontario, Ontario GeoHub, the Ontario Data Catalogue and COLBY (also known as CollabON, an internal information portal to find, share and collaborate on government data and records) to share the data designed to fit the purpose of the client needs. For example, monitoring results from the inland lakes aquatic monitoring program are available through the Fish ONLine platform, while results from forest health monitoring are available through Ontario GeoHub.

The Ministry will share information about the objectives, activities and results of monitoring programs with the Ministry of the Environment, Conservation and Parks and the Ministry of Agriculture, Food and Rural Affairs, and work with these ministries and the Land and Resources Information and Information Technology Cluster to utilize a collaborative approach to data sharing and management.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and that inter-ministry information sharing is important for co-ordination and collaboration on monitoring programs where there is a shared area of interest.

The Ministry currently collaborates with partner ministries on our respective monitoring programs (e.g. with the Ministry of the Environment, Conservation and Parks, Health Canada and the Pest Management Regulatory Agency to develop a reporting process for honey bee mortality incidents reported in Ontario).

The Ministry commits to establishing a mechanism by December 2021 to better share information and processes with partner ministries to ensure information is kept up to date.

5.2 Air and Water Monitoring Extensive; Monitoring Lacking on Biodiversity, Species at Risk, Protected Areas, Pollinators and Soil Health

Our audit found that the Environment Ministry's air and water monitoring programs are extensive, and respond to legislative and regulatory requirements, inter-jurisdictional agreements and other commitments. For the Ministry's ambient air monitoring, which consists of three programs, the monitoring network is a component of the federal National Air Pollutant Surveillance program, formalized in a Memorandum of Understanding between the Environment Ministry and Environment and Climate Change Canada. This network consists of 39 Air Quality Health Index monitoring stations, four dedicated roadside research stations, and three ambient air research stations, mainly focused on the most populous areas of the province.

The Environment Ministry's water quality monitoring programs respond, in part, to monitoring obligations and discretionary monitoring authority outlined in several pieces of legislation (the *Clean Water Act, 2006*, *Environmental Protection Act*, *Great Lakes Protection Act, 2015*, *Lake Simcoe Protection Act, 2008*, and *Safe Drinking Water Act, 2002*). Several of these water-quality monitoring programs are province-wide and collectively gather data on thousands of parameters.

Where provincial monitoring requires improvement and integration is in areas where there is little to no legislative or inter-jurisdictional requirement: biodiversity, species at risk, protected areas, pollinators and soil health.

5.2.1 No Long-Term, Broad-Scale Biodiversity Monitoring

Despite a commitment to do so, the Natural Resources Ministry has not yet developed an integrated, broad-scale monitoring program for all aspects of Ontario's biodiversity.

Species and biodiversity are threatened by habitat loss and degradation, climate change, disease and parasites, invasive species, pollution and overexploitation. Monitoring biodiversity can help the province identify the changing threats and their impacts, and make informed decisions to respond effectively. However, collecting this data is not a one-time exercise—long-term monitoring is needed to detect changes and trends over time. Moreover, broad-scale monitoring of biodiversity is not required by any provincial legislation or regulations.

In 2012, the province recognized that, while many independent monitoring programs across a number of ministries collect biodiversity-related data, there is a need for an integrated, broad-scale monitoring program for all aspects of Ontario's biodiversity. With this in mind, in its 2012 biodiversity plan (*Biodiversity: It's In Our Nature*), the province committed to developing such a program, with the Natural Resources Ministry as the lead.

Eight years later, an integrated, broad-scale program has not yet been developed. The Natural Resources Ministry, however, has taken some steps in this direction, including implementing its Broad-scale Fisheries Monitoring Program to collect data on aquatic ecosystem health and fisheries populations; making progress on using remote sensing to monitor land cover changes; and developing the Integrated Monitoring Framework (2015) to modernize the Ministry's approach to monitoring natural resources.

The Integrated Monitoring Framework outlines a series of steps to align monitoring activities with business needs and science priorities; improve efficiencies and cost savings; produce recommendations to re-design monitoring activities; and create a shared understanding of roles and responsibilities for monitoring activities. To ensure a comprehensive and long-lasting understanding of monitoring objectives, methods and outputs, the Framework specifies that each step needs to be documented. This includes documenting key questions, achievable monitoring objectives, linkages to existing activities, collaboration and data mining opportunities, design options and costing, performance measures, management approval and direction, data and information management plans, and reporting plans. However, we found that, for monitoring programs that had gone through the steps of the Framework, several of these steps had not been well documented and compiled; documentation had not yet been developed, was not readily available, or was not kept in an organized fashion to ensure that current and future staff have access to historical and current information on a program's purpose, processes and activities.

Through the Integrated Monitoring Framework, the Natural Resources Ministry has developed the Ontario Wildlife Monitoring Network (Network). With pilot work occurring in 2020, the Network will replace the Multi-Species Inventory and Monitoring program under the Provincial Wildlife Population Monitoring Program (which was established in response to the now-cancelled *Class Environmental Assessment for Forest Management on Crown Lands in Ontario*). The Network will expand upon the previous program and use cameras and acoustic recording in fixed plots to broaden and increase the monitoring of mammals, birds, terrestrial reptiles and amphibians. The Network is currently designed to monitor the 45 million hectares of Crown lands in central and Northern Ontario where forestry is approved. The intention is to increase the scale of this monitoring to apply across the province. This represents an opportunity to make progress developing a broad-scale biodiversity monitoring program.

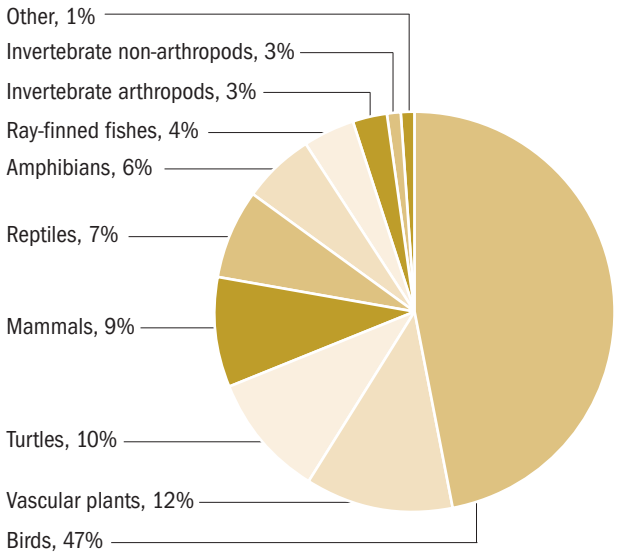
However, even if the Network were expanded across the province, comprehensive monitoring of other important aspects and indicators of Ontario's biodiversity and environmental health, including

wetlands, rare plants, lichens and insects, would still be lacking. While information on many aspects are tracked by the Natural Heritage Information Centre (a unit within the Natural Resources Ministry), many of the records in its database are a result of incidental observations rather than systematic monitoring that allows analysis of trends over time and space. As an example of the bias in the data received by the Natural Heritage Information Centre, although less than about 1% of Canada's known species (excluding viruses and bacteria) are birds, almost 50% of the species observation records in the database are of birds (see **Figure 5**). Moreover, these observations provide information on species' occurrence but not on population or genetic diversity, or the health of populations. While the database has the ability to store information on population sizes, trends, threats and overall health of each occurrence, such information is not always available.

Without an integrated, long-term, and broad-scale monitoring of biodiversity, it is difficult for the Ministry to measure the direction and speed of changes within natural systems, assess the causes and impacts of those changes, and predict and respond to future changes. Incomplete information about what is happening on the landscape also reduces the Ministry's ability to detect and quickly respond to emerging issues (e.g., wildlife disease, invasive species, population declines) until the problem is too big to address.

Figure 5: Observation Records in Natural Heritage Information Centre Database by Biological Group

Source of data: Ministry of Natural Resources and Forestry



RECOMMENDATION 6

So that Ontario's biodiversity is effectively monitored and the province can make informed decisions to protect and restore it, we recommend that the Ministry of Natural Resources and Forestry develop an integrated, broad-scale monitoring program for all aspects of Ontario's biodiversity.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry agrees with the Auditor General's acknowledgement of the importance of biodiversity monitoring. Providing long-term, broad-scale monitoring is a key science service that the Ministry is committed to providing for Ontario. The Ministry appreciates the Auditor General's acknowledgement of efforts made to modernize monitoring through the Integrated Monitoring Framework. These efforts enable the Ministry to take a risk-based approach to re-engineer our programs so they become more efficient, aligned with priorities and more effective to inform management decisions to support biodiversity.

While monitoring all aspects of biodiversity is a significant undertaking, the Ministry strives to measure indicators (e.g., species, habitats, and the pressures impacting them) that reflect changes across a variety of species and habitats to allow scientists to make inferences about how and why biodiversity changes, including for species that cannot be monitored. In this context, the Ministry will continue to identify gaps and make efforts to bring together terrestrial, aquatic and wildlife data to analyze them collectively to improve the understanding of the state and trends of biodiversity.

As the Auditor General recommends, the Ministry will continue to enhance monitoring programs, and will continue to collaborate to share data and leverage new geospatial techniques to improve Ontario's knowledge of its biodiversity in a fiscally responsible manner.

5.2.2 Monitoring Protocols and Programs Not Developed for 12 of 16 Endangered Species

Despite the province identifying it as a high priority to develop and implement monitoring programs for certain species at risk, these actions have not been initiated for a number of endangered species.

The purposes of the *Endangered Species Act, 2007* are to identify and protect species at risk and their habitats, and promote the recovery of species at risk, including the promotion of stewardship activities. Once a species is listed as endangered or threatened under this Act, the Environment Ministry must ensure that a recovery strategy is prepared (usually by outside experts) that includes recommendations to the Ministry on what is required to protect and recover the species. In return, the Environment Ministry must then publish a "government response statement" (response statement) that summarizes and prioritizes the actions the province intends to take in response to the recovery strategy. These response statements identify which actions are of highest priority, and whether actions will be "government-led" (undertaken by a provincial ministry or agency) or "government-supported" (carried out by conservation partners with provincial support). These actions often include developing and implementing survey and monitoring protocols for the species. Development and implementation of response statements is led by the Environment Ministry's Species at Risk Branch.

However, we found through the course of our work that the Ministry does not have a database to track the assignment, implementation and progress of actions in response statements. We reviewed response statements for high-priority actions that relate to monitoring and surveying Ontario's 117 endangered species—Ontario's most vulnerable plants and animals. We asked the Species at Risk Branch for the status of a sample of 16 monitoring protocols, and found that development and implementation had not yet been initiated for 12 (or 75%) of them, including for species with response statements that are 10 years old (See **Figure 6**). Moreover, we found other examples where the Environment Ministry (and the Natural Resources Ministry, which was previously responsible for species at risk) have failed to follow through on actions related to monitoring species at risk. For example:

- No survey protocols have been developed for the endangered Fowler's toad or common five-lined skink (Carolinian population), despite this being identified as a "government-led action" in the 2011 response statements for these species;
- A monitoring plan, with standards and protocols, has not been developed for the threatened Boreal population of caribou, despite this being identified as a priority to be implemented within one year of releasing the *Woodland Caribou Conservation Plan* (2009) (the response statement to the recovery strategy); and
- Despite being due in 2014, no response statement has been finalized for the endangered American eel to respond to recommendations in the recovery strategy, including the development and implementation of an ongoing monitoring program.

Until the Environment Ministry undertakes, delegates, co-ordinates and tracks the implementation of actions in response statements, including those related to monitoring, little progress will be made toward species' recovery goals.

RECOMMENDATION 7

For progress to be made on protecting and recovering species at risk, we recommend that the Ministry of the Environment, Conservation and Parks:

Figure 6: Status of High-Priority Actions in Government Response Statements to Develop and Implement Survey and/or Monitoring Protocols for Several Endangered Species

Prepared by the Office of the Auditor General of Ontario

Species Name	Year of Government Response Statement	Status
American badger	2010	No protocol available[1]
American columbo	2014	No protocol available or in development
Barn owl	2010	No protocol available or in development
Bluehearts	2016	No protocol available or in development
Butternut	2014	No protocol available or in development[2]
False hop sedge	2017	No protocol available or in development[3]
Golden eagle	2016	No nest-monitoring methodologies available or in development[4]
Juniper sedge	2016	No protocol available or in development
King rail	2017	No species-specific protocol developed[5]
Lowland toothcup	2018	No protocol available or in development
Mottled duskywing	2016	Standardized survey protocol developed in 2017 through Species at Risk Stewardship Program funding
Riverine clubtail	2016	No protocol available or in development
Scarlet ammannia	2018	No protocol available or in development
Small white lady's-slipper	2016	Standardized survey protocol developed in 2020 through Species at Risk Stewardship Program funding
Spotted gar	2016	No protocol available or in development
Wood turtle	2010	Natural Resources Ministry developed survey protocol in 2015

1. Work from 2009–2015 through the Species at Risk Stewardship Program led to new information to support the development of protocols.
2. Stewardship partners and volunteers have located trees throughout its range, assessed tree health, and monitored the health of trees assumed to be resistant to butternut canker (a fungal disease).
3. Species listed as a 2020/21 priority for Species at Risk Stewardship Program funding
4. Species covered by North American Breeding Bird Survey methodology
5. Species targeted in the *National Protocol Framework for the Inventory and Monitoring of Secretive Marsh Birds* (US Fish and Wildlife Service, 2015)

- establish a database of actions contained in government response statements;
- execute on high-priority actions to be taken, including monitoring;
- solicit interest from and assign responsibility for certain actions to conservation partners (e.g., organizations, agencies, universities and other stakeholders); and
- use the database to annually track and follow up on progress on actions.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation and will explore the feasibility of implementing processes and systems to enhance tracking progress and following up on actions identified in the government response statements.

Protecting and recovering species at risk is a shared responsibility – that is why the Ministry will work with willing partners to implement high-priority actions.

This includes implementing the Species at Risk Stewardship Program, through which the government is delivering up to $4.5 million in 2020-21 to support projects by non-profit organizations, Indigenous communities and other stakeholder groups. Since 2007, Ontario has provided Species at Risk Stewardship Program

funding for more than 1,100 projects, which have implemented on-the-ground recovery actions for nearly 200 species at risk; involved over 73,000 individuals who volunteered their time for the projects; contributed to the restoration of more than 54,000 hectares of habitat for species at risk; and provided species at risk information through their education and outreach activities to millions of people.

In accordance with the *Endangered Species Act, 2007*, the Ministry will continue to report on progress toward the protection and recovery of species at risk for species that have completed government response statements, including a summary of progress and actions toward meeting the recovery goal for the species. To date, Ontario has successfully reported on the progress toward the protection and recovery of 81 species at risk, and plans to develop and publish reports, in alignment with the provisions of the *Endangered Species Act, 2007*, on four additional species at risk in 2020 and 18 others in 2021.

5.2.3 Monitoring Inconsistent across Ontario's Protected Areas

Because there is no specific direction from the Ministry of the Environment, Conservation and Parks on what is to be monitored in Ontario's protected areas, or how it is to be monitored, monitoring is variable and inconsistent.

Under the *Provincial Parks and Conservation Reserves Act, 2006*, protected areas are to "provide points of reference to support monitoring of ecological change on the broader landscape." However, the Environment Ministry does not have a monitoring program to systematically monitor native species, invasive species, or other aspects of ecological integrity across its network of protected areas. Although the Ministry has draft guidelines and methodologies for an Ontario Parks Inventory and Monitoring Program, these guidelines are not applied consistently across all protected areas, and do not provide specific direction on what to monitor to fulfil the monitoring objective of the Act.

In the absence of any overarching direction, any specific requirements for monitoring within a provincial park would be described in a park's management direction (management plan or statement). We reviewed the park management directions for the 328 provincial parks that have them and found that 160 (or 49%) lack any direction on monitoring of any kind. Of those parks that do have management direction to conduct monitoring, only 93 (or 28% of all parks) have direction specifically related to the state of the environment (e.g., monitoring species at risk, water quality, and changes due to acid rain).

Internal Ministry documents indicate that, due to limited co-ordination, park management and program areas have developed their own approaches for identifying, prioritizing and generating science and information. Ministry staff identified: few consistent standards for inventorying, monitoring and managing data; uncertainty over roles and responsibilities for co-ordinating and prioritizing science activities; and limited ability to compile and report on information at a higher level. With a target completion date of March 2021, the Ministry is developing an Ontario Parks Science Strategy to guide how Ontario Parks generates, acquires, manages and uses science and information to inform policy, planning, management and operations.

See Recommendations 4 and 5 in our 2020 report, *Conserving the Natural Environment with Protected Areas*.

5.2.4 No Provincial Monitoring of Wild Pollinator Health

Despite the importance of pollinators to agricultural production and wild plant communities, Ontario has no comprehensive, long-term wild pollinator monitoring program.

Pollinators, which include species of bees, flies, wasps, butterflies, moths, beetles and hummingbirds, are essential to agricultural production (particularly fruit, vegetable and nut crops) and

maintaining the health and diversity of wild plant communities. In Ontario, there are more than one thousand species of insects that pollinate flowering plants. Evidence of the impacts of pollinator declines around the world (e.g., due to habitat loss, pesticides, pests and diseases, and climate change) on crop pollination and yield raises concerns for Ontario's agricultural production and biodiversity.

In Ontario, insect pollination is needed for at least 30 economically important crops, representing six major types (berry fruit, field fruit and vegetables, orchard fruit, forage and oilseeds, greenhouse crops, and other crops). The Agriculture Ministry has estimated that managed and wild pollinators contribute more than $990 million annually to Ontario's economy. However, information on the contribution of pollinators to Ontario's crop pollination is dated or lacking for many crops (e.g., soybeans, peas, beans, peaches and sour cherries). Although it funds several projects related to controlling managed honey bee pests and diseases, and in 2019 funded a project to research the contribution of wild pollinators to several crops (e.g., apples, strawberries, and gourds), the Agriculture Ministry does not monitor the health of wild species or their contribution to the pollination of Ontario's crops. For example, while it has funded research on the impacts of stressors (pesticides and tillage), the Ministry does not monitor populations of the squash bee, a highly specialized native pollinator that pollinates squash, pumpkin and zucchini.

The Agriculture Ministry does have an apiary inspection program to monitor the health of managed honey bees, check compliance with legislation, and minimize the spread of pests and diseases named under the *Bees Act*. However, there are opportunities to expand surveillance to provide a more informed view of pests and diseases in the honey bee population, and their potential spillover effects on wild species, including those that pollinate Ontario's crops. The Ministry initiated an Enhanced Apiary Monitoring Project for pests and diseases in 2015 under the now-cancelled Pollinator Health Action Plan, but that monitoring was stopped in 2019. Ministry staff have since developed options for surveying American Foulbrood and Varroa mites (two of the greatest threats to Ontario's managed honey bees) to provide a more informed view of pests and diseases in honey bee populations. Of the proposed options, staff recommended a flexible approach that balances risk, logistics and randomness of inspections.

Also, little information is known and collected on wild pollinators and their pollination of wild plants. Although the Natural Resources Ministry started some monitoring on wild pollinators in 2016, the data has not yet been processed and summarized, and the monitoring is limited to eight sites in Peterborough and Northumberland Counties. While research groups, including at Brock University, the University of Guelph and York University, conduct research and surveying of wild pollinators, there is no broad-scale, long-term monitoring, especially in the North. By contrast, the United Kingdom's Pollinator Monitoring and Research Partnership aims to establish how insect pollinator populations are changing, and the Status and Trends of European Pollinators project (2010-2015) engaged more than 20 organizations to assess the status and trends of pollinators throughout Europe.

In 2014, the Agriculture Ministry commissioned a report, prepared by some of Ontario's top experts on pollinators, to review the scientific evidence relating to the status and trends of pollinator health in Ontario. The report was published in 2017 and concluded that the lack of critical information on the distribution and biodiversity of pollinators in Ontario represents a major obstacle to developing appropriate and sustainable conservation strategies.

RECOMMENDATION 8

To support the long-term sustainability of Ontario's animal-pollinated crops, we recommend that the Ministry of Agriculture, Food and Rural Affairs:

- explore and implement opportunities to expand the surveillance of honey bee pests

and diseases, and monitor their impacts on wild species that pollinate Ontario's crops;
- work with the Ministry of Natural Resources and Forestry to develop and implement a research and monitoring program on wild species that pollinate Ontario's crops; and
- publicly report annually on the results of these monitoring programs.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and that collecting and assessing information on the pests and diseases that affect managed honey bees is important to bee health.

As noted in this report, regulatory inspections under the Ministry's Apiary Program routinely collect data and information about managed honey bee pests and diseases every year. The Ministry commits to continue to collect these data and information, analyze it and to publicly share summary data about managed bee health as part of the Provincial Apiarist's annual report. These data provide tracking of diseases and pests in the managed honey bee sector.

The Ministry also commits to reviewing the baseline data from the five-year Enhanced Apiary Monitoring Project and releasing all qualifying data sets on the Ontario Data Catalogue by December 2022.

The Ministry will provide assistance to the Ministry of Natural Resources and Forestry (e.g., share information on the Ministry's monitoring program and any changes being made) on developing and implementing a research and monitoring program on wild species that pollinate Ontario's crops, when a program is initiated.

RECOMMENDATION 9

To detect changes in wild pollinator species, and inform actions to be taken on related conservation strategies, we recommend that the Ministry of Natural Resources and Forestry:

- develop and implement a broad-scale, long-term monitoring program for wild pollinators; and
- publicly report annually on the results of this monitoring program and on the status of Ontario's wild pollinators.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry of Natural Resources and Forestry (Ministry) agrees wild pollinators are an important aspect of Ontario's biodiversity. In recognition of this importance, the Ministry has supported activities that emerged from the *Pollinator Health Action Plan*. In relation to the *Pollinator Health Action Plan*, the Ministry's efforts focused on landscape-scale natural resource and crop mapping to establish a wild pollinator habitat baseline inventory. In addition, the Ministry is assisting a university-led pollinator monitoring project, as described in the Auditor General's report.

The Ministry acknowledges the information gaps in pollinator monitoring provincially and will consult with the Ministry of the Environment, Conservation and Parks and the Ministry of Agriculture, Food and Rural Affairs on how to address wild pollinator species within a broader monitoring framework as pollinators are of interest to all three ministries. The Auditor General has referenced the Ministry of Agriculture, Food and Rural Affairs' interest, and the Ministry of the Environment, Conservation and Parks may have interests to consider as a number of pollinator species are endangered. The Ministry will develop a proposal that explores a suite of options for delivery models for this monitoring and reporting.

5.2.5 More Progress Needed on Developing Ontario-Specific Monitoring of Soil Health

Despite the Agriculture Ministry recognizing the need to improve the tracking and measuring of changes in the health of Ontario's agricultural soils, little progress has been made to implement foundational actions in Ontario's 2018 Soil Health Strategy.

Healthy soil is essential for the sustainability of Ontario's agricultural system, with many environmental and economic benefits. These benefits can include improved crop growth, yield and quality; water and nutrient retention; biodiversity; resilience to respond and recover to change; and climate change adaptation and mitigation. However, the health and conservation of Ontario's agricultural soils face challenges, such as decreasing soil organic matter and increasing risk of erosion. Assessing the state of agricultural soil health across the varying landscapes of Ontario and tracking changes over time is necessary to determine the effectiveness of management actions, and to inform future policy and program decisions.

Although the Agriculture Ministry undertakes efforts to map, assess and support the adoption of farm practices to improve soils, the Ministry does not have its own soil health monitoring program. Instead, it relies on national-scale reporting by the federal government. Agri-Food and Agriculture Canada (Agriculture Canada) uses Agri-Environmental Indicators that measure the agriculture and agri-food sector's environmental performance for soil, water and air quality and farmland management at a national scale. These 12 indicators are calculated using mathematical models that integrate information on soil, climate and landscape, with information on crops, land use, land management and livestock from the Census of Agriculture and other datasets. Information is collected every five years, with the most recently published data covering results and trends from 1981 to 2011. (Agriculture Canada plans to update the data based on the 2016 Census of Agriculture by the end of 2021.)

Agriculture Canada acknowledges limitations and lack of certainty in this published information, noting that very little independent experimental data is available to calibrate or validate the model results. We found that Ontario's Agriculture Ministry does not have an independent assurance report from Agriculture Canada related to the validity of the Agri-Environmental Indicators and the mathematical models used to calculate them.

The Agriculture Ministry recognizes the need to develop province-specific indicators and monitoring of Ontario's soil health. In *New Horizons: Ontario's Agricultural Soil Health and Conservation Strategy* (Soil Health Strategy), the Ministry noted that province-wide soil assessment tools are not well developed, and that creating Ontario-specific indicators and making them consistent and comparable at different scales (e.g., farm, field, regional and provincial) would allow for a more detailed and useful analysis of Ontario's soil health.

With the objective of developing the capacity to track soil health, and ensure that soil data is well documented, replicable, defensible, comprehensive and publicly available, the Soil Health Strategy outlines more than 30 actions related to tracking, measuring, storing and sharing soil health data. Specific actions include:

- developing and implementing a comprehensive Ontario soil health test;
- developing options to measure soil health at a more detailed scale;
- establishing and evaluating changes in benchmarked soil profiles across the province;
- examining the potential for ongoing monitoring of long-term soil plots across Ontario;
- developing a Soil Information System to store soil data;
- determining best practices for standardized data collection, storage and maintenance; and
- making soil data available on a publicly accessible platform.

However, two years since the Agriculture Ministry released the Soil Health Strategy, little progress has been made to implement foundational actions

within it. The strategy indicates that developing a collaborative implementation model will be an early implementation action, followed by an implementation plan, annual work plans, and a schedule for progress reporting. But the Soil Action Group (a partnership between government, industry, conservation groups and academics to lead and monitor the strategy's implementation) only first met in January 2020, and its terms of reference were still in draft form as of October 2020. Moreover, no collaborative implementation plans, annual work plans or schedules for progress reporting have been developed to co-ordinate and document actions, or report on progress.

RECOMMENDATION 10

To implement *Ontario's Agricultural Soil Health and Conservation Strategy* and improve the tracking, measuring, analyzing and reporting on the state of Ontario's agricultural soil health, we recommend that the Ministry of Agriculture, Food and Rural Affairs work with the Soil Action Group to:

- promptly develop and execute a collaborative implementation plan; and
- report annually to the public on progress.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and that there are opportunities to enhance soil health information in Ontario.

The Ministry's soil health related activities are a comprehensive, multi-faceted approach to advancing science, translating knowledge, developing decision support tools, financially supporting implementation of soil health on-farm practices, and working collaboratively with invested groups to promote the adoption of practices that build soil health. Since the release of *Ontario's Agricultural Soil Health and Conservation Strategy* in 2018, the Ministry has committed over $33 million to soil health related projects. In addition, 23 Soil Action Group partners have over 60 actions underway to support implementation of the Strategy.

Working collaboratively with the Soil Action Group, the Ministry commits to finalizing the development of an implementation plan by December 2021. The Ministry also commits to publicly report on progress, with the endorsement of the Soil Action Group.

5.3 Lack of Standardized Monitoring Protocols Jeopardizes Consistency and Comparability of Collected Data

Few of the three ministries' environmental monitoring programs have complete, standardized monitoring protocols to have data collected in a consistent way to allow for valid analysis.

Environmental monitoring, whether it be through water sampling, wildlife recordings or aerial surveys, can be conducted in many different ways. As a result, the comparability of data over time and space can be affected by what, how, when and where the data are collected. To ensure that data collected by different people, in different locations and at different times (sometimes decades apart) are comparable, monitoring protocols are intended to be detailed plans that explain how data is to be collected, managed, analyzed and reported. Standardized protocols are necessary to ensure that changes detected by monitoring are actually occurring in nature and not a result of differences in the way that people collected, processed and analyzed the information. Best practices and guidance used by the United States Department of Agriculture, Fish & Wildlife Service, Geological Survey and National Park Service recommend that effective monitoring protocols include:

- background information (e.g., the monitoring history, rationale and objectives);
- sampling and survey design (e.g., the design rationale, site selection with criteria and sampling frequency);

- field methods (e.g., field season preparations and equipment, sequence of events and measurement details);
- data management and analysis;
- reporting (schedule and format for reporting, distributing and archiving results);
- personnel requirements (e.g., roles, responsibilities, qualifications and training);
- operational requirements (e.g., budget, staff time, annual workload and field schedule); and
- procedures for reviewing the monitoring program and revising the protocol.

The Environment, Natural Resources and Agriculture ministries do not have standards or direction for the required content or format of their environmental monitoring and survey protocols. Not surprisingly, we found great variability in the existence, content and quality of protocols used to monitor Ontario's environment. A few protocols, related to monitoring ambient air quality, Asian carp, fish communities, flooding, and forest resources, contain many of the items described above. However, many only describe the steps for collecting data once in the field—lacking details on monitoring objectives, site selection, survey design, personnel requirements, data management, performance measurement, and the review and revision process. In other cases (e.g., for Algonquin wolves, cormorants, snowshoe hare, squirrels and other small mammals, and forest biomonitoring), monitoring programs rely on draft ministry protocols or methods described in journal articles. Other programs, such as those related to wildlife diseases and moose transect surveys have no standard monitoring protocols at all (see also **Section 5.2.2**).

Considerable effort may be required initially to develop and evaluate monitoring methods to ensure they will be consistent and comparable over multi-year periods. However, developing standardized and comprehensive monitoring protocols provides increased assurance over the quality of the environmental data collected, the ability to reliably detect changes over time, and conclusions drawn from a monitoring program.

RECOMMENDATION 11

So that monitoring programs are credible, and collect standardized, comparable data that can reliably detect environmental changes over time, we recommend that the Ministry of the Environment, Conservation and Parks; Ministry of Natural Resources and Forestry; and Ministry of Agriculture, Food and Rural Affairs develop and implement requirements and processes for developing, reviewing and approving the content of standardized monitoring and survey protocols for all their monitoring programs.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges the objective of this recommendation and the importance of detecting significant environmental changes over time. The Ministry, however, disagrees that the ability to detect environmental change over time can only be achieved by implementing standardized monitoring and survey protocols for all monitoring programs. The Ministry has specifically designed and continues to maintain and adapt its monitoring programs to ensure the ability to reliably detect significant changes over time and draw accurate conclusions. The Ministry will review material on establishing a process for documentation of its monitoring programs and implement where value is added in doing so.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry agrees with this recommendation. As noted by the Auditor General, the Ministry's Integrated Monitoring Framework champions the value of documenting monitoring program protocols. The Ministry is making progress for some, but not all, Ministry monitoring programs and the Ministry acknowledges the importance of working to improve in this regard.

To achieve greater consistency in documenting its monitoring programs and associated processes, the Ministry will develop a standardized template to provide a framework for organizing and recording the details of monitoring programs. Similar to the approach of the Ministry's data management policy, new and active monitoring programs will work toward adhering to the framework for documenting and standardizing protocols.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and that monitoring programs should be credible and should collect standardized, comparable data.

The Apiary Program reviews its internal inspection/monitoring protocols (e.g., Standard Operating Procedures, Internal Guidance Documents) on an annual basis. In addition to continuing to develop new requirements and processes as needed, the Ministry commits to establishing a formal process for reviewing and approving the Apiary Program protocols by July 2022.

5.4 Few Monitoring Programs Are Measured for Their Effectiveness

None of the monitoring programs we reviewed have developed documented performance measurement frameworks, and few have undergone program evaluations to assess their effectiveness.

For over a decade, ministries have been encouraged to develop performance measurement frameworks – consistent processes to collect, analyze and report information on how programs are performing and whether they are achieving their intended outcomes. Embedding performance measurement into a monitoring program—including the monitoring protocol itself (see **Section 5.3**)—can better ensure that metrics are collected to evaluate the effectiveness of the program.

However, our audit found that none of the three ministries' environmental monitoring programs have documented performance measurement frameworks in place (see **Appendix 2**).

Furthermore, the Secretariat has repeatedly provided guidance on conducting program evaluations to assess the effectiveness, efficiency, relevance and sustainability of programs. Independent program evaluations can help objectively: identify aspects of a program that are outdated or not working (e.g., field and laboratory methodologies, technologies, software, assumptions, models, analyses); assess whether the program is effectively meeting its objectives; expand understanding of leading practices; and identify opportunities for improvement. In its guidance materials, the Secretariat specifies the fundamental elements of program evaluations (e.g., terms of reference, evaluation plan, program profile/logic model, data collection and analysis), and best practices for the contents of final evaluation reports (e.g., the evaluation's scope, timing, budget and methodology, findings and analysis, conclusions and recommendations for action).

We asked the three ministries for copies of any internal reviews or evaluations on the effectiveness of their environmental monitoring programs and found that few have undergone formal, documented evaluations (see **Appendix 2**). The ministries provided only a few comprehensive evaluation reports that clearly outlined the evaluation methodology, findings, conclusions and recommendations. In some instances, ministries simply provided slides from meeting presentations that mentioned that a review had occurred or was planned to occur but lacked the content of an evaluation. For example, of the four environmental monitoring programs that were identified by the Environment Ministry as having been subject to a program review over the past five years, only one (the Fish Contaminant Monitoring Program) is documented in a program review report, with the remainder consisting only of presentation slides that lacked the fundamental elements of a program evaluation. The 2015 Fish Contaminant Monitoring

Program review was comprehensive, addressing the history of the program, operational details, and costs. It also included a SWOT (strengths, weaknesses, opportunities and threats) analysis, strategic plan, implementation plan, and draft performance measures, providing an example for other monitoring programs to follow. However, the review was conducted by the monitoring program's staff rather than an independent evaluation unit or third party that could provide an objective analysis and recommendations for improvement.

The Environment Ministry provided us with two older reviews that inventoried and evaluated a number of environmental monitoring programs in a single report. These reviews, undertaken in 1994 (by the Ministry) and 2003 (by a consultant), looked at the rationale for select programs; identified best practices, monitoring gaps and costs; highlighted opportunities and provided recommendations. Comprehensive reviews can prove useful in that, unlike individual program reviews, they can identify monitoring gaps across all environmental categories, as in the 2003 report. Since then, the only cross-program review was a prioritization exercise undertaken in 2017 of programs in the Ministry's Environmental Monitoring and Reporting Branch. This initiative differed from the previous two reviews in terms of content and scope. This exercise assessed the alignment of each monitoring program with Ministry priorities, relative to its potential to mitigate environmental risk and its use of resources (staff time, budget and lab analysis). This assessment also gave an overall ranking to each program based on these factors, but did not assess each program's effectiveness at meeting its objectives or make recommendations for improvement.

RECOMMENDATION 12

To assess the effectiveness of monitoring programs at achieving their stated objectives, we recommend that the Ministry of the Environment, Conservation and Parks; Ministry of Natural Resources and Forestry; and Ministry of Agriculture, Food and Rural Affairs, in adherence with guidance from the Treasury Board Secretariat:

- develop effective, program-specific performance measurement frameworks for all their monitoring programs;
- establish and implement documented processes for regularly, independently and formally evaluating and reporting on the effectiveness of their monitoring programs; and
- periodically undertake a co-ordinated, comprehensive and independent evaluation of their environmental monitoring programs.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation and that performance measurement and evaluation are important to the strategic and sustainable operation of its monitoring programs.

The Ministry will establish processes to develop program-specific performance measurement frameworks and evaluation plans, considering guidance from the Treasury Board Secretariat. Framework implementation will be rolled out over time and will be subject to available resources.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry agrees with this recommendation and that program-specific performance measurement frameworks are critical to evidence-based decision-making. The Ministry's Integrated Monitoring Framework initiative aims to modernize resource monitoring programs by ensuring efficient delivery, effectiveness, and alignment with priorities by continuous improvement. Many of the Ministry's recent monitoring evaluation efforts have been relatively informal and a regular review

schedule would be beneficial. As an example, to support the Forest Sector Strategy efforts, the Ministry externally reviewed its Growth and Yield program by way of a workshop commissioned and facilitated by the Forestry Futures Trust. Feedback on the program was obtained from across the Ministry and the forest industry sector, which will assist the program as it adapts to the sector's future needs.

The Ministry agrees that additional action needs to be taken to develop more formal processes to assess performance of all our monitoring programs. The Ministry will take steps to develop a consistent approach for systematically collecting, analyzing and reporting on the performance of its monitoring activities and outcomes.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and recognizes that effective, program-specific performance measurement frameworks are important for its monitoring programs.

Preliminary analysis is underway to identify internal and external data and measures as building blocks toward a performance measurement framework for environmental stewardship programming. The Ministry has started to develop a performance measurement framework for the apiary inspection program.

To assess the effectiveness of the apiary inspection program in achieving its legislative and strategic objectives, the Ministry commits to developing program-specific performance measures for evaluating the effectiveness of the inspection program by fall 2022. This would include monitoring and surveillance of honey bee pests and diseases, regulatory oversight and response, and advisory and outreach to the industry. The Ministry also commits to engaging with the Ontario Animal Health Network on an independent evaluation of the monitoring activities of the Apiary Program by fall 2022.

6.0 Detailed Audit Observations: Data Quality and Data Sharing

6.1 Monitoring Programs Lack Data and Information Plans

Many of the three ministries' environmental monitoring programs that we reviewed lack data and information management plans, jeopardizing the integrity, security and effective use of collected data.

Data management plans are important for ensuring that the resources and safeguards needed to manage data throughout their lifecycle are identified and documented before the data is collected. Collecting data without a plan in place may result in unclear ownership, inappropriate use and access, and insufficient security and storage. All these factors jeopardize data quality, which may pose risks to data integrity and analysis, and to the reliability of data for decision-making and compliance purposes. Data management plans are meant to mitigate these risks and enable knowledge transfer among those responsible for collecting, analyzing and managing data.

To this end, the Natural Resources Ministry released a Data Management Policy in April 2019, outlining requirements for data management activities, including the planning, collection, use, access, maintenance, security, retention and disposal of data collected or acquired after the policy took effect. This policy requires that program areas responsible for co-ordinating the collection or acquisition of data: prepare a data management plan; release data according to the requirements of the Open Data Directive (see **Section 6.1.2**); and identify stakeholders to engage on data access. Neither the Environment Ministry nor the Agriculture Ministry has a data management policy.

We requested data and information plans related to the ministries' environmental monitoring programs and found that few such plans have been developed (see **Appendix 2**).

The lack of a documented data management plan not only threatens the security, integrity, and access of data, but also hinders the identification of opportunities to proactively share collected data with those who would benefit from it. For example, the Natural Resources Ministry collects and stores sensitive information about rare species. Although the Ministry makes some of this data available online, it has removed sensitive information from publicly available datasets (see **Section 6.1.1**), generalizing the locations of occurrences of species, plant communities and wildlife concentration areas to a one-kilometre grid. Access to more detailed data on the precise locations, biological information and names of commercially exploited or sensitive species requires a Sensitive Data Use Licence with the Ministry, a demonstrated need to know, and data sensitivity training. Detailed natural heritage data would be useful to municipalities in their land use planning, and to conservation authorities in their natural resource management. However, we found that only 37 (or 8%) of Ontario's 444 municipalities and 20 (or 56%) of Ontario's 36 conservation authorities have ongoing Sensitive Data Use Licences to obtain access to this data.

RECOMMENDATION 13

To improve the integrity, security and effective use of data being used for monitoring purposes, we recommend that:

- the Ministry of the Environment, Conservation and Parks and Ministry of Agriculture, Food and Rural Affairs develop and implement a data management policy that outlines requirements for establishing data management plans; and
- the Ministry of the Environment, Conservation and Parks; Ministry of Natural Resources and Forestry; and Ministry of Agriculture, Food and Rural Affairs develop and implement data and information management plans for their monitoring programs.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation and will assess its current data and information management practices and develop options for a data management policy to address data from monitoring programs.

When modernizing our legacy science information technology systems, we will document the associated data management plan.

NATURAL RESOURCES MINISTRY RESPONSE

The Natural Resources Ministry (Ministry) agrees with this recommendation. As the Ministry's data management policy applies not only to new programs, but also to existing programs that continue to actively collect data, the Ministry will continue to implement the policy for active monitoring programs. As this policy was established in 2019, it will take time to develop plans for these existing programs. A staged approach is planned for data management plan development to incorporate learning from early adopters into the development process for subsequent program teams.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and that data management is critical for supporting decision-making. Data management is identified as a priority for the Ministry. The Ministry's Community of Practice brings together staff and management from across the Ministry to promote excellence in agri-food and rural data collection, analytics and economic research to enhance the capacity for evidence-informed decision-making. The Ministry commits to developing a data management policy and data management plans by July 2022.

6.1.1 Sensitive Natural Heritage Data Stored in the United States

Despite the abundance of important information in its natural heritage database, some of which is highly sensitive, the Natural Resources Ministry has no third-party, independent assurance over the information technology system that is being used to store the data in the United States instead of Ontario.

The Natural Heritage Information Centre (Information Centre) within the Natural Resources Ministry collects, reviews, manages and distributes information about the location of species of conservation concern, rare plant communities, wildlife concentration areas, and natural areas in Ontario. The Information Centre database tracks the locations and conditions of over 2,000 species, plant communities and wildlife concentration areas. The database contains more than 900,000 species observation records, of which more than 79,000 are of restricted species that are susceptible to persecution and harm. Restricted species are commercially exploited or sensitive to disturbance, such that they could be harmed if data is not stored securely and people use the location information to hunt, collect or disturb the species.

Observations are reported to the Information Centre by Ministry staff, academics, conservation partners, and members of the public. Among other things, collected information is used to assign conservation status ranks to species, plant communities and wildlife concentration areas to help guide conservation and research efforts.

Since 2005, this natural heritage information has been stored in a web-based database operated by NatureServe, a non-profit organization based in the United States. The Natural Resources Ministry is a member of the NatureServe network.

The Natural Resources Ministry pays US$16,000/year for the use of the software service, which is provided through a Service Level Agreement. However, the Ministry was unable to provide us with a contract with NatureServe or independent assurance over the information technology controls, such as the hosting environment (located in Ashburn, Virginia), system backup, access and security of Ontario's natural heritage data. Although the Ministry does not have requirements for physically backing up the data, or have records documenting data backup, staff informed us that it downloads backup copies annually as well as periodically throughout the year.

Similarly, we found that the Natural Resources Ministry does not own, control or have assurance over the security and integrity of data related to the distribution of invasive species in Ontario. Rather, the Ontario Federation of Anglers and Hunters, which delivers Ontario's Invading Species Awareness Program with Ministry support, has an agreement with the University of Georgia to house and maintain Ontario's invasive species data on its servers.

RECOMMENDATION 14

To obtain assurance over the security, access and integrity of Ontario's natural heritage information, we recommend that the Ministry of Natural Resources and Forestry obtain and review independent assurance reports annually for the information technology systems used to store this information.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry agrees with the Auditor General's recommendation and the importance of information security. The Ministry will work with its external partners and the Land and Resources Cluster to assess and document the necessary assurances of their information technology systems.

6.1.2 Not All Environmental Monitoring Data Released to Public in Accordance with Open Data Directive

Despite requirements in Ontario's Open Data Directive (Directive), data collected through the three ministries' environmental monitoring programs was not all published in the Ontario Data Catalogue in a timely manner.

Since 2016, Ontario's Open Data Directive has required that all data created, collected and/or managed by ministries and provincial agencies be made public, unless exempt in specified circumstances. The purpose of the Directive is to support government efficiency, effectiveness and innovation, and support public engagement and participation by allowing Ontarians to develop their own analysis, insights and digital products. Under the Directive, ministries are to periodically review and update released datasets to ensure accuracy and timeliness. Ministries must also provide a detailed explanation as to why a dataset cannot be made accessible to the public as open data.

As of October 6, 2020, 2,738 datasets were posted on the Ontario Data Catalogue at (**data.ontario.ca**), 834 (or 30%) of which were populated with data. Our audit found that data was published for 49 (or 48%) of the Environment Ministry's 102 datasets, 211 (or 76%) of the Natural Resources Ministry's 279 datasets, and 125 (or 45%) of the Agriculture Ministry's 276 datasets. The access levels for open data datasets include the following categories: open, under review and restricted. More datasets are classified as under review (1,091 datasets or 40%) than either open (833 or 30%) or restricted (814 or 30%). Dataset restrictions are based on legal, privacy, security, confidentiality or commercially-sensitive reasons.

Some monitoring programs collect enormous quantities of data, especially those that undertake measurements of many parameters over short time intervals. For example, air temperature is measured every 3–5 seconds at field sites for monitoring carbon sequestration and storage in northern peatlands, and 60 parameters are measured at the province's four dedicated roadside air research stations. It may not be practical to post all this data in a disaggregated form. Nevertheless, we found instances where datasets from entire monitoring categories were not published at all on the Ontario Data Catalogue. For example, there are no posted datasets related to roadside air conditions or carbon fluxes. In other cases, more recent data had been collected, but datasets were not updated in a timely manner (see **Figure 7**).

The Natural Resources Ministry's Data Management Policy (2019) states that, in cases where data is restricted from release, rationale for the restriction shall be documented in an approved Data Management Plan. However, as discussed in **Section 6.1**, the Ministry's monitoring programs do not yet have approved Data Management Plans. The other two ministries do not have requirements or policies on the development of Data Management Plans, and do not have Data Management Plans that contain rationales as to why data is restricted from release.

RECOMMENDATION 15

So that the public, researchers and interested stakeholders are able to make effective use of data collected through monitoring programs, we recommend that the Ministry of the Environment, Conservation and Parks; Ministry of Natural Resources and Forestry; and Ministry of Agriculture, Food and Rural Affairs comply with the Open Data Directive and, unless exempted in specified circumstances, release data to the Ontario Data Catalogue in a timely manner.

ENVIRONMENT MINISTRY RESPONSE

The Ministry of the Environment, Conservation and Parks acknowledges this recommendation and the importance of compliance with the Open Data Directive, so that public researchers and interested stakeholders can make effective use of data collected through the monitoring programs. The Ministry will work to ensure the timely release of its data, as appropriate.

Figure 7: Examples of Datasets Not Published or Updated in the Ontario Data Catalogue

Prepared by the Office of the Auditor General of Ontario

Name of Dataset	Last Year Data Published in the Ontario Data Catalogue	Update Frequency Specified in the Ontario Data Catalogue	Years of Collected Data Not Published in the Ontario Data Catalogue	Ministry's Explanation Why Data Not Published in the Ontario Data Catalogue
Ministry of Agriculture, Food and Rural Affairs				
Honey bee pests and pathogens in Ontario apiaries	2015	Yearly	2016–2019	Draft report on 2016 data being finalized for publication. 2017–2019 data not yet analyzed.
Ministry of the Environment, Conservation and Parks				
Large landfill sites	2011	As required	2012–2019	Additional data will be published in future.
Ontario Benthos Biomonitoring Network	2013	Yearly	2014–2018	Dataset to be updated fall 2020.
Benthic Invertebrate Neonicotinoid Monitoring Study	2015	Yearly	2016–2017	Dataset to be updated fall 2020.
Drinking Water Neonicotinoid Monitoring Study	2015	As required	2016–2019	Dataset with 2016 and 2017 data to be updated fall 2020.
Soil Neonicotinoid Monitoring Study	2015	Yearly	2016–2018	Dataset to be updated fall 2020.
Stream Neonicotinoid Monitoring Study	2015	Yearly	2016–2019	Dataset to be updated fall 2020.
Industrial wastewater discharges	2016	Yearly	2017–2018	Dataset to be updated fall 2020.
Municipal treated wastewater effluent	2016	Yearly	2017–2018	Dataset to be updated fall 2020.
Sediment chemistry (Great Lakes nearshore areas)	2016	Yearly	2018–2019	Dataset to be updated in 2021.
Corn and soybean neonicotinoid-treated seed data	2016/2017	Yearly	2017/18–2018/19	Regulatory amendment in May 2020 removed requirement for vendors to report neonicotinoid-treated corn and soybean sales data. Ministry has not published data for final two reporting years.
Drinking Water Surveillance Program	2017	Yearly	2018–2019	Dataset to be updated in 2021.
Lake water quality at drinking water intakes	2017	Yearly	2018–2019	Dataset to be updated fall 2020.
Toxics Reduction Act—Reporting	2017	Yearly	2018–2019	Additional data will be published in future.

NATURAL RESOURCES MINISTRY RESPONSE

The Ministry agrees with this recommendation and the importance of providing timely data to the public and interested stakeholders. Using internal governance structures, the Ministry will continue to identify datasets and support them through the publication process to include these in the Ontario Data Catalogue.

AGRICULTURE MINISTRY RESPONSE

The Ministry of Agriculture, Food and Rural Affairs (Ministry) agrees with this recommendation and the importance of the effective use and release of data as outlined in the Open Data Directive, and closely monitors our actions to achieve compliance with Directive requirements.

The Ministry commits to an annual review of the metrics and targets related to open datasets and their timely release. The Ministry also commits to releasing all qualifying environmental monitoring data sets, including from the Enhanced Apiary Monitoring Project, by July 2022.

Appendix 1: Summary of Report Recommendations, by Ministry

Prepared by the Office of the Auditor General of Ontario

Ministry of the Environment, Conservation and Parks

Recommendation 1: To track performance, report on progress and drive continuous improvement toward environmental goals, we recommend that the Ministry of the Environment, Conservation and Parks establish and implement a process for developing outcome-based targets to meet the legislated and strategic goals and objectives within its areas of responsibility.

Recommendation 2: So that key performance indicators are meaningful, transparent and effective at assessing progress toward environmental targets and goals, we recommend that the Ministry of the Environment, Conservation and Parks:

- submit consistent outcome-based key performance indicators to Treasury Board Secretariat; and
- include all approved key performance indicators and targets in its published annual plans.

Recommendation 3: So that the values used in water quality assessments are transparent and adequately substantiated, we recommend that the Ministry of the Environment, Conservation and Parks establish a documented process, similar to that used for air quality, for evaluating the use of assessment values from other jurisdictions and organizations where provincial values do not exist.

Recommendation 4: So that set targets are effective at driving and measuring progress toward science-based environmental goals, we recommend that the Ministry of the Environment, Conservation and Parks review its existing targets, and ensure that these and new targets have meaningful achievement-focused time frames and are based on sound, scientific evidence.

Recommendation 5: So that staff are able to co-ordinate, collaborate and draw on information collected through monitoring programs within the ministry, as well those within the Ministry of Natural Resources and Forestry and the Ministry of Agriculture, Food and Rural Affairs, we recommend that the Ministry of the Environment, Conservation and Parks:

- establish an internal means for sharing information on the objectives, activities and results of monitoring programs; and
- require staff to keep the information up to date.

Recommendation 7: For progress to be made on protecting and recovering species at risk, we recommend that the Ministry of the Environment, Conservation and Parks:

- establish a database of actions contained in government response statements;
- execute on high-priority actions to be taken, including monitoring;
- solicit interest from and assign responsibility for certain actions to conservation partners (e.g., organizations, agencies, universities and other stakeholders); and
- use the database to annually track and follow up on progress on actions.

Recommendation 11: So that monitoring programs are credible, and collect standardized, comparable data that can reliably detect environmental changes over time, we recommend that the Ministry of the Environment, Conservation and Parks develop and implement requirements and processes for developing, reviewing and approving the content of standardized monitoring and survey protocols for all its monitoring programs.

Recommendation 12: To assess the effectiveness of monitoring programs at achieving their stated objectives, we recommend that the Ministry of the Environment, Conservation and Parks, in adherence with guidance from the Treasury Board Secretariat:

- develop effective, program-specific performance measurement frameworks for all its monitoring programs;
- establish and implement documented processes for regularly, independently and formally evaluating and reporting on the effectiveness of its monitoring programs; and
- periodically undertake a co-ordinated, comprehensive and independent evaluation of its environmental monitoring programs.

Recommendation 13: To improve the integrity, security and effective use of data being used for monitoring purposes, we recommend that:

- the Ministry of the Environment, Conservation and Parks develop and implement a data management policy that outlines requirements for establishing data management plans; and
- the Ministry of the Environment, Conservation and Parks develop and implement data and information management plans for its monitoring programs.

Recommendation 15: So that the public, researchers and interested stakeholders are able to make effective use of data collected through monitoring programs, we recommend that the Ministry of the Environment, Conservation and Parks comply with the Open Data Directive and, unless exempted in specified circumstances, release data to the Ontario Data Catalogue in a timely manner.

Ministry of Natural Resources and Forestry

Recommendation 1: To track performance, report on progress and drive continuous improvement toward environmental goals, we recommend that the Ministry of Natural Resources and Forestry establish and implement a process for developing outcome-based targets to meet the legislated and strategic goals and objectives within its areas of responsibility.

Recommendation 2: So that key performance indicators are meaningful, transparent and effective at assessing progress toward environmental targets and goals, we recommend that the Ministry of Natural Resources and Forestry:

- submit consistent outcome-based key performance indicators to Treasury Board Secretariat; and
- include all approved key performance indicators and targets in its published annual plans.

Recommendation 4: So that set targets are effective at driving and measuring progress toward science-based environmental goals, we recommend that the Ministry of Natural Resources and Forestry review its existing targets, and ensure that these and new targets have meaningful achievement-focused time frames and are based on sound, scientific evidence.

Recommendation 5: So that staff are able to co-ordinate, collaborate and draw on information collected through monitoring programs within the ministry, as well those within the Ministry of the Environment, Conservation and the Ministry of Agriculture, Food and Rural Affairs, we recommend that the Ministry of Natural Resources and Forestry:

- establish an internal means for sharing information on the objectives, activities and results of monitoring programs; and
- require staff to keep the information up to date.

Recommendation 6: So that Ontario's biodiversity is effectively monitored and the province can make informed decisions to protect and restore it, we recommend that the Ministry of Natural Resources and Forestry develop an integrated, broad-scale monitoring program for all aspects of Ontario's biodiversity.

Recommendation 9: To detect changes in wild pollinator species, and inform actions to be taken on related conservation strategies, we recommend that the Ministry of Natural Resources and Forestry:

- develop and implement a broad-scale, long-term monitoring program for wild pollinators; and
- publicly report annually on the results of this monitoring program and on the status of Ontario's wild pollinators.

Recommendation 11: So that monitoring programs are credible, and collect standardized, comparable data that can reliably detect environmental changes over time, we recommend that the Ministry of Natural Resources and Forestry develop and implement requirements and processes for developing, reviewing and approving the content of standardized monitoring and survey protocols for all its monitoring programs.

Recommendation 12: To assess the effectiveness of monitoring programs at achieving their stated objectives, we recommend that the Ministry of Natural Resources and Forestry, in adherence with guidance from the Treasury Board Secretariat:

- develop effective, program-specific performance measurement frameworks for all its monitoring programs;
- establish and implement documented processes for regularly, independently and formally evaluating and reporting on the effectiveness of its monitoring programs; and
- periodically undertake a co-ordinated, comprehensive and independent evaluation of its environmental monitoring programs.

Recommendation 13: To improve the integrity, security and effective use of data being used for monitoring purposes, we recommend that the Ministry of Natural Resources and Forestry develop and implement data and information management plans for its monitoring programs.

Recommendation 14: To obtain assurance over the security, access and integrity of Ontario's natural heritage information, we recommend that the Ministry of Natural Resources and Forestry obtain and review independent assurance reports annually for the information technology systems used to store this information.

Recommendation 15: So that the public, researchers and interested stakeholders are able to make effective use of data collected through monitoring programs, we recommend that the Ministry of Natural Resources and Forestry comply with the Open Data Directive and, unless exempted in specified circumstances, release data to the Ontario Data Catalogue in a timely manner.

Ministry of Agriculture, Food and Rural Affairs
Recommendation 1: To track performance, report on progress and drive continuous improvement toward environmental goals, we recommend that the Ministry of Agriculture, Food and Rural Affairs establish and implement a process for developing outcome-based targets to meet the legislated and strategic goals and objectives within its areas of responsibility.
Recommendation 2: So that key performance indicators are meaningful, transparent and effective at assessing progress toward environmental targets and goals, we recommend that the Ministry of Agriculture, Food and Rural Affairs: • submit consistent outcome-based key performance indicators to Treasury Board Secretariat; and • include all approved key performance indicators and targets in its published annual plans.
Recommendation 4: So that set targets are effective at driving and measuring progress toward science-based environmental goals, we recommend that the Ministry of Agriculture, Food and Rural Affairs review its existing targets, and ensure that these and new targets have meaningful achievement-focused time frames and are based on sound, scientific evidence.
Recommendation 5: So that staff are able to co-ordinate, collaborate and draw on information collected through monitoring programs within the ministry, as well those within the Ministry of the Environment, Conservation and the Ministry of Natural Resources and Forestry, we recommend that the Ministry of Agriculture, Food and Rural Affairs: • establish an internal means for sharing information on the objectives, activities and results of monitoring programs; and • require staff to keep the information up to date.
Recommendation 8: To support the long-term sustainability of Ontario's animal-pollinated crops, we recommend that the Ministry of Agriculture, Food and Rural Affairs: • explore and implement opportunities to expand the surveillance of honeybee pests and diseases, and monitor their impacts on wild species that pollinate Ontario's crops; • work with the Ministry of Natural Resources and Forestry to develop and implement a research and monitoring program on wild species that pollinate Ontario's crops; and • publicly report annually on the results of these monitoring programs.
Recommendation 10: To implement Ontario's Agricultural Soil Health and Conservation Strategy and improve the tracking, measuring, analyzing and reporting on the state of Ontario's agricultural soil health, we recommend that the Ministry of Agriculture, Food and Rural Affairs work with the Soil Action Group to: • promptly develop and execute a collaborative implementation plan; and • report annually to the public on progress.
Recommendation 11: So that monitoring programs are credible, and collect standardized, comparable data that can reliably detect environmental changes over time, we recommend that the Ministry of Agriculture, Food and Rural Affairs develop and implement requirements and processes for developing, reviewing and approving the content of standardized monitoring and survey protocols for all its monitoring programs.
Recommendation 12: To assess the effectiveness of monitoring programs at achieving their stated objectives, we recommend that the Ministry of Agriculture, Food and Rural Affairs, in adherence with guidance from the Treasury Board Secretariat: • develop effective, program-specific performance measurement frameworks for all its monitoring programs; • establish and implement documented processes for regularly, independently and formally evaluating and reporting on the effectiveness of its monitoring programs; and • periodically undertake a co-ordinated, comprehensive and independent evaluation of its environmental monitoring programs.
Recommendation 13: To improve the integrity, security and effective use of data being used for monitoring purposes, we recommend that: • the Ministry of Agriculture, Food and Rural Affairs develop and implement a data management policy that outlines requirements for establishing data management plans; and • the Ministry of Agriculture, Food and Rural Affairs develop and implement data and information management plans for its monitoring programs.
Recommendation 15: So that the public, researchers and interested stakeholders are able to make effective use of data collected through monitoring programs, we recommend that the Ministry of Agriculture, Food and Rural Affairs comply with the Open Data Directive and, unless exempted in specified circumstances, release data to the Ontario Data Catalogue in a timely manner.

Appendix 2: Key Ministry Programs to Monitor the State of the Environment, Natural Resources and Environmental Sustainability of Ontario's Agriculture

Prepared by the Office of the Auditor General of Ontario

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Ministry of Agriculture, Food and Rural Affairs			
Apiary Inspection Program Started several decades ago Regular and targeted inspections of apiaries (managed beehives) to check compliance with the *Bees Act* and monitor presence of pests and diseases	Data collected: • Overwinter mortality, presence of diseases (e.g., American foulbrood) and pests (e.g., Varroa mites), in-season incidents and general colony conditions (e.g., queenless) Inspection sites: • Province-wide, no predetermined number of inspections or inspection sites (621 inspections in 2019) Data collection frequency: • On an ongoing basis	To confirm regulatory compliance, respond to honey bee mortality incidents and provide advisory services	• No performance measurement frameworks • No formal program evaluations • No data management plan
Apiary Monitoring Project 2015-2019 Planned six-year project (it was ended early) to determine prevalence and load of pests and pathogens in beekeeping industry	Data collected: • Colony population and conditions, including queen status, brood and bee areas and presence of disease and pests Monitoring sites: • 32 bee yards across Ontario Data collection frequency: • Three to four times a season	To improve understanding of prevalence and load of honey bee pests and pathogens over a season across the province	• No performance measurement frameworks • No program evaluations • No data management plan
Pesticide Water Monitoring Program Started 1981 Joint program between the Agriculture Ministry and Environment Ministry to monitor pesticide levels in streams	Data collected: • Conservation authorities collect stream water samples Monitoring sites: • Currently 18 sites (plus one reference site) on tributaries in watersheds of predominantly agricultural use in the Great Lakes Basin Data collection frequency: • About eight times a year (April–November)	To compare pesticide concentrations to *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, and provide datasets for particular pesticides under review to the Pest Management Regulatory Agency	• No performance measurement framework provided • No comprehensive program evaluations, but a 2019 exposure assessment recommended improvements – including creating a data management plan • No data management plan provided

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Ministry of the Environment, Conservation and Parks			
Air Monitoring—Provincial Ambient Air Monitoring Started 1960s Collection of general air quality data across Ontario	Data collected: • Ambient pollutant concentrations and meteorological parameters Monitoring sites: • 46 sites mainly concentrated in southern, central and eastern Ontario Data collection frequency: • Every minute to every day	To inform Ontarians about outdoor air quality, assess air quality and evaluate long-term trends, identify pollution sources and hotspots, and provide baseline data for researchers, health practitioners and policy-makers	• No performance measurement frameworks • No comprehensive program evaluations by the Ministry (an informal process is led by Environment and Climate Change Canada), but our audit did find a 2011 Air Programs SWOT Analysis and 2006 Program Review Matrix • No comprehensive data management plan
Air Emissions Reporting—Acetone Started 2001 Collection of data on acetone emissions from industrial facilities	Data collected: • Emissions of acetone from industrial facilities Reporting facilities: • About 115 facilities province-wide Data collection frequency • Annually	To produce an inventory of acetone emissions in the province	• No performance measurement frameworks • No comprehensive program evaluations • No comprehensive data management plan, but data management instructions outlined in 2019 Knowledge Base document
Air Emissions Reporting—Air Pollution Emissions Inventory Started 1990 Collection of data on air emissions from industrial and non-industrial sources	Data collected: • Industrial facility emissions, as well as transportation, commercial and residential emissions Reporting facilities: • About 1,500 facilities province-wide Data collection frequency: • Annually	To produce an inventory of air emissions in the province, provide baseline estimates for the Drive Clean program, administer and maintain the NO_x/SO_2 Ontario Emission Trading Registry, monitor trends, and support policy and program development and evaluation	• No performance measurement frameworks • No comprehensive program evaluations by the Ministry (process would be led by Environment and Climate Change Canada) • No comprehensive data management plan
Air Emissions Reporting—Gasoline Volatility Started 1991 Collection of data on fuel vapour pressure of summer gas	Data collected: • Fuel vapour pressure for summer gas Reporting facilities: • 20-25 facilities reporting province-wide Data collection frequency: • Monthly in the summer	To confirm regulatory compliance with O. Reg. 271/91 under the *Environmental Protection Act*	• No performance measurement frameworks • No comprehensive program evaluations • No comprehensive data management plan
Air Emissions Reporting—Landfill Gas Started 2009 Collection of data to estimate the quantity of landfill gas emitted annually from large landfills	Data collected: • Landfill capacity, emissions and calculation parameters Reporting facilities: • 31 large landfills province-wide Data collection frequency: • Annually	For program tracking and review, and compliance and tracking against targets	• No performance measurement frameworks • No comprehensive program evaluations • No comprehensive data management plan, but our audit did find processes and responsibilities for preparing data in the Landfill Gas Reporting Roles and Responsibilities document

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Air Monitoring—Roadside Air Monitoring Started 2010 Collection of roadside air quality data	Data collected: • Traffic-related ambient air pollutants such as ultrafine particles Monitoring sites: • 12 sites (4 dedicated sites in Toronto and 8 others, with limited monitoring, in other cities) Data collection frequency: • Every minute to every day	To inform Ontarians about traffic-related air pollution in urban environments, assess air quality and evaluate long-term trends, identify pollution sources and hotspots, and provide baseline data for researchers, health practitioners and policy-makers	• No performance measurement framework beyond the production of a logic model, which represents the components and structure of the program, including available resources, activities, outputs, and outcomes • No comprehensive program evaluations, but a 2019 program assessment identified locations for expansion of monitoring • No comprehensive data management plan
Air Quality Health Index/Smog Notification Started 1988 Collection of air quality data for health-based air quality alerts	Data collected: • Ambient concentrations of ozone, fine particulate matter and nitrogen dioxide Monitoring sites: • 39 sites mainly concentrated in southern, central and eastern Ontario Data collection frequency: • Every minute to every day	To notify the public of instances of degraded air quality through health-based air quality alerts	• No performance measurement frameworks • No comprehensive program evaluations by the Ministry (an informal process is led by Environment and Climate Change Canada), but our audit found a 2011 Air Programs SWOT Analysis and 2006 Program Review Matrix • No comprehensive data management plan, but there is a 2016 technical guidelines document
Benthos Biomonitoring Started mid-1990s Collection of data on the biological conditions of Ontario's aquatic ecosystems	Data collected: • Water chemistry, benthic taxa counts, and habitat measurements Monitoring sites: • 3,862 total sampling locations province-wide Data collection frequency: • Annually from about 300 sites	To improve understanding of the biological conditions of aquatic ecosystems using invertebrates. Results are used in technical reports and peer-reviewed journal articles that address water quality, as well as baseline environmental conditions and assessment methodologies	• No performance measurement frameworks • No comprehensive program evaluations, but our audit did find a 2011 Biomonitoring SWOT Analysis • No comprehensive data management plan, but instructions found in 2007 Protocol Manual and project descriptions (sometimes incomplete)
Carbon Flux Monitoring Started 2009 Collection of data of carbon cycling in the Hudson Bay lowlands, an enormous store of peatland carbon (Ontario's peatlands store about 28 billion tonnes)	Data collected: • Greenhouse gas concentrations, as well as meteorological and soil conditions Monitoring sites: • Three sites in southern, central and northern Hudson Bay Lowlands Data collection frequency: • Sub-second to hourly	To improve understanding of carbon sequestration and storage in Ontario's vast northern peatlands. Results are used in technical reports and peer-reviewed journal articles, and inform land-use planning, resource development, and climate change adaptation and resilience strategies	• No performance measurement frameworks • No comprehensive program evaluations, but our audit found a 2011 Air Programs SWOT Analysis • No comprehensive data management plan, but our audit did find a 2020 document describing the quality assurance process for eddy covariance measurements

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Drinking Water Monitoring—Drinking Water Surveillance Program Started 1986 Collection of data on drinking water quality at municipal drinking water treatment facilities	Data collected: • Water samples tested for general chemistry, metals, and various contaminants Monitoring sites: • 112 sampling sites province-wide Data collection frequency: • Each site provides 2–9 sets of samples annually	To track contaminants excluded from drinking water standards. Results are used in technical reports and peer-reviewed journal articles, as well as in setting standards for drinking water	• No performance measurement frameworks • No comprehensive program evaluations, but our audit did find presentation slides for a review in 2015 and a 2004 new strategy update • No comprehensive data management plan, but our review did find 2009 instructions for drinking water sampling
Drinking Water Monitoring—Great Lakes Intakes Program Started 1960s Collection of data on Great Lakes water quality at municipal drinking water treatment facility intakes	Data collected: • Water samples tested for biological indicators of ecosystem health and nutrient status, as well as other water chemistry parameters Monitoring sites: • 17 sampling sites in the Great Lakes and two in Lake Simcoe Data collection frequency: • Biweekly	To track water quality at drinking water intakes and better understand the impacts of stressors on lake ecosystems. Results are used in technical reports and peer-reviewed journal articles.	• No performance measurement framework beyond the production of a logic model, which represents the components and structure of the program, including available resources, activities, outputs and outcomes • No comprehensive program evaluations, but our audit did find a 2014 program review summary • No comprehensive data management plan
Fish Contaminant Biomonitoring Started 1970 Collection of data on the presence of contaminants in freshwater fish	Data collected: • Fish species, size, sex, and contaminants present in fish tissues Monitoring sites: • 4,000+ total sampling locations province-wide Data collection frequency: • 1–50 years, depending on the estimated risk	To estimate the level of contaminants present in fish located in the Great Lakes, inland waters and rivers. Results are used in technical reports and peer-reviewed journal articles, to provide advice to the public on the safe consumption of fish, as well as to assess contaminated sites and the effectiveness of site restoration projects	• No performance measurement framework beyond the production of a logic model, which represents the components and structure of the program, including available resources, activities, outputs, and outcomes • A comprehensive program evaluation in 2015 (conducted by program staff) and a 2011 Biomonitoring SWOT Analysis • No comprehensive data management plan, but our audit did find data management instructions in a 2019 Protocol for the Collection of Large (Sport) Fish Samples for Contaminant Analyses

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Forest Biomonitoring Started 1986 Collection of data on the health of Ontario's hardwood forests	Data collected: • Field observations of tree health, as well as meteorological and soil conditions Monitoring sites: • 93 active monitoring plots in southern and central Ontario (hardwood forest range) Data collection frequency: • Every 3 years	To improve understanding of the health of Ontario's hardwood forests, one of the province's dominant ecosystems. Results are used in technical reports and peer-reviewed journal articles	• No performance measurement frameworks • No comprehensive program evaluations • No comprehensive data management plan, but instructions found in a number of monitoring protocols
Greenhouse Gas Reporting Started 2010 Collection of data on greenhouse gas emissions from industrial facilities	Data collected: • Industrial facility emissions data, production information and calculation factors Reporting facilities: • 283 industrial facilities and 9 electricity importers Data collection frequency: • Annually	To produce an inventory of greenhouse gas emissions, monitor trends, and inform the development of the Emissions Performance Standards Program	• No performance measurement frameworks, though the compliance rate of report submission is used as a performance indicator • No comprehensive program evaluations, but our audit found a 2014 informal internal review and a 2011 Air Programs SWOT Analysis • No comprehensive data management plan, but data management instructions outlined in 2019 Knowledge Base document
Great Lakes Monitoring Started 1960s Collection of data on Great Lakes water quality	Data collected: • Water chemistry and physical parameters, as well as data on sediments Monitoring sites: • 70 long-term monitoring stations in Great Lakes nearshore environment and 4 buoys in Lake Erie and Lake Ontario Data collection frequency: • From 3–6 years for fixed stations, and near-real time for buoys	To assess the conditions of the Great Lakes nearshore environment and identify trends. Results are used to meet obligations under the *Great Lakes Protection Act, 2015*, *Ontario's Great Lakes Strategy* and inter-jurisdictional agreements, such as the *Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health*. They are also used in technical reports and peer-reviewed journal articles, and support policy and program development and evaluation	• No performance measurement framework beyond the production of a logic model, which represents the components and structure of the program, including available resources, activities, outputs, and outcomes • No comprehensive program evaluations, but our audit did find a 2015 performance-measures charter, with no follow-up • No comprehensive data management plan, although monitoring descriptions (occasionally incomplete) outlined certain data collection or management details

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted

Groundwater Monitoring
Started 2000
Collection of data on groundwater levels and water quality
	Data collected:
	• Groundwater levels, barometric pressure, water chemistry, precipitation and meteorological conditions
	Monitoring sites:
	• 480 monitoring wells province-wide (south of 49 degrees latitude)
	Data collection frequency:
	• Every 15 minutes to every year
		To track groundwater levels and quality. Results are used for mapping, and to support work associated with water-taking permits, groundwater interference complaints, brownfield site assessments, public health risk assessments, drought responses and setting standards for drinking water	• No performance measurement framework beyond the production of a logic model, which represents the components and structure of the program, including available resources, activities, outputs, and outcomes
			• A 2009 comprehensive program evaluation and:
			  • a 2019 Provincial Groundwater Monitoring Network (PGMN) Program Review (presentation slides for a review in progress)
			  • a 2019 PGMN In-House Technical Assessment (2 pages)
			• No comprehensive data management plan, but our audit did find:
			  • 2020 Precipitation Data Quality Assurance
			  • 2019 Sampling Field Instructions
			  • 2018 Sampling Protocol
			  • 2011 Draft Data Review and Adjustment Procedures
			  • Exceedance Protocol

Industrial Wastewater Reporting
Started early to mid-1990s
Collection of data on industrial wastewater discharges directly into surface water
	Data collected:
	• Effluent parameters, specific chemicals and solvents, acute lethality testing as well as discharge rates
	Reporting facilities:
	• About 120 facilities
	Data collection frequency:
	• Quarterly
		To track industrial wastewater discharges and assess compliance with the province's Effluent Monitoring and Effluent Limits regulations. Results are also used to estimate the inputs of contaminants to surface water, which can be used to inform the assessment of effluent discharge approval applications	• No performance measurement frameworks
			• No comprehensive program evaluations
			• No comprehensive data management plan, but our audit did find:
			  • 2017 Wastewater System Industrial User Guide
			  • 2016 Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater
			  • 2008 data migration protocol

Inland Lakes Monitoring
Started 1978
Collection of data on conditions and stressors of inland lakes, streams and wetlands
	Data collected:
	• Water chemistry, as well as physical, biological and meteorological parameters
	Monitoring sites:
	• 1,000+ sites
	Data collection frequency:
	• From near real-time to once every five years
		To improve understanding of the conditions and stressors of inland lakes, streams and wetlands. Results are used in technical reports and peer-reviewed journal articles, and support policy and program development and evaluation	• No performance measurement frameworks
			• No comprehensive program evaluations, but our audit did find:
			  • 2016 evaluation of participant feedback
			  • 2011 SWOT analysis
			• No comprehensive data management plan, but our review did find a 2006 Lake Sampling Methods Manual

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted

Lake Simcoe Monitoring
Started 1980
Collection of data on the current and long-term changes in the water quality of Lake Simcoe in response to cumulative environmental stressors
	Data collected:
	• Water chemistry, physical parameters, characteristics of the lower trophic web (plankton)
	Monitoring sites:
	• 11 monitoring stations (8 in Lake Simcoe and 3 in the Holland River)
	Data collection frequency:
	• About once every two weeks
		To improve understanding of the conditions and stressors of Lake Simcoe water quality. Results are used to meet obligations under the *Lake Simcoe Protection Act* and *Protection Plan*. Results are also used in technical reports and peer-reviewed journal articles, and support policy and program development and evaluation	• No performance measurement frameworks
			• No comprehensive program evaluations, but our audit did find the 2014 analysis of Lake Simcoe spatial and temporal sampling
			• No comprehensive data management plan, but our audit did find:
			  • 2018 quality control procedure manual
			  • 2016 and 2020 database documentation
			  • 2014 Lake Simcoe Ice-Free Sampling Manual

Municipal Wastewater Reporting
Started 1970s
Collection of data on wastewater quality and flows
	Data collected:
	• Flows, influent and effluent parameters, as well as primary and secondary bypass volumes and duration times
	Reporting facilities:
	• About 450 facilities
	Data collection frequency:
	• Monthly
		To support research and compliance, evaluate municipal wastewater quality, and assess progress on the *Canada-Ontario Lake Erie Action Plan* and *Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health*	• No performance measurement frameworks
			• No comprehensive program evaluations
			• No comprehensive data management plan, but our audit did find:
			  • 2016 Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater
			  • 2008 data migration protocol

Stream Water Monitoring
Started 1964
Collection of data on stream water quality
	Data collected:
	• Water chemistry and physical parameters
	Monitoring sites:
	• Over 400 stations province-wide
	Data collection frequency:
	• Monthly
		To improve understanding of the conditions of stream water quality and flow. Results are used to support obligations under the *Great Lakes Protection Act, 2015* and various inter-jurisdictional agreements such as the *Canada–Ontario Agreement on Great Lakes Quality and Ecosystem Health*. They are also used in technical reports and peer-reviewed journal articles, support policy and program development and evaluation, as well as the setting of water quality guidelines and standards	• No performance measurement frameworks
			• A 2009 comprehensive program evaluation and presentation slides for an in-progress 2019 Provincial Water Quality Monitoring Network review
			• No comprehensive data management plan, but our audit did find:
			  • 2020 Provincial Water Quality Monitoring Network Comprehensive Guide
			  • 2019 Stream Database and Business Intelligence Project
			  • Assorted documents associated with data collection, sampling and database use

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Toxics Reporting Started 2010, scheduled to end December 31, 2021 Collection of data on the collection, storage, and management of toxic substances	Data collected: • Information on the use, creation and amounts of toxic substances in products, and the amount released, disposed and recycled at facilities Reporting facilities: • About 1,000 regulated manufacturing and mineral processing facilities Data collection frequency: • Annually	To produce an inventory of toxic environmental discharges, assess regulatory compliance, and support policy and program development and evaluation	• No performance measurement frameworks • No comprehensive program evaluations • No comprehensive data management plan, but our audit did find a 2019 Knowledge Base document
Water Use Reporting Started 2005 Collection of data on water withdrawals	Data collected: • Water taking volumes, source type, and geographic locations Reporting facilities: • Over 5,000 water-taking permit holders Data collection frequency: • Daily measurements reported on an annual basis	To estimate water withdrawals across the province, support policy and program development and evaluation, and meet obligations under O. Reg. 387/04, 450/07, 176/17 (under the *Ontario Water Resources Act*), and 63/16 (under the *Environmental Protection Act*) including estimating water taking charges and charges for taking groundwater to produce bottled water	• No performance measurement frameworks • Program evaluation included as part of 2020 review of water taking programs, policies and science tools • No comprehensive data management plan, but our audit did find a 2020 Knowledge Base document
Ministry of Natural Resources and Forestry			
Asian Carp Surveillance Program Started 2012 Collaboration with Fisheries and Oceans Canada, uses traditional techniques (netting and electrofishing) and environmental DNA monitoring to undertake surveillance of invasive Asian carp species	Data collected: • Monitoring effort; age, weight, sex and genetic information; DNA detections Monitoring sites: • In 2019, 164 sampling sites, primarily in Lake Erie, southern Lake Huron, and the Erie-Huron corridor Data collection frequency: • Multiple times a year	To inform further monitoring or Asian carp control actions	• No performance measurement framework • No formal program evaluation • No data management plan

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Broad-scale (Fisheries) Monitoring Program and Provincially Significant Inland Fisheries Monitoring Program Started 2008 and 2018 Monitor and report on fisheries resources across Ontario	Data collected: • Information on fish species and aquatic communities, species at risk, aquatic invasive species, lake habitat, fishing activity, and fish genetics and contaminants Monitoring sites: • Approximately 550 inland lakes in fisheries management zones in each monitoring cycle, as well as 11 Provincially Significant Inland Fisheries Data collection frequency: • Annually on a five-year cycle	To assess the state of fisheries, support fisheries management planning, document invasive species and species at risk distribution, and support fish contaminant and water quality reporting	• Formal performance measurement framework discussed but not developed • No formal program evaluation but a 10-year review is being drafted by science staff, and the Integrated Monitoring Framework made recommendations • Data management plan in development
Caribou Monitoring Program Started 2018 Uses data collected from GPS collars and DNA samples to estimate survival, movement, and overall population size of caribou	Data collected: • Movement and genetic information Monitoring sites: • Genetic samples collected throughout the species' provincial distribution Data collection frequency: • GPS data collected multiple times a day	To model the population and estimate cumulative effects of resource and development planning (e.g., forestry and mining)	• No documented performance measurement framework • No formal program evaluation • No data management plan
Cormorant Monitoring Program Started 2019 Collect data on location and abundance of nesting double-crested cormorants on the Great Lakes and large inland lakes	Data collected: • Abundance and location Monitoring sites: • Cormorant colonies on Great Lakes and large inland lakes Data collection frequency: • Designed to occur annually	To support policy decisions related to managing cormorants and inform harvest decisions	• No finalized monitoring protocol • No performance measurement framework • No planned program evaluation • No data management plan
Early Detection and Distribution Mapping System Started 2014 Launched by Ministry and Ontario Federation of Anglers and Hunters (OFAH) to track the distribution of invasive species based on observations submitted online	Data collected: • Date, location, photos and extent of infestation of invasive species Geographic range: • Provincial Data collection frequency: • Depends on public reporting	To document and inform the public and stakeholders on invasive species distributions, and inform management and rapid response actions	• No documented performance measurement framework, but OFAH reports internally on annual metrics (e.g., new reports, number of users, number of new species recorded) • No formal program evaluation • No data management plan

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Fisheries Community/Fisheries Independent Assessment Started at various times across Great Lakes Monitoring of fish communities on the Great Lakes via sampling of offshore, nearshore and riverine fish communities	Data collected: • Species, species composition, size, abundance, age and growth, and fish movement Monitoring sites: • Permanent and random sampling in Canadian waters of Great Lakes using various methods (e.g., trawling, trap nets, seines, hydroacoustics, telemetry) Data collection frequency: • Annually, some programs rotated depending on design	To manage Great Lakes fish populations and fisheries on a sustainable basis, and understand the presence, movement and abundance of invasive species	• Each Great Lake has its own monitoring protocols • No formal performance measurement frameworks • Program evaluations conducted as needed • No data management plans provided
Forest Health Monitoring Program Surveys taken over from federal government in 1998 Collects information on forest health, including areas affected by disease, insects and weather	Data collected: • Insect and disease samples, aerial mapping and pest surveys, and permanent sample plot data collection Monitoring sites: • All forested area in Ontario, with about 135 permanent plots and 735 point sample locations in 2019 Data collection frequency: • Annually	To inform the development of guidelines and forest and invasive-species management decisions, and identify damaged forest to evaluate fire hazards	• Monitoring protocols outlined in annual field manuals and as methods in peer-reviewed journals • No documented performance measurement framework • No formal program evaluation • No data management plan
Forest Resources Inventory Program Started 1946 Large-scale survey maintains a detailed inventory of forests in the Area of the Undertaking (Crown lands in central and northern Ontario where forestry is approved). Program also maintains a provincial inventory of land cover types (e.g., developments, forests and wetlands)	Data collected: • Aerial photos, light detection and ranging data, satellite data and field plot data Monitoring sites: • Across the Area of the Undertaking Data collection frequency: • Managed over 10-year cycles	To develop digital elevation models, forest stand maps, land cover maps and other information products to support provincial reports	• No performance measurement framework • No formal program evaluation • No data management plan

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Great Lakes Fisheries Monitoring Started 1950s Monitoring focused on important Great Lakes recreational, commercial and Indigenous fisheries. Includes broad fish community and fisheries specific monitoring and assessment	Data collected: • Fish species, abundance, age, growth, location and harvest levels Monitoring sites: • Permanent and random sampling in Canadian waters of Great Lakes using various methods (e.g., trawling, trap nets, seines, hydroacoustics and telemetry) Data collection frequency: • Annually, some programs rotated depending on design	To inform State of the Great Lakes Reports, allocate sustainable harvest quotas, restore native species, support recreational fisheries, inform stocking, and track and control invasive species	• Each Great Lake has its own monitoring protocols • No formal performance measurement frameworks • Program evaluations conducted as needed • No data management plans provided
Large and Small Game and Furbearer Monitoring Started 1950s Collection of programs that monitor furbearers and game species, such as black bear, deer, elk, fisher, waterfowl and wild turkey	Data collected: • Information on species' genetics, occurrence, location, distribution and movement Monitoring sites: • Provincial in scope, depending on species range Data collection frequency: • Daily to annually (depending on project)	To inform wildlife management decisions	• Programs use various protocols, some draft, some outlined as methods in peer-reviewed journals • No performance measurement frameworks • No formal program evaluations • No data management plans
Lower Trophic Level Assessment Started at various times across Great Lakes Monitoring of non-fish portions of Great Lakes ecosystems, including fish diet, lamprey wounding rates on fish, lake bottom organisms (invasive mussels), prey fish and water sampling	Data collected: • Species, species composition, size, abundance, age and growth, water quality and impacts of invasive species Monitoring sites: • Ranges from lake-wide to targeted area Data collection frequency: • Annually	To manage fish populations and fisheries, inform management of predator stock levels and harvest rates, and to understand presence, movement and abundance of invasive species	• Each Great Lake has its own monitoring protocols • No formal performance measurement framework • Program evaluations conducted as needed • No data management plans provided
Moose Aerial Inventory Program Started 1975 with standardized surveys monitoring moose population size, trend and herd composition	Data collected: • Moose abundance, age, sex and location Monitoring sites: • Surveys using standardized grids or transects within moose range Data collection frequency: • Annually on a rotating schedule. Resampling in core moose zones averages every 3.4 years	To monitor implementation of moose policy, develop moose harvest plans and adaptively manage forest policy	• Performance measurement framework to be determined • No comprehensive program evaluation, but moose monitoring reviewed and updated based on Integrated Monitoring Framework recommendations • No data management plan

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Natural Heritage Information Centre Monitoring Started 1993 Collects and manages data on the location of natural areas, plant communities, species of conservation concern (including species at risk), and wildlife concentration areas	Data collected: • More than one million observations of provincially tracked species, plant communities and wildlife concentration area locations Geographic scale: • Across the province Data collection frequency: • Data received daily	To inform natural resources management and conservation decisions and reports	• No performance measurement framework • No program evaluation • No data management plan or assurance over data stored in the US
Ontario Flood Forecasting and Warning Program Responsibilities started 1984 Provides province-wide flood forecasts, near real-time data, risk assessment and communication for overland flooding, Great Lakes storm surges and high water levels	Data collected: • Ministry and conservation authorities collect near real-time hydro-meteorological data (e.g., water levels, stream flows, precipitation, wind speeds and weather forecasts) Monitoring sites: • About 1,000 sampling sites across Ontario, supplemented by remote sensing and satellite imagery Data collection frequency: • Varies from minutes to hours	To assess risk of flooding, track flood situations, and notify the public and emergency management agencies to help them prepare for flooding	• No formal performance measurement framework • Program evaluated in independent review of 2019 flood events • No data management plan provided
Ontario Low Water Response Program Started 2000 To recognize and measure the severity of a low water condition, Ministry and conservation authorities monitor precipitation, stream flow and water levels	Data collected: • Near real-time hydro-meteorological data (e.g., air and water temperature, water levels, stream flows and precipitation) Monitoring sites: • About 150 weather sites and 280 water monitoring sites across Ontario Data collection frequency: • Precipitation data collected hourly, stream flow data collected every five minutes	To conduct weekly to monthly analyses of drought/low water conditions, track low-water situations, and notify the public and emergency management agencies to help them prepare for drought and low water conditions	• No performance measurement framework • No formal program evaluation • No data management plan provided

Monitoring Program	Data Collection	How Data Is Used	Issues We Noted
Ontario's Niagara Escarpment Monitoring Program Started 1996 Niagara Escarpment Commission, in partnership with the University of Waterloo, collects data on the state of the escarpment (e.g., forest biodiversity, growth, mortality and health)	Data collected: • Tree species abundance and diversity, height, health and ground cover Monitoring sites: • Five one-hectare forest plots Data collection frequency: • Every five years (last collected in 2017/18)	To assess the impacts of development and other pressures on forest ecosystems, and determine whether the policies of the Niagara Escarpment Plan are meeting the goals and objectives of the *Niagara Escarpment Planning and Development Act*	• No performance measurement framework • No program evaluation • No data management plan provided
Provincial Wildlife Population Monitoring Program Started 1998 Monitors populations and habitats of representative terrestrial vertebrate species expected to be affected by forest management activities	Data collected: • Use and occupancy of wildlife species on fixed plots Monitoring sites: • Fixed plots on Crown lands in central and northern Ontario where commercial forestry is approved Data collection frequency: • Annually	To evaluate the response of wildlife to forest management on Crown land, to inform sustainable management of furbearers and game species, and to understand the impacts of predation, connectivity and land use on furbearers and game wildlife	• Monitoring protocols in development • Performance measurement framework to be determined • Program evaluated through Integrated Monitoring Framework • No data management plan
Species at Risk Monitoring Programs Started for some species as early as mid-1980s Monitoring of select species at risk, such as the Algonquin wolf, little brown bat and polar bears	Data collected: • Species-specific genetic information, occurrence and location, distribution and movement Monitoring sites: • Multiple sites across Ontario Data collection frequency: • Varies across projects	To assess population trends, research threats, evaluate the effectiveness of species recovery measures, and inform recovery planning (e.g., government response statements and recovery actions)	• Monitoring protocols vary in content, some limited to drafts, Standard Operating Procedures or journal articles • No formal performance measurement frameworks • No formal program evaluations • No data management plans provided
Wildlife Disease Monitoring Program Started 1996 (for rabies) and 2002 (for Chronic Wasting Disease) Monitors for rabies (e.g., in foxes, raccoons and skunks) and Chronic Wasting Disease (e.g., in American elk, moose and white-tailed deer) in wildlife populations	Data collected: • Location, species and symptoms of rabies-infected animals, sample location of Chronic Wasting Disease Monitoring sites: • Province-wide, based on risk Data collection frequency: • Weekly for rabies, during deer hunting season for Chronic Wasting Disease	To inform management actions and surveillance planning	• No formal performance measurement frameworks • No program evaluations • No data management plans provided

Appendix 3: Audit Criteria

Prepared by the Office of the Auditor General of Ontario

Ministry of the Environment, Conservation and Parks	
1.	The Ministry sets key performance indicators and associated targets to measure and assess progress in achieving environmental goals and objectives.
2.	Established key performance indicators are measurable, relevant, based on sound evidence, and are in line with best practices.
3.	Established targets are measurable, realistic, relevant, time-bound, based on sound evidence, and are in line with best practices.
4.	The Ministry conducts comprehensive, well-co-ordinated and effective monitoring to track the state of Ontario's environment and progress in meeting environmental goals, objectives and targets so that any necessary corrective action can be taken on a timely basis.
5.	The monitoring systems use indicators that are objective, useful, based on sound evidence, and are in line with best practices, and qualitative information and quantitative data that is credible and collected in a transparent, scientifically sound, efficient and economical way.
6.	The Ministry shares qualitative and quantitative environmental information and data with relevant provincial, federal and municipal ministries, departments, agencies and other parties that need, or would benefit from, the collected information and data.
7.	The Ministry regularly reports to the public on the state of Ontario's environment, and progress in meeting environmental targets, goals and objectives. This reporting is objective, timely and understandable to the general public.
Ministry of Natural Resources and Forestry	
1.	The Ministry sets key performance indicators and associated targets to measure and assess progress in achieving goals and objectives to protect and sustainably manage Ontario's natural resources.
2.	Established key performance indicators are measurable, relevant, based on sound evidence, and are in line with best practices.
3.	Established targets are measurable, realistic, relevant, time-bound, based on sound evidence, and are in line with best practices.
4.	The Ministry conducts comprehensive, well-co-ordinated, and effective monitoring to track the state of Ontario's natural resources and progress in meeting environmental goals, objectives and targets so that any necessary corrective action can be taken on a timely basis.
5.	The monitoring systems use indicators that are objective, useful, based on sound evidence, and are line with best practices, and qualitative information and quantitative data that is credible and collected in a transparent, scientifically sound, efficient and economical way.
6.	The Ministry shares qualitative and quantitative environmental information and data with relevant provincial, federal and municipal ministries, departments, agencies and other parties that need, or would benefit from, the collected information and data.
7.	The Ministry regularly reports to the public on the state of Ontario's natural resources, and progress in meeting environmental targets, goals and objectives. This reporting is objective, timely and understandable to the general public.
Ministry of Agriculture, Food and Rural Affairs	
1.	The Ministry sets key performance indicators and associated targets to measure and assess progress in achieving goals and objectives to help ensure the environmental sustainability of Ontario's agriculture.
2.	Established key performance indicators are measurable, relevant, based on sound evidence, and are in line with best practices.
3.	Established targets are measurable, realistic, relevant, time-bound, based on sound evidence, and are in line with best practices.

4.	The Ministry conducts comprehensive, well-co-ordinated and effective monitoring to assess the environmental sustainability of Ontario's agriculture and progress in meeting environmental goals, objectives and targets so that any necessary corrective action can be taken on a timely basis.
5.	The monitoring systems use indicators that are objective, useful, based on sound evidence, and are in line with best practices, and qualitative information and quantitative data that is credible and collected in a transparent, scientifically sound, efficient and economical way.
6.	The Ministry shares qualitative and quantitative environmental information and data with relevant provincial, federal and municipal ministries, departments, agencies and other parties that need, or would benefit from, the collected information and data.
7.	The Ministry regularly reports to the public on the environmental sustainability of Ontario's agriculture, and progress in meeting environmental targets, goals and objectives. This reporting is objective, timely and understandable to the general public.

Appendix 4: Targets Associated with Environmental Goals and Objectives in Legislation, Strategies and Policies Administered by the Three Ministries

Prepared by the Office of the Auditor General of Ontario

Legislation, Strategy or Policy	Environmental Goals or Objectives	Requirement to Monitor	Requirement to Establish Target(s)	Relevant Published Target(s) and/or Target-Setting Requirements	Target(s) Time-Bound and Based on Sound Evidence?
Ministry of Agriculture, Food and Rural Affairs					
Bees Act	Protect the health of managed honey bees, particularly from pests and diseases	None	None	No targets set	n/a
New Horizons: Ontario's Agricultural Soil Health and Conservation Strategy (2018)	Sustain and enhance soil health, make reliable soil data and tools available, track the health and status of Ontario's agricultural soils over time, and optimize soil knowledge and skills	Mandatory	None	No targets set	n/a
Nutrient Management Act, 2002	Provide for the management of nutrient-containing materials in ways that will enhance protection of the natural environment and provide a sustainable future for agricultural operations and rural development	Optional	None	No targets set	n/a
Ontario's Pollinator Health Action Plan (2016)*	Reduce level of exposure of pollinators to pesticides	Mandatory	None	80% reduction in the number of acres planted with neonicotinoid-treated corn and soybean seed by 2017	No evidence provided to support 80% target
	Reduce impacts of diseases and pests on pollinators	Mandatory	None	Reduce overwinter mortality rates for managed honeybees to 15% by 2020	Target is time-bound and supported by scientific studies and the Canadian Association of Professional Apiculturists
	Improve habitats and nutrition for pollinators	Mandatory	None	Restore, enhance and protect 1 million acres of pollinator habitat	Not time-bound, and based on unsubstantiated proposal submitted by Grain Farmers of Ontario

Legislation, Strategy or Policy	Environmental Goals or Objectives	Requirement to Monitor	Requirement to Establish Target(s)	Relevant Published Target(s) and/or Target-Setting Requirements	Target(s) Time-Bound and Based on Sound Evidence?
Ministry of the Environment, Conservation and Parks					
Cap and Trade Cancellation Act, 2018 (Target set in *Preserving and Protecting Our Environment for Future Generations: A Made-In-Ontario Environment Plan*)	Establish targets to reduce greenhouse gas emissions and prepare a climate change plan	None	Mandatory	Reduce emissions 30% below 2005 levels by 2030	Time-bound, based to align with federal 2030 target
Clean Water Act, 2006	Protect sources of drinking water	Mandatory	Optional	No targets set. Under this Act, the Minister may establish targets relating to the use of the Great Lakes as a source of drinking water	n/a
Endangered Species Act, 2007	Protect and recover species at risk and their habitats	Optional	None	No high-level targets set, although some species-specific targets set through recovery goals in the development of government response statements	Species-specific targets generally not time-bound; based on best available scientific evidence from species' recovery strategies and policy development and consultation processes
Environmental Protection Act	Protect and conserve Ontario's natural environment	Optional	None	By March 31, 2021, meet the Canadian Ambient Air Quality Standards for ozone, fine particulate matter and sulphur dioxide (by decreasing exceedances of these standards by 16.67% relative to 2007 levels)	Time-bound; target based on Canadian Ambient Air Quality Standards that account for scientific evidence, but have been tempered by negotiations, consensus and alignment with other parties
Ontario's Food and Organic Waste Policy Statement (2018)	Prevent and reduce food waste, effectively and efficiently collect and process food and organic waste, and reintegrate recovered resources back into the economy	None	Mandatory	By 2023/2025, divert 50% or 70% of food waste (depending on the sub-sector) from landfills	Time-bound; no analysis or evidence provided to support target levels

Legislation, Strategy or Policy	Environmental Goals or Objectives	Requirement to Monitor	Requirement to Establish Target(s)	Relevant Published Target(s) and/or Target-Setting Requirements	Target(s) Time-Bound and Based on Sound Evidence?
Great Lakes Protection Act, 2015 *Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health* (2014) *Canada–Ontario Lake Erie Action Plan: Partnering on Achieving Phosphorus Loading Reductions to Lake Erie from Canadian Sources* (2018)	Protect human health and well-being through the protection and restoration of water quality, hydrologic functions, natural habitats, biodiversity and the ecological health of the Great Lakes–St. Lawrence River Basin	Mandatory	Mandatory	Reduce phosphorus loadings to the Ontario portion of Lake Erie western and central basins by 40% by 2025 (from 2008 levels), using an adaptive management approach, as well as an aspirational interim target of reducing loadings by 20% by 2020	Time-bound; target based on actions in the *Canada-Ontario Lake Erie Action Plan* and quantitatively interpreted as reducing algae in the western basin to non-severe levels 90% of the time
Lake Simcoe Protection Act, 2008 *Lake Simcoe Protection Plan* (2009)	Protect and restore the ecological health of the Lake Simcoe watershed	Optional	Mandatory	By the end of each summer (September 15), the mean volume-weighted hypolimnetic dissolved oxygen in Lake Simcoe should be a minimum of 7 milligrams/litre	Not time-bound; target level is based on estimates from current models indicating the dissolved oxygen conditions necessary to support self-sustaining coldwater fish community
				Reduce pathogen loading to eliminate beach closures	Not time-bound; target level based on Health Canada's *Guidelines for Canadian Recreational Water Quality*
				Reduce contaminants to levels that achieve Provincial Water Quality Objectives or better	Not time-bound; target levels based on numerous scientific studies, as well as 1979 document entitled *Rationale for the Establishment of Ontario's Provincial Water Quality Objectives*
Ontario Water Resources Act	Conserve, protect and manage Ontario's waters and their efficient and sustainable use	Optional	None	No targets set	n/a

Legislation, Strategy or Policy	Environmental Goals or Objectives	Requirement to Monitor	Requirement to Establish Target(s)	Relevant Published Target(s) and/or Target-Setting Requirements	Target(s) Time-Bound and Based on Sound Evidence?
Provincial Parks and Conservation Reserves Act, 2006 *Ontario Provincial Parks: Planning and Management Policies* (1992)	Permanently protect a system of provincial parks and conservation reserves that includes ecosystems representative of all of Ontario's natural regions, protects provincially significant elements of Ontario's natural and cultural heritage, maintains biodiversity, and provides opportunities for compatible, ecologically sustainable recreation	Mandatory	None	**Provincial park class targets**—specific targets for the number, size and distribution of wilderness, natural-environment and waterway-class parks within ecoregions and ecodistricts	Not time-bound. Park class targets are based on the premise that no individual park can be all things to all people. To this end, the principle of classification is used to organize Ontario's provincial parks into broad categories based on their size, natural character and intended use
				Representation targets–targets for provincial parks, conservation reserves and areas of natural and scientific interest have been defined by frameworks for geological and biological conservation	Targets are not time-bound. According to the Environment Ministry, targets of life science feature representation (including specific types of forests, valleys, prairies and wetlands) are minimum levels and not necessarily adequate for representation
Resource Recovery and Circular Economy Act, 2016	Minimize the use of raw materials, maximize the useful life of materials and other resources through resource recovery, and minimize waste generation at the end of life of products and packaging	Optional	None	Decrease the amount of waste disposed per capita each year	Time-bound; target level is not specific, but based on progressive annual reduction in waste disposed per capita
Safe Drinking Water Act, 2002	Protect human health and prevent drinking water health hazards through the control and regulation of drinking water systems and testing	Mandatory	None	By March 31, 2021, eliminate all long-term drinking water advisories at federally funded public drinking water systems	Time-bound; the levels set for triggering drinking water advisories are based on sound evidence
Strategy for a Waste-Free Ontario: Building the Circular Economy (2017)	Achieve a zero waste (waste-free) Ontario and zero greenhouse gas emissions from the waste sector	Mandatory	Optional	• 30% waste diversion by 2020 • 50% waste diversion by 2030 • 80% waste diversion by 2050	Time-bound; no analysis or evidence provided to support target levels
Toxics Reduction Act, 2009 (to be repealed December 31, 2021)	Prevent pollution, and protect human health and the environment, by reducing the use and creation of toxic substances	Optional	Optional	No targets set, although regulated facilities may set targets for reducing the use and creation of toxic substances	n/a
Water Opportunities Act, 2010	Conserve and sustain water resources for present and future generations	None	Optional	No targets set. Under this Act, the Minister may establish targets with respect to water conservation	n/a

Legislation, Strategy or Policy	Environmental Goals or Objectives	Requirement to Monitor	Requirement to Establish Target(s)	Relevant Published Target(s) and/or Target-Setting Requirements	Target(s) Time-Bound and Based on Sound Evidence?
Ministry of Natural Resources and Forestry					
A Wetland Conservation Strategy for Ontario: 2017–2030	Develop and advance public awareness of, appreciation for and connection to Ontario's wetlands Increase knowledge about Ontario's wetlands, including their status, distribution, functions and vulnerability Establish and strengthen partnerships to focus and maximize conservation efforts for Ontario's wetlands Develop conservation approaches and improve policy tools to conserve the area and function of Ontario's wetlands	Mandatory	None	Using 2010 as a baseline, by 2025, the net loss of wetland area and function is to be halted where wetland loss has been the greatest	Target is time-bound and based on public consultation. No analysis or evidence provided on target's measurability, achievability or time frame
				Using 2010 as a baseline, by 2030, a net gain in wetland area and function is to be achieved where wetland loss has been the greatest	Target is time-bound and based on public consultation. No analysis or evidence provided on target's measurability, achievability or time frame
Aggregate Resources Act, 1990	Minimize adverse impacts of aggregate operations on the environment, and require the rehabilitation of land from which aggregate has been excavated	Optional	None	No targets set	n/a
Cervid Ecological Framework (2009)	Ensure ecologically sustainable populations of cervids (members of the deer family) and the ecosystems on which they rely	Mandatory	None	No targets set	n/a
Crown Forest Sustainability Act, 1994	Provide for the sustainability of Crown forests, and manage Crown forests to meet social, economic and environmental needs of present and future generations	Mandatory	The Forest Management Planning Manual under the Act requires designated management units to have targets with time frames, based on categories identified in the Act	Targets set in individual forest management plans	Targets have time frames and are based on public and Indigenous consultation
Elk Management Plan (2010)	Support sustainable elk populations and the ecosystems on which they rely	Mandatory	None	No targets set	n/a

Legislation, Strategy or Policy	Environmental Goals or Objectives	Requirement to Monitor	Requirement to Establish Target(s)	Relevant Published Target(s) and/or Target-Setting Requirements	Target(s) Time-Bound and Based on Sound Evidence?
Far North Act, 2010	Protect ecological systems and areas of cultural value in the Far North; maintain biological diversity, ecological processes and ecological functions in the Far North	None	None	Include at least 225,000 square kilometres of the Far North in an interconnected network of protected areas designated in community-based land-use plans.	Not time-bound; no analysis or evidence provided to support target's magnitude or achievability
Framework for Enhanced Black Bear Management in Ontario (2009)	Ensure sustainable black bear populations across the landscape and the ecosystems on which they rely	Mandatory	None	No targets set	n/a
Invasive Species Act, 2015 *Ontario Invasive Species Strategic Plan* (2012)	Prevent, detect and respond to the spread of invasive species	Optional	None	No targets set	n/a
Lakes and Rivers Improvement Act	Provide for the management, protection, preservation and use of Ontario's lakes and rivers	Optional	None	No targets set	n/a
Moose Management Policy (2009)	Ensure sustainable moose populations and the ecosystems on which they rely	Mandatory	None	No targets set	n/a
Naturally Resilient: MNRF's Natural Resource Climate Adaptation Strategy (2017–2021) (2017)	Build resilience and biodiversity	Mandatory	None	No targets set	n/a
Niagara Escarpment Planning and Development Act	Provide for the maintenance of the Niagara Escarpment and land in its vicinity substantially as a continuous natural environment, and ensure only such development occurs as is compatible with that natural environment	None	None	No targets set	n/a
Ontario's Provincial Fish Strategy: Fish for the Future (2015)	Healthy ecosystems that support self-sustaining native fish communities	Mandatory	None	No targets set	n/a

Legislation, Strategy or Policy	Environmental Goals or Objectives	Requirement to Monitor	Requirement to Establish Target(s)	Relevant Published Target(s) and/or Target-Setting Requirements	Target(s) Time-Bound and Based on Sound Evidence?
Small Game and Furbearer Management Framework (2017)	Ensure sustainable populations of small game and furbearers in an ecosystem context	Mandatory	None	No targets set	n/a
Strategic Policy for Ontario's Commercial Fisheries (2011)	Ensure the long-term sustainability of fish populations, safeguarding function and biodiversity	None	None	No targets set	n/a
Strategy for Wolf Conservation in Ontario (2005)	Ensure ecologically sustainable wolf populations and the ecosystems on which they rely	Mandatory	None	No targets set	n/a
White-Tailed Deer Management Policy for Ontario (2017)	Manage for sustainable deer populations and the ecosystems on which they rely	Mandatory	None	No targets set	n/a
Wild Turkey Management Plan (2007)	Ensure sustainable management of turkeys as important components of the biodiversity of southern Ontario	Mandatory	None	No targets set	n/a

* During the course of our audit, we found that *Ontario's Pollinator Health Action Plan*, and the targets within it, had been cancelled.

Appendix 5: Three Ministries' Treasury Board-Approved Internal and Published Key Performance Indicators (KPIs), 2017/18–2020/21

Prepared by the Office of the Auditor General of Ontario

Key Performance Indicator (KPI)	Year(s) Included as an Internal KPI				Years Published in Annual Plan[1]	KPI Related to Environmental Condition? (Y/N)
	2017/18	2018/19	2019/20	2020/21		
Ministry of Agriculture, Food and Rural Affairs						
Annual growth rate of agri-food sector exports	✓	✓	✓	✓	–	N
Level of adoption of environmentally beneficial best-management practices	✓	✓	✓	✓	–	Y
Number of new technologies, practices and processes assessed, evaluated and/or demonstrated	✓	✓	✓	✓	–	N
Percentage of active provincially licensed facilities that meet provincial food safety requirements	✓	✓	✓	✓	–	N
Ratio of third-party investment leveraged through cost-share support to agri-food businesses and rural communities	✓	✓	x	x	–	N
Dollars of investment affected by Ministry involvement, and jobs created/retained in food and beverage manufacturing	x	x	✓	✓	–	N
Direct operating expenses as a percentage of total budget	x	x	✓	✓	–	N
Number of highly qualified personnel supported	x	x	x	✓	–	N
Number of patents and licences granted through Ministry-funded research	x	x	x	✓	–	N
Ministry of the Environment, Conservation and Parks						
Decreased amount of waste disposed per capita	✓	✓	✓	✓	2017/18 2019/20	Y
Improved ambient air quality	✓	✓	✓	✓	2017/18 2019/20	Y
Improved ecological health of the Great Lakes and Lake Simcoe	✓	✓	✓	✓	2017/18 2019/20	Y
Greenhouse gas emissions reductions	✓	✓	✓	✓	2017/18 2019/20	Y
Annual visits to Ontario Parks	✓[2]	x	✓	✓	2017/18[3]	N
Hectares of land deemed suitable for reuse based on Records of Site Condition filed	✓	x	x	x	–	Y
Area of Ontario's land regulated as a provincial park or conservation reserve	✓[2]	x	✓	✓	2017/18[3]	Y

Key Performance Indicator (KPI)	Year(s) Included as an Internal KPI				Years Published in Annual Plan[1]	KPI Related to Environmental Condition? (Y/N)
	2017/18	2018/19	2019/20	2020/21		
Maintaining or increasing the percentage of drinking water tests results from municipal residential systems that meet Ontario Drinking Water Quality Standards (O. Reg. 169/03)	✓	x	✓	✓	–	Y
Source-to-tap provision of safe drinking water in all Ontario communities	x	✓	x	✓[4]	2019/20	Y
Increase in restored beneficial uses in Canadian Great Lakes Areas of Concern	x	x	✓	✓	–	Y
Spending on Other Direct Operating Expenses as a percentage of the Ministry's overall spending is steady year-over-year.	x	x	✓	✓	–	N
Turnaround time for completing higher-risk environmental compliance approval applications	x	x	✓	✓	–	N
Ministry of Natural Resources and Forestry						
Percent of available Crown timber harvested	✓	✓	✓	✓	2017/18[3]	N
Rate of compliance with resource laws and regulations (% compliant)	✓	✓	x	x	2017/18[3]	N
Effectiveness of initial attacks on forest fires (% full response fires with effective initial responses)	✓	✓	x	x	2017/18[3]	N
Percentage of wetland area lost in southern Ontario	x	✓	x	x	–	Y
Indigenous communities/groups involved in natural resource management	x	✓	x	x	–	N
Sustainability Index (undeveloped composite index of natural resources sustainability, ecological integrity and biodiversity)	x	✓	x	x	–	Y
Outdoor recreational opportunities provided by fishing and hunting permits	x	✓	✓	✓	–	N
Variance in spending of Treasury Board Secretariat-approved allocation (i.e., managing expenditures within budget)	x	x	✓	✓	–	N
Composite measure of 12 different customer service standard scores	x	x	✓	✓	–	N
Percentage annual increase in number of Learn to Fish participants	x	x	✓	✓	–	N
Percentage progress toward $20 million in savings	x	x	✓	✓	–	N
Percentage annual increase in Ontario's forest industry exports	x	x	✓	✓	–	N
Percentage of on-line/self-service registrations	x	x	✓	✓	–	N
Timely recovery assistance to communities regarding floods and/or fires	x	x	x	✓	n/a	N

1. No government plans were published in 2018/19, and no 2020/21 plans had been published at the time of our review.
2. This key performance indicator belonged to the Ministry of Natural Resources and Forestry for 2017/18.
3. Key performance indicator published, but internal target not published.
4. This key performance indicator belonged to the Ministry of Indigenous Affairs for 2020/21.

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