



# Audit of infrastructure renewal within the Meteorological Service of Canada

October 2019



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## List of acronyms and abbreviations

|       |   |
|-------|---|
| ADM   | Assistant Deputy Minister                         |
| AMDS  | Atmospheric Monitoring and Data Services Division |
| CLDN  | Canadian Lightning Detection Network              |
| CWRRP | Canadian Weather Radar Replacement Project        |
| CSFB  | Corporate Services and Finance Branch             |
| DGAC  | DG Advisory Committees                            |
| DPMO  | Departmental Project Management Office            |
| ECCC  | Environment and Climate Change Canada             |
| MDSD  | Monitoring and Data Services Directorate          |
| MSC   | Meteorological Service of Canada                  |
| PCC   | Project Coordination Committee                    |
| PCD   | Procurement and Contracting Division              |
| PMF   | Project Management Framework                      |
| PMP   | Project Management Plan                           |
| PSPC  | Public Services and Procurement Canada            |
| QMO   | Quality Management Office                         |
| QMS   | Quality Management System                         |
| RBIS  | Reality Business Integrity Services               |
| RRPD  | Radar Replacement Program Division                |
| RUAD  | Radar and Upper Air Division                      |
| SMN   | Surface and Marine Networks                       |
| SSC   | Shared Services Canada                            |
| ToR   | Terms of reference                                |
| UAN   | Upper Air Network                                 |
| UAR2  | Upper Air Renewal II                              |

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## 1. Executive summary

The objective of this internal audit was to assess the effectiveness of the governance, risk management and control processes in place to oversee and manage the infrastructure renewal of the weather monitoring framework. The audit focused on the four networks covered under the Renewal II initiative:

- National Radar Network and, in particular, the Canadian Weather Radar Renewal Project (CWRRP)
- Surface and Marine Weather and Climate Stations Network (SMWCSN)
- Upper Air Network (UAN)
- Canadian Lightning Detection Network (CLDN)

### Why is it important?

The Meteorological Service of Canada (MSC) at Environment and Climate Change Canada (ECCC) is the primary supplier of meteorological and water resource information in Canada. As such, MSC maintains a Canada-wide observation network to monitor changes in the weather, climate, water, ice and air quality. It also obtains the data that is the foundation of weather and environmental prediction upon which Canadians rely. It is critical for ECCC to maintain a well-functioning infrastructure, to ensure that the Department carries out its core responsibility of predicting weather and environmental conditions.

In 2013, MSC developed a 10-year strategic plan for the renewal of the weather monitoring network. 2018 marked the mid-point in the 10-year plan. It is therefore important to review progress made to date, to ensure that MSC achieves its weather monitoring framework renewal objectives.

### What we found

#### Governance

A governance framework is in place for the Canadian Weather Radar Renewal Project (CWRRP), which includes dedicated oversight committees. Infrastructure renewal activities for the Surface and Marine Weather and Climate Stations Network (SMWCSN), the Upper Air Network (UAN), and the Canadian Lightning Detection Network (CLDN) are managed as part of ongoing regular program activities. The networks are discussed at different management committees, both operational and strategic. Governance documentation is incomplete. Key decisions are not consistently documented. There is an opportunity to improve governance by strengthening the comprehensive oversight function at the director general level.

## Management of risks and issues

The CWRRP actively tracks and manages risks and issues with an effective suite of risk management tools and defined processes. Risk documentation is limited in other areas of the Renewal II initiative. There is no overall risk framework to ensure that risks associated with the other renewal components are systematically identified, analyzed and managed.

Without a consistent approach to risk identification, proper risk registries and documented mitigation strategies for all parts of the Renewal II initiative, it is unclear to what extent MSC senior management is equipped to manage effectively risks and issues associated with the initiative.

## Project management

An overall strategic plan is in place that defines the Renewal II initiative. This key document supported the initial funding of the renewal of the ECCC weather monitoring network. There is a sound and comprehensive project management framework in place for CWRRP. The other network components of the Renewal II are managed through ongoing regular program activities. The absence of a project management framework increases the risk that the activities planned under these components may not be delivered on schedule and within budget, or may not produce the planned outcomes.

## Monitoring and reporting

The CWRRP has effective monitoring and reporting processes in place to support decision making. Although the audit found some evidence of monitoring and reporting activities for the other three components of the Renewal II initiative, the process is not clear and the requirements are not specified. MSC management would benefit from clearly articulating and documenting the required content for monitoring and reporting, the frequency, the target audiences and the approval process.

## Recommendations

### Recommendation 1 – Governance

The Assistant Deputy Minister, Meteorological Service of Canada, should strengthen the governance for the Renewal II initiative by:

- Clearly articulating how oversight is performed, specifically for components that have no dedicated governance structure
- Finalizing terms of reference for the oversight bodies
- Consistently documenting key decisions and action items, whether they are taken at the committee level or during bilateral discussions between project leads and senior management

### **Recommendation 2 – Management of risks and issues**

The Assistant Deputy Minister, Meteorological Service of Canada, should improve Renewal II risk management-related activities for the Surface and Marine Weather and Climate Stations Networks, Upper Air Network and Canadian Lightning Detection Network components, to ensure that risks are systematically identified, assessed, mitigated and communicated. This should include developing and updating risk registers and implementing mitigation strategies.

### **Recommendation 3 – Project management**

The Assistant Deputy Minister, Meteorological Service of Canada, should improve plans, processes and tools to manage the implementation of the Surface and Marine Weather and Climate Stations Networks, Upper Air Network and Canadian Lightning Detection Network components of the Renewal II initiative for the remaining period of the initiative. The plans should clearly demonstrate how MSC effectively manages activities to achieve the planned goals.

### **Recommendation 4 – Monitoring and reporting**

The Assistant Deputy Minister, Meteorological Service of Canada, should clarify the monitoring and reporting requirements for the Surface and Marine Climate Stations Networks, Upper Air Network and Canadian Lightning Detection Network components of the Renewal II initiative, to support timely and informed decision making.

## 2. Background

The Meteorological Service of Canada (MSC) is the primary supplier of meteorological and water resource information in Canada. In accordance with the [Department of the Environment Act](#) (1971), Environment and Climate Change Canada (ECCC) is responsible for providing Canadians with the information they need to make informed decisions to protect their health, safety, security and economic prosperity in the face of changing weather and environmental conditions. The MSC issues forecasts, conducts research and provides information about the past, present and future conditions of the atmosphere, climate, water, air quality, ice and related environment.

In its December 2008 Report entitled [Managing Severe Weather Warnings](#), the Commissioner of the Environment and Sustainable Development noted that the MSC's monitoring infrastructure was aging and had increasing risk of failure. This could negatively affect ECCC's ability to warn Canadians of hazardous weather in the short term, and limit its ability to monitor climatic trends in the long term. In response to the audit, the MSC developed a 10-year strategic plan for the renewal of its infrastructure.

In its 2011 budget, the Government of Canada included funding of \$96.6 million over five years to address the most critical deficiencies in Canada's weather monitoring infrastructure and to renew the supercomputing contract for weather services under ECCC's responsibility. The supercomputer's responsibility was later transferred to Shared Services Canada (SSC) while the weather services remained under ECCC.

In 2013, new funding included \$104.62 million for 10 years (see [Appendix B](#)) for ECCC and SSC to renew key elements of the meteorological infrastructure. In particular, the infrastructure funding was part of a larger envelope that was to be used to:

- determine which areas of the radar technology would be renewed
- replace other aging weather monitoring infrastructure
- upgrade the weather warning and forecast system
- ensure continued access to high-performance computing

In 2016, ECCC received additional funding of \$174.35 million for the remaining seven years of the 10-year plan (see [Appendix B](#)), to replace its radar infrastructure.

### Renewal II initiative

The MSC operates a variety of networks to observe the range of weather and water parameters required to support its services. It uses different observation systems to monitor a variety of parameters in different locations. Observations are used to form as complete a picture as possible of the state of the atmosphere and water. They are essential to providing a good record of weather conditions and a sound basis for making forecasts. To be able to gather, record and analyze these observations, it is critical that ECCC maintain a well-functioning infrastructure.



The renewal of the meteorological infrastructure is a responsibility of the Monitoring and Data Services Directorate (MDSD) within the MSC. This audit focuses on the infrastructure elements of the initiative, known as the **Renewal II** initiative, which provides improvements to the following networks:

- National Radar Network
- Surface and Marine Weather and Climate Stations Network
- Upper Air Network
- Canadian Lightning Detection Network

Each network generates important data to support the prediction model for weather forecasts and warnings.

### National Radar Network

Canada's National Weather Radar Network supports the early detection and surveillance of developing precipitation, thunderstorms and high impact weather. This component of the Renewal II initiative is managed by the Canadian Radar Replacement Program Division (CRRPD).

When the Renewal II initiative began, the network included 31 radars that were largely concentrated in the southern part of Canada, as well as two radars owned and operated by the Department of National Defence (DND) and one radar owned and operated by McGill University. The network included different generations of radars. Some were several decades old and had already surpassed their life expectancy of 25 years. The 17 oldest ECCC radars and the two DND radars relied on obsolete technology that could no longer be procured, maintained or upgraded. The McGill University radar was the oldest and its unique technology was no longer supported. It was also the sole source of radar data for the Montreal area.

### Surface and Marine Weather and Climate Stations Networks

The Atmospheric Monitoring and Data Services Division (AMDS) manages the Surface and Marine Weather and Climate Stations Networks. The networks comprise about 1125 weather stations, including:

- 1000 ground-based surface stations for the Surface Weather Network, the Reference Climate Network and the Daily Climatological Network (550 automatic stations and 450 sites providing daily manual climate reports)
- 125 marine stations. Marine observations (50 moored weather buoys, 25 drifting buoys, and 50 automatic weather stations installed on ships)

### Upper Air Network

The Radar and Upper Air Division (RUAD) manages the Upper Air Network (UAN). Whereas the Surface and Marine Weather and Climate Stations Networks cover the horizontal or surface

dimension, the UAN supplies the vertical dimension to the picture of the atmosphere. The network provides critical input for numerical modelling (weather, climate, air quality) and is useful for weather forecasting and calibrating satellite observations.

The UAN currently consists of 31 radiosonde stations, with balloon launches twice daily. Data such as wind speed and direction, temperature and humidity is collected up to 35,000 feet through the radiosondes attached to the balloons. Nearly 10,000 observations of wind and temperature are generated daily by a fleet of about 27 aircraft operated by a contract air carrier in Canada.

## Canadian Lightning Detection Network

The RUAD also manages the Canadian Lightning Detection Network (CLDN), which provides real-time information on winds, precipitations and lightning. This network supplements the radar network in the detection of thunderstorm activity. The CLDN's 84 sensors located across Canada provide detection of cloud to ground lightning on a continuous basis, 24 hours a day, 7 days a week.

Table 1 provides a summary of the planned renewal activities for each network.

**Table 1: planned activities under the Renewal II initiative**

| Network                           | Planned Activities  |
|-----------------------------------|---|
| <b>National Radar Network</b>     | <p>The original plan for the infrastructure renewal consisted of:</p> <ul style="list-style-type: none"> <li>• modernizing or replacing 28 ECCC-owned radars</li> <li>• replacing three radars not belonging to ECCC</li> <li>• adding one radar in the Northeastern Alberta region to support increasing economic activity</li> </ul> <p>Different approaches for accomplishing the radar renewal goals were considered during the definition phase. However, it was determined that a commercial solution would cost less and be more effective in terms of lifetime costs and risk management. The contract bidding process confirmed that the best option would be to replace the entire network with new technology. This meant replacing 31 radars and adding two new radars, including one for training purposes.</p> <p>Due to the size, scale (replacement of the entire network) and nature (new approach and technology) of the investment in the National Radar Network, a separate project, the Canadian Weather Radar Project (CWRRP), was established. A dedicated project team provides project management support and oversight of this infrastructure renewal initiative.</p> |
| <b>Surface and Marine Weather</b> | The 10-year plan includes the replacement or upgrade of obsolete observation equipment (including sites operated by others) at a rate of 20   |

| Network                                     | Planned Activities  |
|---|---|
| <b>and Climate Stations Networks</b>        | <p>to 30 per year, as well as a more rigorous lifecycle management of this core infrastructure.</p> <p>Key planned activities include:</p> <ul style="list-style-type: none"> <li>• modernizing 150 land-based surface weather and climate stations and installing 40 new sites</li> <li>• modernizing 125 marine weather and climate stations and securing the buoy maintenance service with Canadian Coast Guard</li> </ul> |
| <b>Upper Air Network</b>                    | <p>Key planned activities include:</p> <ul style="list-style-type: none"> <li>• enhancing the current network</li> <li>• integrating known technologies into operations</li> <li>• exploring new technologies to enhance the UAN</li> </ul>   |
| <b>Canadian Lightning Detection Network</b> | <p>Key planned activities include:</p> <ul style="list-style-type: none"> <li>• upgrading the sensors at 6 to 8 sites per year</li> <li>• upgrading communications at 15 sites</li> </ul>   |

## Enabling resources

The Corporate Services and Finance Branch (CSFB) provides support to help the MSC achieve its infrastructure renewal objectives. It is a key corporate enabler for the Renewal II initiative.

## Project Management Framework

Through the Departmental Project Management Office (DPMO), CSFB assists ECCC programs with project management. The ECCC Project Management Framework (PMF), approved by Senior Management in 2017, defines the processes for managing departmental projects. It is primarily intended as a reference for project managers, project sponsors and members of project steering committees. It also provides the structure and guidance to help ECCC meet its Treasury Board Policy obligations.

## Realty Business Integrity Services

Through the Realty Business Integrity Services (RBIS), CSFB provides functional support to ensure compliance with policies, acts and regulations applicable to the management of real property. Where a program needs a real property instrument to support the delivery of its services, RBIS negotiates and drafts agreements for installations. Specific to the Renewal II initiative, RBIS is responsible for ensuring that proper leases and other required agreements are in place before structural changes can be made to any site (for example, excavation, installation of foundations and road building).

## Procurement and Contracting Services Division

Through the Procurement and Contracting Division (PCD), CSFB provides department-wide functional direction, advice and guidance in all areas of procurement and contracting. PCD liaises with central agencies and Public Services and Procurement Canada (PSPC) when the size of a contract exceeds the departmental level of authority. As the project authority, MSC management relies on the services of PCD to coordinate Renewal II procurement activities. As the contracting authority, PCD leads or coordinates the procurement process with PSPC for the acquisition of goods and services, the development of specifications and selection criteria, the coordination of the tendering process, requests for proposals, negotiations and contract awards.

### 3. Objective, scope and methodology

#### Objective

The objective of this audit was to assess the effectiveness of the governance, risk management and control processes in place to oversee and manage the infrastructure renewal of the weather-monitoring framework.

#### Scope

The audit covered the period from April 2013 to December 2018. This period represents the first five years of the 10-year renewal plan ending in 2023. The audit focused on the following elements of the renewal project:

- the governance structure – governance bodies, roles and responsibilities, information for decision making and planning and reporting processes related to the MSC's infrastructure renewal
- the project management framework, including risk management, tools and guidance and controls supporting the infrastructure renewal
- the reporting processes in place to support MSC senior management decision making

The scope of the audit excluded the following elements:

- the National Hydrological Monitoring Network renewal, since this element only received funding in July 2018 and there has been limited activity on the renewal of its infrastructure
- the satellite ground receiving stations, due to the limited activities and limited funding related to this sector
- the supercomputing contract for weather services since it has been transferred to SSC, which published the [Audit of High Performance Computing Service](#) in March 2019
- the prediction models, since the audit focused only on the management of physical assets

- the maintenance and life cycle management of the networks' assets which, given the significance and complexity of these activities, could be the focus of a separate audit

## Methodology

The audit approach included the following:

- interviews and walk-throughs conducted with key management and staff involved in the oversight and management of the renewal of weather monitoring networks, including key corporate function enablers
- review, analysis and testing of relevant documentation, processes and information management systems for the renewal and maintenance of the weather monitoring networks, including legislation, policies, directives, guidance, procedures, documented controls, documented business processes, flow charts and records of decisions
- review of tools in place to support management decision making
- file review of progress made on the implementation of renewal plans for radar, upper air and surface and marine networks

The audit line of enquiry and criteria are provided in [Appendix A](#).

## Internal audit opinion

In my professional opinion and judgment, sufficient and appropriate procedures were performed, and evidence gathered, to support the accuracy of the audit conclusion. The audit findings and conclusion are based on a comparison of the conditions that existed as of the time of the audit, against established criteria that were agreed upon with management. The audit conforms to the International Standards for the Professional Practice of Internal Auditing, as supported by the results of the quality assurance and improvement program.



Paule-Anny Pierre  
Chief Audit Executive

## 4. Findings, recommendations and management responses

### 3.1 Governance

**Findings:** A governance framework is in place for the Canadian Weather Radar Renewal Project (CWRRP), which includes dedicated oversight committees. Infrastructure renewal activities for the Surface and Marine Weather and Climate Stations Network (SMWCSN), the Upper Air Network (UAN), and the Canadian Lightning Detection Network (CLDN) are managed as part of ongoing regular program activities. The networks are discussed at different management committees, both operational and strategic. Governance documentation is incomplete. Key decisions are not consistently documented. There is an opportunity to improve governance by strengthening the comprehensive oversight function at the director general level.

### What we examined

Treasury Board (TB) [Policy on the Management of Projects](#) requires that a department-wide governance and oversight mechanism be put in place, documented and maintained. The aim is to support the achievement and demonstration of value for money and sound stewardship of projects. The audit reviewed the departmental governance bodies in place to provide oversight of the Renewal II initiative. Auditors examined terms of reference (ToR), meeting agendas, minutes of meetings, records of decisions and other relevant documentation, to verify whether the governance bodies fulfill their oversight and challenge functions. The audit also examined the documentation available on the roles and responsibilities of the committees, to ensure that they are clearly defined, documented, communicated and carried out as intended.

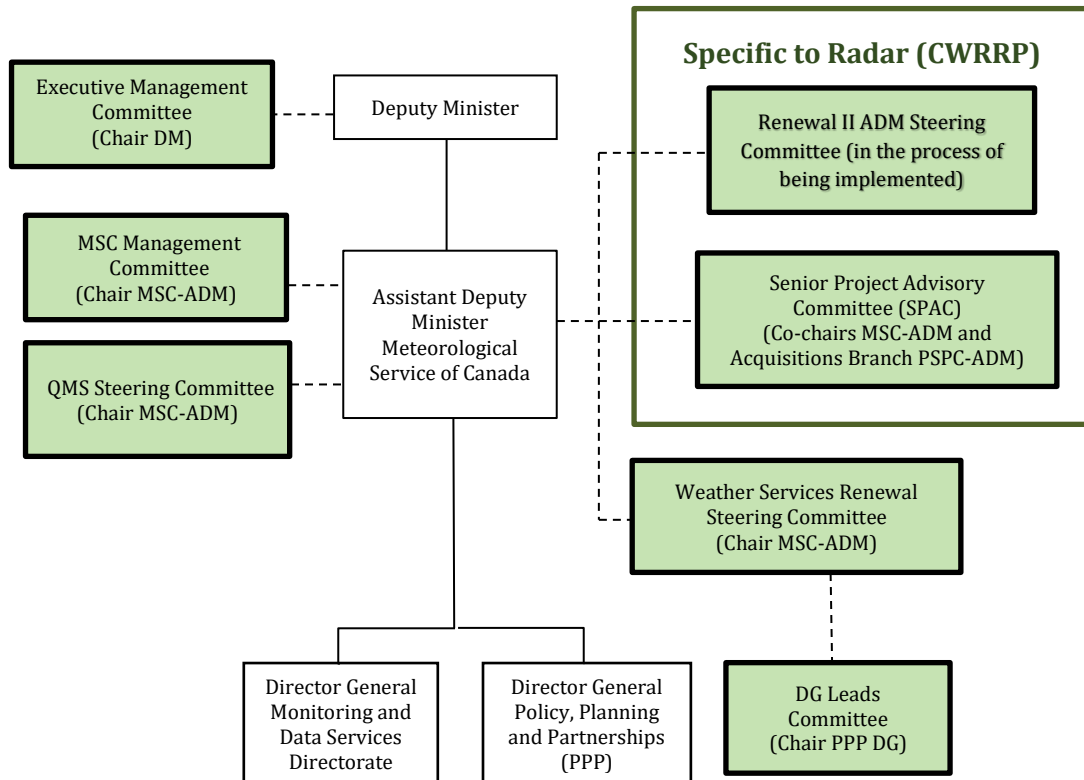
**Why is this important?** Project governance is the process by which high-level decisions are made about a project, such as whether to approve changes to its scope. Governance is used to balance the interests of stakeholders and to provide high-level approvals and guidance to the project team. Governing bodies play an important role in setting priorities and in ensuring that adequate oversight is in place to achieve expected results and meet departmental priorities.

### What we found

#### Senior level oversight

Oversight for the Renewal II initiative is performed through a number of committees at different levels. Some of these committees are dedicated solely to the management and oversight of the renewal projects. As well, some committees include members from other departments such as PSPC and SSC. Figure 1 sets out the oversight structure in place at the senior management level.

The audit found that the CWRRP is discussed at the departmental **Executive Management Committee (EMC)**, chaired by the Deputy Minister. The committee endorsed the CWRRP management plan, including the number of radars to be installed per year until FY 2022 to 2023. EMC also received presentations on progress to date on infrastructure renewal activities.

**Figure 1: renewal II initiative senior-level oversight structure**

The Renewal II initiative is also discussed periodically at **MSC Management Committee** meetings. The ADM of MSC chairs the weekly meetings that provide opportunities for information sharing and regular updates on progress.

As part of the ISO 9001 certification, MSC committed in 2013 to conducting regular reviews and “surveillance audits” of its Quality Management System (QMS) to verify that processes are working as anticipated and that continuous improvement is occurring. The audit observed that some areas within the Renewal II initiative were examined through the ISO 9001 external reviews conducted annually. The most recent report available covered the period from November 30, 2017 to December 19, 2017.

The **QMS Steering Committee** provides senior management oversight and guidance for maintaining and strengthening the QMS. The Monitoring and Data Services Directorate (MDS) informs the committee at mid-year and year-end on the status of the Renewal II initiative network components. Reports include progress made, internal and external risks and actions items.

The **Senior Project Advisory Committee (SPAC)** is the interdepartmental forum for the CWRRP, chaired by the ADM of MSC and the ADM of the PSPC Acquisitions Branch. This committee managed and governed the CWRRP during the definition phase. It carried out the procurement review functions for the project, including all significant associated procurement activities handled by the project team. Management indicated that during the implementation phase, SPAC meetings will be

convened only when required by the ADM, such as if there is a need to seek more funding. As a result, the committee has been inactive since March 2016.

Management indicated that the **Renewal II ADM Steering Committee** is in the process of being implemented and will be chaired by the ADM of MSC. While there is no TOR yet, the CWRRP project charter, revised and approved in October 2018, states that this committee has the mandate to provide guidance on decisions concerning the CWRRP plan and to oversee project accountability.

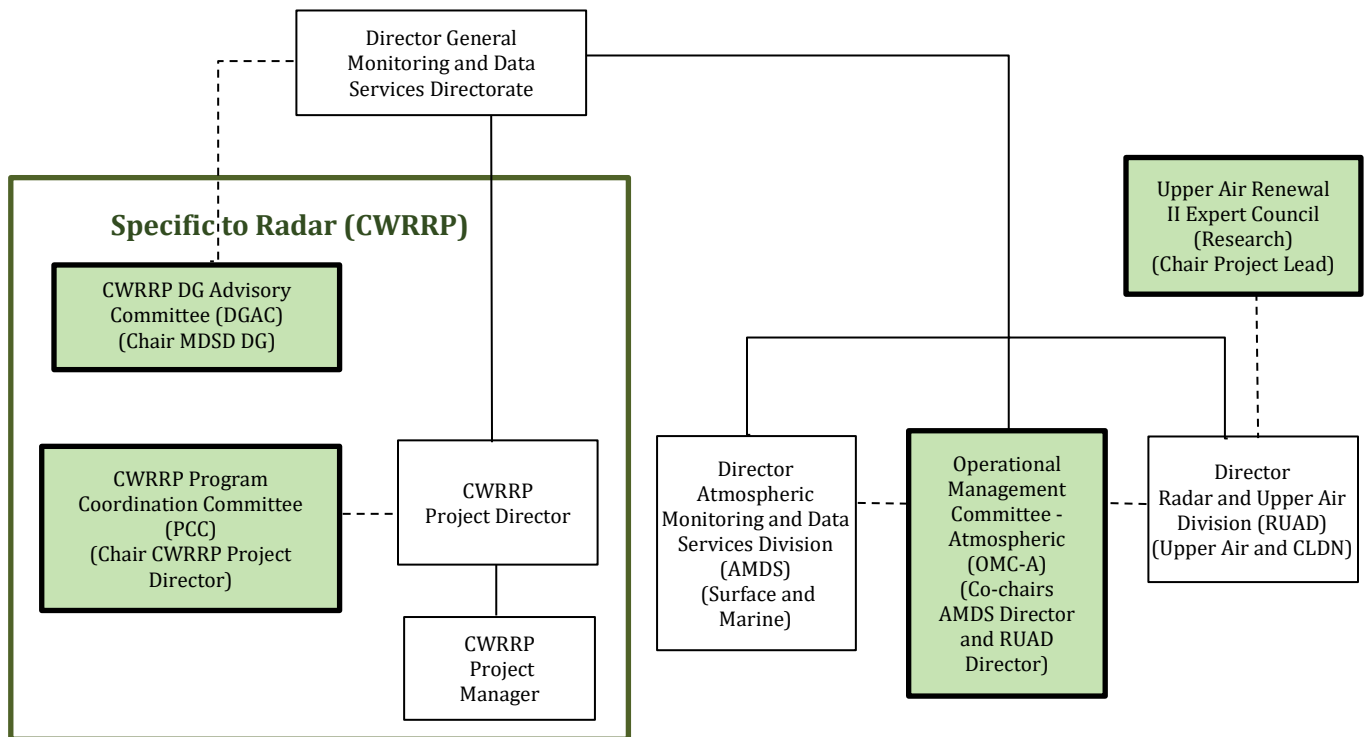
MSC established a horizontal ECCC director general level committee for the management and oversight of MSC programs and activities. The **DG Leads Committee**, managed by the Policy, Planning and Partnerships (PPP) Directorate, provides policy, planning and performance advice to the ADMs of three ECCC branches: MSC, CSFB and the Science and Technology Branch (STB). It is through this committee that the QMS ISO 9001 review reports and the Annual Report to TBS on Canada's Weather Services Renewal Initiative are discussed prior to being presented respectively to the QMS Steering Committee and the **Weather Services Renewal Steering Committee (WSRSC)**, both chaired by the MSC ADM.

The audit noted that the DG Leads Committee, which is intended to meet monthly, met seven times in FY 2017 to 2018 and once in FY 2018 to 2019. A planned meeting in October 2018 to review key renewal reports was cancelled as quorum was not obtained, and was never held after. Furthermore, there was no evidence of activities for the WSRSC between July 2016 and April 2018.

### **Project and operational level oversight**

Oversight for the Renewal II initiative is also performed at the project level as depicted in Figure 2.



**Figure 2: Renewal II initiative oversight bodies at the project and operational level**

The **Director General Advisory Committee (DGAC)** is a key committee for the CWRRP. Its main role is to provide the corporate challenge and oversight functions in support of the lead DG, SPAC and the lead ADM. The ToR indicates that DGAC meetings should occur at least once a year. The committee met in June 2017 and February 2018.

The CWRRP **Program Coordination Committee (PCC)** was established to coordinate and integrate the activities of the key groups from ECCC, SSC and PSPC that directly contribute to program delivery and to confirm priorities and manage change requests, issues and risks, as required. PCC meets quarterly to support and advise the CWRRP Director.

The audit found no documented interactions between the DGAC and the PCC. The audit also found that program issues raised by the project director are not discussed at the DGAC, but are reported or escalated directly to the Project DG during bilateral meetings. In addition, bimonthly dashboards generated to report on progress are not discussed at DGAC. Given the complexity, interdependencies and significance of the CWRRP, there is an opportunity to improve the effectiveness of the DGAC.

There is no specific governance structure established to oversee progress on the implementation of the Renewal II initiative for the Surface and Marine Weather and Climate Stations Network, the Upper Air Network and the Canadian Lightning Detection Network. Infrastructure renewal for all three networks is managed as part of ongoing regular program activities, including maintenance of equipment. The networks are discussed at the **Operational Management Committee - Atmospheric (OMC-A)** and the audit found evidence of presentations for information purposes to

senior management committees such as the MSC Management Committee and the QMS Steering Committee.

It should be noted that for the research activities to explore new technologies and to enhance the Upper Air Network, MSC has put in place the **MSC Renewal II: Upper Air Expert Council**. It provides a forum for members to update, coordinate and make recommendations for decisions related to the Upper Air Renewal Project. The audit found that minutes are documented. Renewal projects were discussed at the meetings, including status on progress and risks.

### **Governance supporting documentation**

Effective project governance requires that oversight bodies be in place for decision making. Approved ToRs confirm their mandate and roles and responsibilities. Clear processes and escalation mechanisms help ensure proper oversight and accountability for achieving the project goals.

The audit found that roles and responsibilities are defined for the majority of the committees that support oversight for the Renewal II initiative. However, many ToRs are still in draft form. Except for CWRRP during the definition phase, the audit found limited evidence that key decisions or actions were discussed at committee meetings. Management reported that issues are mostly discussed during regular bilateral meetings between the supervisor and the direct reports responsible for network renewal activities. Decisions are made through the hierarchical structure at different levels, rather than by using the governance oversight bodies in place. The outcomes of these bilateral discussions, including key decisions, are not consistently documented.

Table 2 summarizes the audit findings related to the governance, the existence of ToRs and the documentation of roles and responsibilities for the oversight of the Renewal II initiative activities.

**Table 2: Renewal II initiative governance documentation**

| Oversight Committee                                       | Dedicated to renewal project | Level            | Approved terms of reference | Defined roles and responsibilities |
|---|------------------------------|------------------|-----------------------------|------------------------------------|
| <b>Branch-level</b>                                       |                              |                  |                             |                                    |
| Weather Services Renewal Steering Committee               | yes                          | ADM/DG           | no                          | no                                 |
| QMS Management Steering Committee                         | no                           | ADM/DG           | draft                       | yes                                |
| MSC Management Committee                                  | no                           | ADM/DG           | draft                       | yes                                |
| Director General Leads                                    | no                           | DG               | draft                       | yes                                |
| <b>Canadian Weather Radar Replacement Project (CWRRP)</b> |                              |                  |                             |                                    |
| Senior Project Advisory Committee (SPAC)                  | yes                          | ADM              | yes                         | yes                                |
| Renewal II ADM Steering Committee                         | yes                          | ADM              | no                          | no                                 |
| Director General Advisory Committee (DGAC)                | yes                          | DG               | yes                         | yes                                |
| Project Coordination Committee (PCC)                      | yes                          | Director         | draft                       | yes                                |
| <b>Surface and Marine Weather and Climate Stations</b>    |                              |                  |                             |                                    |
| Operations Management Committee Atmospheric (OMC-A)       | no                           | Director         | draft                       | yes                                |
| <b>Upper Air</b>  |                              |                  |                             |                                    |
| Upper Air Renewal II Expert Council                       | yes                          | Director/Manager | draft                       | yes                                |
| Operations Management Committee Atmospheric (OMC-A)       | no                           | Director         | draft                       | yes                                |
| <b>Canadian Lightning Detection</b>                       |                              |                  |                             |                                    |
| Operational Management Committee Atmospheric (OMC-A)      | no                           | Director         | draft                       | yes                                |

The absence of a dedicated governance structure for parts of the Renewal II initiative increases the risk that senior decision makers may not fulfill their challenge and oversight functions fully. Given the complexities, significance and interdependencies of the infrastructure renewal activities, there is a risk that important issues may not be communicated in a timely manner to decision makers at the senior level. There is an opportunity to improve the current governance structure for the Renewal II initiative by strengthening the mandate of the DGAC. Management should consider increasing the frequency of meetings for this DG-level governance body and explore expanding its responsibilities to include oversight for the Surface and Marine Weather and Climate Stations, Upper Air and Canadian Lightning Detection networks. This would allow visibility on all parts of the initiative and regular overarching discussions at a senior management level.

Effective governance documentation should spell out clearly the decision-making responsibilities, checks and balances, opportunities for discussion and challenge and levels of accountability among and between the parties involved in the delivery of the project. The audit identified an opportunity to strengthen appropriate governance documentation for the oversight of the Renewal II initiative.

### Recommendation 1 – Governance

The Assistant Deputy Minister, Meteorological Service of Canada, should strengthen the governance for the Renewal II initiative by:

- Clearly articulating how oversight is performed, specifically for components that have no dedicated governance structure
- Finalizing terms of reference for oversight bodies
- Consistently documenting key decisions and action items, whether they are taken at the committee level or during bilateral discussions between project leads and senior management

### Management response

Management agrees with the recommendation.

Given that Renewal II investments represents a relatively small portion of MSC's monitoring expenditures and that oversight mechanisms are already in place, improvements to existing MSC governance will be the most effective way to address the recommendation.

As such, the MSC will address recommendations through improved governance to support awareness and decision making related to Renewal II initiatives. Specific actions to address the audit's findings will be incorporated into existing Branch efforts already underway to review and address governance supporting MSC's monitoring program, including:

- Documenting oversight mechanisms for decision making, reporting, and risk and issue management for Renewal II Initiatives
- Finalizing terms of reference for oversight committees
- Ensuring that key decisions related to Renewal II are captured and documented in the records of decisions

## 3.2 Management of risks and issues

**Findings:** The CWRRP actively tracks and manages risks and issues with an effective suite of risk management tools and defined processes. Risk documentation is limited in other areas of the Renewal II initiative. There is no overall risk framework to ensure that risks associated with the other renewal components are systematically identified, analyzed and managed.

### What we examined

The audit sought to determine whether risks that may preclude the achievement of the infrastructure renewal objectives are systematically identified, documented, assessed and mitigated. The audit looked for the existence of tools to document risks and issues as they arise and to track mitigation measures. The auditors expected to see documents such as risk management plans, risk registers and risk matrix logs.

**Why is this important?** Risk management is an essential component of project delivery. Its primary objective is to ensure that the risks to the outcome of a project are identified and managed

in a way that can reduce or avoid the negative effects of the specific risk events and control these effects in a systematic manner throughout the life of the project.

## What we found

The audit found that the CWRRP manages risks and issues in accordance with the TB [Policy on the Management of Projects](#). The **CWRRP Project Management Plan (PMP)** includes a **Project Risk Management Plan** that defines how risks associated with the CWRRP are identified, analyzed and managed. It outlines how risk management activities are performed, recorded and monitored throughout the life of the project, and provides templates for recording and prioritizing risks.

CWRRP risks are documented through a **risk matrix log**. For each risk, probability and impact ratings determine the overall risk level and the appropriate risk response to accept or mitigate risk. Once mitigation actions are developed, probability and impact ratings are reassessed to determine if the residual risk is now acceptable. For each risk, the residual risks are compiled and reported in the **bimonthly dashboard**, which is monitored by the Departmental Project Management Office (DPMO) and is provided to TBS as part of its oversight. If a risk materializes and becomes an issue, it is added to the **Issues Management Log** and managed according to **the CWRRP Issues Management Plan**.

The audit noted that MSC maintained issues and risk logs up to FY 2015 to 2016. The Renewal Project Office, which no longer exists, managed risks and provided support for the Renewal II initiative, in particular to monitor the radar, surface and marine and upper air components. The audit also confirmed risk management activities for the research component of the Upper Air project, for which project risks included in dashboards are discussed at the Upper Air Renewal II Expert Council meetings.

Although there is evidence of some risk management activities, MSC has no overall comprehensive risk management plan or process in place that defines how risks associated with the renewal projects other than the CWRRP are identified, analyzed and managed. The audit found that there is no continuity to ensure risks are systematically identified, mitigated and resolved. At times, new risks are discussed in meetings, but there is limited documentation on how they are managed.

Without a consistent approach to risk identification, proper risk registries and documented mitigation strategies for all the components of the Renewal II initiative, it is unclear to what extent MSC senior management is equipped to manage effectively the risks and issues associated with the initiative.

### Recommendation 2 – Management of risks and issues

The Assistant Deputy Minister, Meteorological Service of Canada should improve the Renewal II initiative risk management-related activities for the Surface and Marine Weather and Climate Stations Networks, Upper Air Network and Canadian Lightning Detection Network components, to ensure that risks are systematically identified, assessed, mitigated and communicated. This should include developing and updating risk registers and implementing mitigation strategies.

### Management response

Management agrees with the recommendation.

In addition to the recommendations outlined in the audit report, MDSD will build on the existing ISO-QMS process and develop a Risk Management Framework including an internal risk registry and issues log to capture risks related to program operations, including Renewal II. This will provide the evidence base for the management of program risks and will allow for risks to be contextualized and raised to appropriate management levels to support strategic decision making across the organization and with key stakeholders. MSC will:

- Implement a risk registry capable of capturing and tracking risks and mitigation strategies, including those related to Renewal II
- Communicate requirements to Renewal II leads to capture and record risks and mitigation strategies in the MDSD Risk Registry for Renewal II-related risks
- Develop a risk management framework that outlines how risks will be managed and addressed by management
- Develop a dashboard to roll-up and synthesize key risks for awareness and tracking

## 3.3 Project management

**Findings:** An overall strategic plan is in place that define the Renewal II initiative. This key document supported the initial funding of the renewal of the ECCC weather monitoring network. There is a sound and comprehensive project management framework in place for CWRRP. The other network components of the Renewal II initiative are managed through ongoing regular program activities. The absence of a project management framework increases the risk that the activities planned under these components may not be delivered on schedule and within budget, or may not produce the planned outcomes.

### What we examined

The audit sought to determine whether a project management framework, an overall strategy and project plans are in place and clearly defined to support the achievement of the infrastructure renewal objectives. Auditors expected to see documented project management plans, processes and tools such as project charters or equivalents implemented for the renewal of the four network components.

**Why is this important?** Project management is about improving the likelihood of success of time-limited initiatives by applying certain practices. It is the practice of initiating, planning, executing, controlling and closing the work of a team to achieve specific goals and meet specific success criteria within a specified timeframe. These practices include establishing and documenting planned objectives and deliverables of a project or activities, including the scope, planning assumptions and decisions, budgets, schedule, risks, roles, resources, monitoring and control strategies.

## What we found

MSC has developed a 10-year Strategic Plan to define the areas requiring infrastructure renewal and to obtain the necessary funding to do so. The audit noted that the Renewal II initiative was not treated as a project, but rather was broken down into four smaller components (Radar, Surface and Marine, Upper Air and Canadian Lightning Detection networks) and received funding accordingly, as indicated in [Appendix B](#).

With the creation of the Departmental Project Management Office (DPMO) at ECCC, a Project Management Framework (PMF) was developed, with accompanying tools to support project management activities across the organization. EMC approved the PMF in FY 2017 to 2018. The audit noted that only CWRRP uses the services, tools, guidance and templates of the DPMO.

### Canadian Weather Radar Replacement Project (CWRRP)

The audit determined that CWRRP has all the necessary tools in place to properly manage the renewal of the radars. This includes a project charter, effective project management processes and a dashboard for monitoring and reporting purposes.

CWRRP management developed a **project charter**, aligned with [TBS guidance](#). The CWRRP charter was revised and approved in October 2018 to align with the ECCC PMF. It defines the project governance and includes project goals, indicators of success, the project scope, an implementation approach, a project schedule with milestones and deliverables, cost estimates, sources of funding and project risks, dependencies, assumptions and constraints. Key roles are defined, including for the project sponsor, project DG, project director, project manager and chief engineering team. The charter also defines the roles of key enablers and service providers, namely the contractor implementation team, real estate services (RBIS), PSPC (contracting authority), SSC and STB (scientific authority).

CWRRP also has an approved **Project Management Plan (PMP)** in place. It provides the project baselines and includes several plans, namely the management plan, the financial management plan, the schedule management plan, the change management plan, the risk management plan, the issues management plan, the HR management plan, the communication management plan and the procurement management plan.

The first new weather monitoring radar came into service in FY 2017 to 2018. The four additional radars that were planned to be operational by the end of FY 2018 to 2019 were in fact all operational in February 2019. For the remaining four years, the objective is to install seven radars annually, for a total of 28, by the end of FY 2022 to 2023.

The audit also looked at the CWRRP **project schedule**, which is a roadmap for how the CWRRP will be carried out. This document is important because it provides the project team members, project stakeholders and senior executives with a picture of the status of planned activities at any given point in time.

During the planning for radar site installations, CWRRP management use a **matrix**, which considers different parameters of risks such as real estate, proximity to residences, road access, operational support and other factors of risk. The tool helps determine the list and order of the sites where radars will be installed in a given year. The information is shared and discussed with stakeholders who confirm the list or suggest changes. This list is subject to change based on site surveys, severe weather season and contractor constraints. The audit noted that all the sites for radar installation have been identified to end of FY 2022 to 2023. CWRRP relies on the main contractor, an external expert resource, to validate choices and the feasibility of the installation. A **detailed implementation plan and installation schedule** is then developed, including key milestones.

The audit noted that since the beginning of the project, radar installations on sites involving more complex issues, such as communication and property issues, and new sites have been pushed towards the end of the schedule (FY 2022 to 2023). By fall 2019, the contractor is expected to confirm the schedule of sites for the installation of the radars planned for FY 2020 to 2021 and confirm site locations for the radars planned for FY 2021 to 2022. Installation schedules beyond 2020 have not been confirmed.

### Other components of the Renewal II initiative

The audit did not find any overarching project management plan for the Renewal II initiative as a whole. As indicated previously, renewal of infrastructure for the Surface and Marine Weather and Climate Stations Network, the Upper Air Network and the Canadian Lightning Detection Network is managed as part of ongoing regular program activities. MSC management does not consider these components of the Renewal II initiative to be formal projects. Nonetheless, the audit sought to identify what processes and tools are used to ensure proper management of the planned activities (see Table 1).

Management in the Atmospheric Monitoring and Data Services Division (AMDS) was unable to provide the auditors with a specific project plan for the **Surface Network** renewal activities. However, they indicated that a three-year plan is in development. AMDS uses an Excel-based tool with very limited functionalities to manage its activities. The surface renewal activities that must be completed by the end of FY 2022 to 2023 include installing 40 new surface stations and upgrading 150 existing stations. As of December 2018, 22 (55%) new surface stations have been installed and 67 (45%) existing surface stations have been upgraded. The audit noted that installations involving more complex issues (property issues) have been pushed to the last four years of the project timelines.

The ISO 9001 review report from November 30 to December 19, 2017 highlighted a risk for the renewal of MSC infrastructure where areas involve real estate services. MSC has little control over that function and relies on support from CSFB's Realty and Business Integration Services (RBIS). MSC received the following service estimates from RBIS: 17 weeks to complete a standard real estate transaction and 74 weeks to complete a complex transaction, since it involves more discussions and negotiations with landowners and additional legal consultations.



The Quality Management Office (QMO) conducted a review of the MSC internal processes related to real property, including the support services provided by RBIS. This internal review was conducted in the context of the MSC Quality Management System (QMS) and ISO 9001 certification. It identified AMDS as the area most at risk. MSC and RBIS are working together on solutions to address this challenging situation, including identifying replacement sites for those that are expected to generate a complex transaction.

For the **Marine Network**, management could only demonstrate evidence of planning by providing the auditors with one dashboard that was produced by MSC in 2016. It included planned objectives, project health status on budget, schedule, scope, key deliverables and milestones, risks and issues and mitigation strategies. Management indicated that activities for the marine stations were suspended in December 2018 due to a lack of funding and the availability of Coast Guard ship time.

Management in the Radar and Upper Air Division (RUAD) developed a one-page plan for each of the new technologies retained for the **Upper Air Network** renewal. These plans identify objectives, scope, roles, milestones and deliverables to 2020.

The CWRRP has implemented a sound and comprehensive project management framework. The audit team did not observe the same of project planning for the other components of the Renewal II initiative. Without proper planning, there is an increased risk that projects may not deliver planned outcomes within the allocated budget and timeline.

### Recommendation 3 – Project management

The Assistant Deputy Minister, Meteorological Service of Canada, should improve plans, processes and tools to manage the implementation of the Surface and Marine Weather and Climate Stations Networks, Upper Air Network and Canadian Lightning Detection Network components of the Renewal II initiative for the remaining period of the initiative. The plans should clearly demonstrate how MSC effectively manages activities to achieve the planned goals.

### Management response

Management agrees with the recommendation.

Noting that reports on risks, plans and progress have been reported to MMC and other committees within the branch, the MSC recognizes that there are opportunities to improve documentation (for example, Marine transformation).

MDSD is instituting work planning that addresses requirements for all operational activities, including renewal activities. The purpose of the improvements is to ensure that standardized work plans for programs and projects, including Renewal II, are well documented and regularly reported upon for key goals/objectives, milestones, activities, risks and related information.

Efforts for planning and reporting have been scaled according to the risks associated with the planned outcomes.

The MSC will ensure that plans are in place and updated on a regular basis. Plans will also be reviewed at mid-year to track progress. Where required, plans will align with Environment and

Climate Change Canada (ECCC) Departmental Project Management Office (DPMO) guidelines and best practices.

### 3.4 Monitoring and reporting

**Findings:** The CWRRP has effective monitoring and reporting processes in place to support decision making. Although the audit found some evidence of monitoring and reporting activities for the other three components of the Renewal II initiative, the process is not clear and the requirements are not specified. MSC management would benefit from clearly articulating and documenting the required content for monitoring and reporting, the frequency, the targeted audiences and the approval process.

#### What we examined

The audit sought to determine whether a systematic process is in place to monitor and report on the progress made towards achieving the expected outcomes of the Renewal II initiative. The audit also looked at whether meaningful reports are prepared to support management in its decision making and to fulfill TBS reporting requirements.

**Why is this important?** Monitoring and reporting enable management to assess whether the activities are undertaken, and the related milestones are attained, in relation to plans, standards and expectations. It also facilitates the adjustment of plans and strategies and supports the effective reallocation of resources.

#### What we found

##### Annual report to TBS on Canada's Weather Services Renewal Initiative

ECCC is required to work with SSC to produce a joint annual report for TBS. The report highlights progress made on infrastructure renewal for the four monitoring networks and includes the cumulative financial position and forecast. The financial information is prepared by a financial management advisor and is reviewed by the Chief Financial Officer for attestation. The Weather Service Renewal Steering Committee and the DG Leads Committee are also responsible for reviewing the annual report.

The audit found that the CWRRP Annual Reports for FY 2016 to 2017 and FY 2017 to 2018 presented only information related to the 2013 funding (Definition phase) and omitted the required information for the 2016 funding (Implementation phase). CSFB management indicated that the financial information for the CWRRP Implementation phase will be included in subsequent annual reports and that previous year's financials will be restated as required to ensure that the full reporting is captured.

## Annual internal dashboard on Canada's Weather Services Renewal Initiative

MSC prepares an annual internal dashboard, which provides senior management with information on risks related to the monitoring network components, mitigation actions and overall status of implementation. The WSRSC and the DG Leads Committee are responsible for reviewing the dashboard. Information is used for internal purposes only.

The audit found inconsistencies in the 2017 and 2018 annual dashboards for the Surface and Marine Stations component. The information did not reflect the actual status of progress. Senior management may not have received complete and accurate information at that time.

## Project dashboard and other reports

The CWRRP uses a real-time dashboard to follow key project metrics on a timely basis: cost, schedule, scope, risks and issues. With this tool, CWRRP generates an executive project dashboard every two months that includes information on the health and status of the radar renewal. The dashboard is required by the DPMO as part of ECCC project oversight processes. It is aligned with TBS guidance and designed to communicate specific project information, particularly whether the project is on budget, on time and within the original scope. If not, the dashboard highlights the effects on the overall project and the corrective measures taken.

The dashboard indicates critical risks, issues and impact on the project, and includes strategies to mitigate those risks or to manage these issues. DPMO plays an oversight role and is a point of control before the dashboard is sent to TBS. Monitoring of the CWRRP is carried out because of the project's high visibility and the inherent risks.

The ADM of MSC provides the Deputy Minister with a weekly high-level update on the project status and issues, referred to as "the DM weekly report". Also, MSC produces a quarterly newsletter on the renewal of the CWRRP. It provides timelines, updates on progress made to date and other relevant information.

Overall, the audit noted some monitoring and reporting activities for the Surface and Marine Climate Stations Networks, the Upper Air Network and the Canadian Lightning Detection Network renewal components, such as a few high-level presentations made at various committees on progress and risks. Of note, one dashboard was produced for the marine stations in 2016. It provided planned objectives, project health status on budget, schedule, scope, risk and issues (without providing any details), key deliverables and milestones, risks and issues and mitigation strategies. For the research component of the upper air projects, dashboards are prepared that highlight key deliverables, the status on scope and time and cost (without providing any details), risks and mitigation strategies.

Although the audit found some evidence of monitoring and reporting activities for the components of the Renewal II initiative other than the CWRRP, the process is not clear, and the requirements are not specified. MSC management would benefit from clearly articulating and documenting the

required content for monitoring and reporting, the frequency, target audiences and approval process.

**Recommendation 4 – Monitoring and reporting**

The Assistant Deputy Minister, Meteorological Service of Canada, should clarify the monitoring and reporting requirements for the Surface and Marine Climate Stations Networks, Upper Air Network and Canadian Lightning Detection Network components of the Renewal II initiative, to support timely and informed decision making.

**Management response**

Management agrees with the recommendation.

The MSC will conduct a review of its reporting requirements to ensure that they support timely and informed decision making, including MSC's management oversight and quality management system processes.

## 5. Appendix A: lines of enquiry and criteria

| <b>Line of enquiry: assess the effectiveness of the management framework in place to support the renewal of the weather-monitoring network as it relates to governance, risk management and internal controls</b> |  |
|---|--|
| 1.1   | Roles, responsibilities, authority and accountability for the oversight and management of the renewal of ECCC's weather monitoring networks are defined, communicated to all key stakeholders and operating as intended. |
| 1.2   | A project management framework, overall strategy and project plans are in place and clearly defined to support the achievement of the infrastructure renewal objectives  |
| 1.3   | Risks that may preclude the achievement of the infrastructure renewal objectives are systematically identified, documented, assessed and mitigated.  |
| 1.4   | Management monitors the delivery requirements of its network's key components and takes corrective measures as necessary in a timely manner.   |
| 1.5   | Renewal projects' performance, cost and key milestones are effectively monitored and reported to senior management to support decision-making.   |

## 6. Appendix B: post-2011 funding for infrastructure renewal of the monitoring networks at the Meteorological Service of Canada

| Monitoring Network Components  | Radars        | Surface and Marine Network | Upper Air Network | Lightning Detection Network | Total (\$ millions) |
|--|---------------|----------------------------|-------------------|-----------------------------|---------------------|
| <b>New funding received in 2013 – Radar definition and infrastructure renewal of the monitoring networks other than Radars</b> |               |                            |                   |                             |                     |
| Salary and benefits  | 0.64          | 16.91                      | 4.55              | 4.73                        | 26.82               |
| O&M  | 3.31          | 25.89                      | 7.77              | 6.51                        | 43.48               |
| Capital expenditures   | 0.66          | 20.41                      | 8.32              | 2.80                        | 32.20               |
| Other  | 0.00          | 1.72                       | 0.40              | 0.00                        | 2.12                |
| <b>Total</b>   | <b>4.61</b>   | <b>64.93</b>               | <b>21.04</b>      | <b>14.04</b>                | <b>104.62</b>       |
| <b>New funding received in 2016 - Radar implementation phase</b>   |               |                            |                   |                             |                     |
| Salary and benefits and O&M  | 1.16          | -                          | -                 | -                           | 1.16                |
| Capital expenditures   | 173.19        | -                          | -                 | -                           | 173.19              |
| <b>Total</b>   | <b>174.35</b> | <b>0.00</b>                | <b>0.00</b>       | <b>0.00</b>                 | <b>174.35</b>       |
| <b>Total</b>   | <b>178.96</b> | <b>64.93</b>               | <b>21.04</b>      | <b>14.04</b>                | <b>278.97</b>       |

As of February 28, 2019

**Note:** New funding received in 2018 for the National Hydrological Services is not included in this table, since this network is excluded from the audit scope.