

# 2013 ADAPTtool Application

## Adaptive Policy Analysis of Mining Policies in Manitoba

**Prepared by:**

International Institute for Sustainable Development

**Prepared for:**

Province of Manitoba



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## Table of Contents

1.0 What Is Adaptive Policy/Programming? .....	1
1.1 Integrated and Forward-looking Analysis .....	1
1.2 Multistakeholder Deliberation .....	1
1.3 Automatic Policy Adjustment .....	2
1.4 Enabling Self-Organization and Social Networking .....	2
1.5 Decentralization of Decision Making.....	2
1.6 Promoting Variation .....	2
1.7 Formal Policy Review and Continuous Learning .....	3
2.0 The Adaptive Design & Assessment Policy Tool (ADAPTtool) .....	4
3.0 Policy Analysis .....	6
3.1 Natural Resources Canada Project Process Overview .....	6
3.2 Project Scoping and Policy Selection.....	6
3.3 Vulnerability and Adaptation Analysis.....	8
4.0 Adaptive Policy Conclusions and Recommendations .....	13
Reference List.....	16
Appendix A: Results of Vulnerability and Adaptation Action Analysis .....	17
Appendix B: Conclusions and Recommendations for Specific Policies .....	20

## 1.0 What Is Adaptive Policy/Programming?

Over the past several decades, there has been recognition that public policies and programs intended to achieve stated objectives can, even if well-designed, lead to unintended consequences as conditions change. Public policy operates in a dynamic and complex environment. Actors in the policy domain interact with new external factors, changing economic and market conditions, new information, changing technology, and evolving networks of exchange. With increased global interconnection, dynamic economic conditions, shifting climate and rapid changes in technologies, the resulting complexity and pace of change make outcomes difficult to predict. As conditions change, policies and programs may become less effective, or even counterproductive. The idea of adaptive policies is to design policies and programs to increase their adaptability and help avoid these kinds of failures.

The International Institute for Sustainable Development (IISD) collaborated with The Energy Research Institute (TERI) in India over a four year research project to explore case studies of policies in the agriculture and natural resource management sectors in both countries and identify characteristics of adaptive policies based on evidence of their actual performance. The results are described in the 2009 book *Creating Adaptive Policies: A Guide for Policy-Making in an Uncertain World* (Swanson & Bhadwal, 2009).

This research identified seven characteristics of policies that were adaptable to changing conditions. Some of these characteristics were designed to build-in adaptability to anticipated change and projected future conditions, while others are useful in helping policies adapt to unanticipated conditions. The ADAPTtool version used in this project is structured around these seven characteristics. Different questions in the tool are used to assess and score policies in relation to these factors. The characteristics of adaptive policies/programs are: 1) integrated and forward-looking analysis, 2) multistakeholder deliberation, 3) automatic policy adjustment, 4) self-organization and social networking, 5) decentralization of decision making, 6) promoting variation and 7) formal policy review and continuous learning.

These characteristics of adaptive policies/programs are summarized below, and described in more detail, with case studies, in Swanson and Bhadwal (2009).

### 1.1 Integrated and Forward-looking Analysis

Integrated and forward-looking analysis can identify key factors that affect policy/program performance and scenarios for how these factors might evolve in the future, so that policies and programs can be made robust to a range of anticipated conditions. These tools can also be used to develop indicators that will trigger adjustments when needed. Modelling tools of varying sophistication can be used to support this kind of analysis, which is often integrated through scenario planning.

### 1.2 Multistakeholder Deliberation

Multistakeholder deliberation is a collective and collaborative public effort to examine an issue from different points of view as part of a decision-making process. Deliberative processes strengthen policy and program design by building recognition of common values, shared commitments and emerging issues, and by providing a comprehensive understanding of causal relationships. The key aspects of this process are that it involves participants sharing multiple perspectives in an attempt to reach consensus on a relevant decision. This approach goes beyond stakeholder consultation.

### 1.3 Automatic Policy Adjustment

Automatic adjustment mechanisms can speed up the response to conditions that are more or less anticipated. They can be used in complicated policy/programmatic environments by separating the various issues into units in which the understanding of the system is high, allowing for fine-tuning of the system and making adjustments that help reduce risks and maintain performance. Automatic adjustment can be both fully and semi-automatic.

### 1.4 Enabling Self-Organization and Social Networking

The intent of this characteristic is to ensure that policies do not undermine existing social capital, but instead create forums that enable social networking, facilitate the sharing of good practices and remove barriers to local self-organization. Local responses, self-organization and shared learning all strengthen stakeholders' ability to respond to unanticipated events through innovation.

These practices take advantage of the capacity of complex adaptive systems to generate solutions without external input or formally organized interventions. The ability of individuals and groups to self-organize in response to stresses, crises or unexpected problems is well-documented in social and ecological literature, and a key aspect of healthy adaptation. For policy-makers and program managers, the idea is to foster self-organized responses to unexpected conditions by enabling and supporting interaction, learning and networking, without trying to control or dictate outcomes. This goal includes sharing and copying best practices, providing resources to reduce barriers to self-organization and creating spaces for adaptive collaboration.

### 1.5 Decentralization of Decision Making

In governance terms, the principle of "subsidiarity" means decentralizing decision making to the lowest effective and accountable unit of governance. This has adaptive advantages because there are better opportunities for feedback and information sharing to ensure that decision-makers are aware of unexpected problems and effects of proposed interventions, as well as the nature of different interests. For policies/programs directly concerning natural resources and ecosystems, field staff typically notice significant change earlier, and can mobilize affected local interests to address these changes more simply. Because local conditions vary widely, decentralization provides a way to implement policies and programs more flexibly, to ensure effectiveness and adaptation to change. The potential for decentralization in any particular policy or program area will depend on the scale of intervention needed, the extent of local knowledge and capacity, and the structure of governance mechanisms for accountability and coordination.

### 1.6 Promoting Variation

Given the complexity of most policy settings, implementing a variety of policies to address the same issue increases the likelihood of achieving desired outcomes. Diversity of responses also forms a common risk-management approach, facilitating the ability to perform efficiently in the face of unanticipated conditions. Variation may be actively designed, as when a range of alternative options is provided to meet the diverse needs of different stakeholders. This can be facilitated by:

- using a mix of policy instruments;
- exploring synergies with other policies
- providing opportunities for risk-spreading

Another approach is to use policy tools to facilitate variation by removing barriers to alternative solutions and providing information to help explore options.

## **1.7 Formal Policy Review and Continuous Learning**

Regular review, even when the policy or program is performing well, and the use of well-designed pilots throughout the life of the policy/program to test assumptions related to performance can help address emerging issues and trigger value-added policy adjustments. Formal review is different than automatic adjustment, where triggers and responses may be determined in advance. Formal review is a mechanism for identifying and responding to unanticipated circumstances and emerging issues. This assessment process can be very useful in detecting emerging issues that can affect the policy's performance. A formal review mechanism includes triggers for the review, definition of the nature of the review and a learning process that examines who needs to be involved in the review, who will take action on the results and what kinds of actions are to be considered.

Together, these seven characteristics are relevant in the planning, design, implementation and evaluation of adaptive policies and programs. The ADAPTtool is intended to encourage assessment and discussion of these characteristics in various phases of the policy cycle.

## 2.0 The Adaptive Design & Assessment Policy Tool (ADAPTool)

ADAPTool is an Excel spreadsheet developed by IISD to guide users through a structured assessment process that compares the selected policies and programs to the characteristics of adaptive policies set out in Section 2. Following the logic model below, the tool does two things:

1. It shows whether policies and programs support adaptation to a particular stressor (in this case, climate change).
2. It shows whether the policies or programs themselves are inherently adaptable, due to the features of their design and implementation.

The spreadsheet serves as the basis for scoring each of the programs in response to the assessment questions identified in Box 1. The questions cover both planned adaptability (i.e., how well the policy or program anticipates the likely impacts of the stressor) and autonomous adaptability (or adaptability to unanticipated impacts of the stressor).

### BOX 1: ADAPTOOL QUESTIONS AND WORKSHEET STRUCTURE

#### I. Scope of Evaluation Worksheet:

- 1) What is the geographic scope of the analysis (e.g., watershed, conservation district, municipality, region, province)?
- 2) What is the stressor of concern (i.e., climate change, market price instability)?
- 3) What are the policies/programs to be assessed?

#### II. Vulnerability & Adaptation Analysis Worksheet (for planned adaptability):

- 4) What are the main sectors active in the geographic area?
- 5) In what ways are the sectors vulnerable to the stressor?
- 6) What adaptation actions might be necessary if this stressor becomes more severe in the future?
- 7) Are the identified adaptation actions supported by the policies/programs?

#### III. Adaptive Capacity Analysis Worksheet (for both planned and autonomous adaptability):

- 8) Is the policy itself vulnerable to the stressor identified?
- 9) Does the policy enhance the capacity of actors within each sector to adapt (with respect to access to finances, technology, infrastructure, information and skills, institutions and networks, and equitable access) (Smit & Pilofosova, 2001)?
- 10) Were foresight methods and multistakeholder deliberation used in the scoping and design of the policy?
- 11) Are foresight methods and multistakeholder deliberation used in the implementation of the policy?
- 12) Does the policy enable self-organization and social networking among affected stakeholders? (Does the policy provide mechanisms for the sharing and copying of best practices and lessons learned?)
- 13) Is decision making for policy implementation adequately decentralized?
- 14) Is there adequate variety in the suite of policies and programs directed at the policy issue (e.g., economic, regulatory, expenditure, institutional policy instruments)?
- 15) Does the policy have a regular formal review process in place that can detect emerging issues?

#### IV. Synthesis Worksheet

An aggregate ranking of planned adaptability and autonomous adaptability is provided for the overall suite of policies, as well as for each individual policy.

### 2013 ADAPTool APPLICATION

#### Adaptive Policy Analysis of Mining Policies in Manitoba

The ADAPTool is meant to stimulate discussion and to expose knowledge that organizations such as the Manitoba Mines Branch already have. The tool provides a new way to understand how policies or programs work, using the lens of adaptability. The tool is intended to draw out the interactions between policies/programs and major stressors likely to have systemic effects that are difficult to predict. The scoring and analysis used in the ADAPTool is intended to be indicative, rather than precise or highly quantitative. Therefore, scoring is mostly on a simple ordinal scale (0, 1, 2). The spreadsheet is designed with conditional formatting that automatically assigns a red/yellow/green colour to the scoring cell depending on the entry value, which gives the analyst an at-a-glance visual overview of dozens of scores in a complex sheet.

## 3.0 Policy Analysis

### 3.1 Natural Resources Canada Project Process Overview

This application of the ADAPTTool in Manitoba is part of a national project funded in part by Natural Resources Canada's Climate Change Impacts and Adaptation Division. The national project includes a similar pilot application in Saskatchewan. In Manitoba, the project delivery team consists of Daniella Echeverría, Darren Swanson, Karla Zubrycki and Dimple Roy of IISD; Chris Beaumont-Smith and Cal Liske from Manitoba Mines Branch; and Randall Shymko from Manitoba Conservation and Water Stewardship's Climate Change Department.

This process involved several steps, described in more detail in subsequent sections of this report. They include:

- Initial project scoping
- Literature review on vulnerability assessment in the mining sector
- Selection of mining sector policies to be assessed
- Staff training in the use of the ADAPTTool
- Adaptability assessment of selected policies
- Reporting

### 3.2 Project Scoping and Policy Selection

The selected geographic scope of this analysis was the Province of Manitoba. The primary stressor of interest in this analysis is climate change causing increased drought, excessive moisture and increased temperatures. These are some of the most problematic impacts of climate change that may have significant implications for the mining sector. Ensuring that policies and programs are able to positively influence adaptive capacity is an important part of climate change adaptation. Table 1 illustrates the climate change scenarios used for this analysis.

**TABLE 1. CLIMATE CHANGE STRESSOR**

VARIABLE	PROJECTED CHANGE
<b>Temperature Projections</b>	
Annual mean temperature	Increase of 1°C to 3°C by 2050
Warm season heat waves	Warmer and more frequent
Heat extremes	Warmer and more frequent
Frost-free season	Much longer
Mild winter thaws	Warmer and more frequent
Length of winter season	Much shorter
Winter freeze-thaw cycles	More frequent
<b>Precipitation Projections</b>	
Annual precipitation	Modest increase
Winter precipitation	Substantial increase
Summer precipitation	Lower
Droughts	More and longer
Intense rain events	More and more intense
Surface water amount	Less
<b>Extreme Weather &amp; Other Projections</b>	
Lightning	More frequent
Spring flooding	More frequent
Local summer flooding	More frequent

Source: Blair (2012).

Policies were chosen in consultation with the Manitoba Mines Branch and Conservation and Water Stewardship’s Climate Change Department and the final list of policies analyzed include the following:

- *Environment Assessment and Licencing under the Environment Act (EA)*: This act outlines the environmental assessment and licencing process for developments in Manitoba that may have potential for significant environmental and/or human health effects. Under the requirements of this act, any development work (including mining) in Manitoba must undergo an environmental assessment and licencing process prior to construction and operation (Conservation and Water Stewardship, 2013).
- *Manitoba Mine Closure Regulations 67/99*: Provides regulations on the decommissioning and closure of a mine (Innovation, Energy and Mines, 1999).
- *Mine Closure Regulations 67/99 Guidelines*: These guidelines emphasize the main requirements of the Mines and Minerals Act and the Mine Closure Regulation relating to mine closure plans (Innovation, Energy and Mines, 2006).
- *Mines and Minerals Act*: The object and purpose of this act is to provide for, encourage, promote and facilitate exploration, development and production of minerals and mineral products in Manitoba, consistent with the principles of sustainable development (Innovation, Energy and Mines, 1991).

- *The Workplace Safety and Health Act W210: Operations of Mines Regulation*: This act addresses safe working environments in the workplace as well as protection of other persons from risks to their safety and health arising out of, or in connection with, activities in mines (Safe Work, 2013).
- *Water Quality Standards, Objectives, and Guidelines Regulations under the Water Protection Act (WQSOG)*: WQSOG is one of many tools used to protect, maintain and, where necessary, rehabilitate water quality in Manitoba (Conservation and Water Stewardship, 2011).

### 3.3 Vulnerability and Adaptation Analysis

Policy-makers and the public are increasingly aware of the potential impacts of climate change, vulnerability to climate change and adaptation needs. Adaptation in this context is defined as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, in order to reduce harm or take advantage of opportunities (Intergovernmental Panel on Climate Change, 2007). There is also a growing body of literature on the role of policies and strategies in adapting to climate change, including assessing the ability of current policies to address adaptation. This portion of the ADAPTtool identifies key sectors and subsectors relevant to the analysis, a list of vulnerabilities to the selected stressor and then adaptation actions that need to be in place to cope with these vulnerabilities.

In the mining sector, four phases were identified: exploring and siting, development (construction of infrastructure), operations (processing and waste management, extractions) and closure and remediation. A list of vulnerabilities was created using a literature review and rapid assessment process in cooperation with the Mines Branch and Manitoba's Climate Change Department. The main sources that informed the literature review for the vulnerability assessment included reports from the International Council on Mining and Metals, Mine Environment Neutral Drainage Program, and work led by James Ford and Tristan Pearce.

The rapid assessment also identified a list of anticipated necessary adaptation actions for each of the vulnerabilities listed above. These results are detailed in Appendix A. The list of adaptation actions is not meant to be definitive, but to provide examples of the types of actions that would be constructive in response to the climate impacts identified.

IISD and Manitoba's Climate Change Department met with representatives from the Mines Branch and presented a literature review on vulnerability and adaptation actions in the mining sector. Through four meetings, the vulnerability and adaptation actions list was vetted and molded to a Manitoba context, and the focus area was identified as the province as a whole. The representatives also identified a list of policies that affect the mining sector to be assessed. Initially, 15 policies were identified and were later narrowed down to six policies, based on their direct impact on the mining sector and accessibility to experts to review the policy analysis.

Once the scoping and the vetting process was complete, one representative from the Mines Branch attended a day-long ADAPTtool training workshop, which was held on April 16, 2013 for participants and interested individuals from across the Manitoba government. The workshop was a broad introduction to adaptive policies and programming and was attended by 15 people.

After the workshop, the suite of policies was assessed by two members at IISD who verified their findings with policy experts in the Mines Branch and Conservation and Water Stewardship. The experts reviewed the policies via phone interviews, in-person meetings and/or email correspondence. Once the interviews were completed, program scoring and details were validated and elaborated through follow-up phone conversations by the project team. Because an

expert for the Mining Workplace Safety and Health Act W210: Operations of Regulation was unavailable, this review was conducted by a representative in the Mines Branch who is well versed in the policy.

The ADAPTool assessments for each policy or program were then consolidated into a master workbook synthesizing results. IISD experts analyzed the synthesis and initial findings were checked and summarized with project members and leads. These findings were presented at a half-day workshop held on October 18, 2013, with participating government officials from the Manitoba Mines Branch and Manitoba Conservation and Water Stewardship.

Once the vulnerabilities and potential adaptation actions were identified, the project team reviewed each of the six identified policies using the ADAPTool workbook. This review was then shared with representatives from government, who provided feedback on the analysis through in-person or telephone discussions and via email.

### Scoring Guidelines

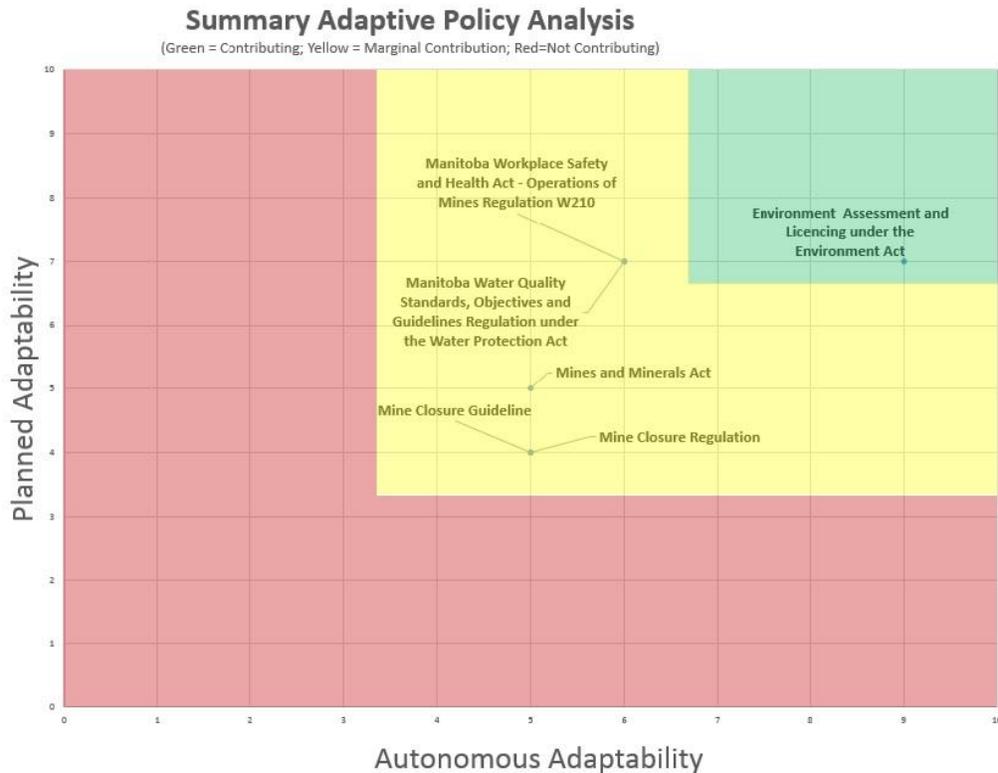
Scoring for the analysis is fairly standard, except for question seven on the policy's response to adaptation, which has five options. Policies given a "0" do not provide any support to the identified adaptation action. In cases where a policy's action actually inhibits or prevents the adaptation measure, it can be scored "-1." If a policy has nothing to do with the adaptation action (i.e., it does not apply at all to this sector or user group), it should be scored with an "n/a." Adaptation measures scoring "n/a" are not counted in the total number of adaptation measures affected by that policy. A score of "1" indicates that the policy indirectly supports the action. Either it enables the adaptation action in some way but does not directly respond, or it partially helps the adaptation action but leaves out a component. A score of "2" is given to a policy that directly and clearly supports the adaptation action. Scores of "1" and "2" are often relative and should be considered by analysts while reviewing the results with policy experts. Table 2 gives a summary of the scoring system.

**TABLE 2. SUMMARY TABLE FOR ADAPTOOL SCORING**

Colour	Explanatory note	Score
Red	Barrier or hindrance	-1
Red	Not contributing	0
Yellow	Contributing somewhat or indirectly	1
Green	Supporting	2
White	Not Applicable	n/a

**TABLE 3. SUMMARY ANALYSIS ON THE SUITE OF POLICIES**

Adaptive Policy Questions	Overall Synthesis	Mine Closure Regulation 67/99 Guidelines	Mine Closure Regulation 67/99	Mines and Minerals Act	Environment Assessment and Licencing under the Environment Act	Water Quality Standards, Objectives and Guidelines under the Water Protection Act	Workplace Safety and Health Act W210: Operations of Mines Regulation
Are anticipated adaptation actions supported by the policies?	1	0.9	0.9	1	1.1	0.8	0.8
Is the policy itself vulnerable to the stressor?	1	1	1	1	2	1	2
Can the existing suite of policies enhance the capacity of actors within each sector to undertake the anticipated adaptation actions?	1	1	1	2	1	1	1
Was multistakeholder deliberation used in the design of the policies?	1	1	1	1	1	2	1
<b>Ability to Respond to Unanticipated Events (score out of 10)</b>	<b>7</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>10</b>	<b>6</b>	<b>6</b>
Is multistakeholder deliberation used in the implementation of the policy?	1	1	1	1	2	1	0
Does the policy enable self-organization and social networking?	2	2	2	2	2	0	1
Is decision making for policy implementation adequately decentralized?	2	2	2	2	2	2	2
Is there adequate variety in the suite of policies and programs directed at the policy issue?	1	1	1	1	1	1	1
Do the policies have a regular formal policy review?	1	0	0	0	2	2	2



**FIGURE 1: SUMMARY OF THE ADAPTIVE POLICY ANALYSIS DIAGRAM**

Figure 1 presents the relative contributions of each of the policies analyzed in this report to both “planned adaptability”—the ability to support anticipated adaptation actions—and “autonomous adaptability” —the ability to support unanticipated adaptation needs. The position along the vertical “Planned Adaptability” axis reflects a policy’s relative support for anticipated adaptation actions, along with the potential vulnerability of the policy itself to climate change; the ability of the policy to contribute to key determinants of adaptive capacity (economic resources, access to technology, infrastructure needs, information and management skills, institutions and networks, and equitable access); and the degree to which stakeholders were consulted during the policy’s scoping and design phase. A policy’s relative position along the horizontal “Autonomous Adaptability” axis is a reflection of: the degree to which stakeholders have input during policy implementation; the ability to enable self-organization through the sharing of best management practices and lessons learned; if the policy is sufficiently decentralized to respond to local adaptation needs; and whether or not the policy has a formal review process to trigger key policy improvements and detect emerging issues.

If a policy appears in the green area of the diagram, it contributes well to both planned and autonomous adaptability. A policy appearing in the red area signifies that there are issues to address with regard to its ability to contribute to adaptation and to adapt itself to climate change stressors. If a policy falls in the yellow area, it is partially contributing and some improvements might be warranted to help it better contribute to adaptation needs and be more adaptive itself. It is important to note that these rankings are not an assessment of policy performance relative to their original policy objective and mandate.

**2013 ADAPTtool APPLICATION**

As illustrated in the diagram, all but one policy was ranked as “partially contributing” (in yellow) to anticipated and unanticipated adaptation needs. Within this suite of policies that partially contribute to adaptation needs, the Manitoba Workplace and Safety Operations of Mines Regulation W210 as well as the WQSOG ranked the highest, owing to their adaptive capacity on autonomous adaptability. For example, the Manitoba Workplace and Safety Operations of Mines Regulation W210 is not vulnerable to climate change stressors and is highly decentralized (e.g., workers are well informed about when to leave unsafe working conditions). As well, the policy has a regular five-year review imbedded within its legislation. The WQSOG, on the other hand, scored highly because of the multistakeholder deliberation in its design, it is adequately decentralized and new available scientific information triggers a policy review. It has a mandate for a five-year policy review to gauge its effectiveness and this review includes consultation with stakeholders.

## 4.0 Adaptive Policy Conclusions and Recommendations

The overall conclusions and recommendations of the adaptive policy analysis for the suite of policies in Manitoba's mining sector are outlined in Appendix B. We found that some of the policies were focussed on and relevant to only one specific phase in the mining process. As a result, not all identified adaptation actions were relevant to all policies. This was particularly apparent for the Manitoba Mine Closure Regulation 67/99 and its guidelines. These two policies are focussed on only one of four mining phases and were relevant to only 15 and 18 of the identified adaptation actions, respectively. However, 94 per cent of all adaptive actions are indirectly supported by at least one policy, while 35 per cent of the adaptive actions are directly supported.<sup>1</sup>

The policies performed relatively well in their ability to respond to unanticipated events. The analysis showed that the policies are adequately decentralized. All policies have a degree of multistakeholder deliberation, through ongoing public consultations and meetings between the Mines Branch, mining companies and the Mining Association; however, there are no formalized tools that enable self-organization under any of the policies. In addition, Mines Branch policies have not had a formal review process since the early 1990s.

Specific recommendations:

- **Support to Anticipated Adaptation Needs** (planned adaptability). Of the 48 anticipated adaptation actions, 46 are directly or partially supported by at least one policy in the suite of policies considered. One action that is not supported by any policy is related to the diversion of rivers and water storage to ensure that there is an adequate amount of water for brining. The Environmental Assessment and Licencing and the WQSOG present barriers to this action, as it would alter flows and lake levels, and potentially affect water quality use for nearby communities and habitats. Another unsupported action is related to the vulnerability caused by longer ice-free seasons and the challenges associated in accessing the sites by roads or waterways, transportation of outputs etc. due to longer ice-free seasons in the Arctic. Longer ice-free seasons are viewed as a positive impact as it would lengthen the operating season in some ways. In addition, this policy could present a barrier via WQSOG public opinion and consultations regarding concerns for potential accidents in the Arctic waterways. These policies should be assessed further to consider any necessary mitigating actions.
- **Policy Stress** (planned adaptability). None of the policies were highly vulnerable to the stressor. Four of the six were marginally vulnerable and the remaining two were not vulnerable to the stressor. The mining companies are required to send reports to Manitoba's Mines Branch and Conservation and Water Stewardship on the operations of the mines throughout their lifespans, outlining any challenges and appropriate solutions. This reporting allows flexibility to make any necessary adjustments to the mining operations under Manitoba mining and environmental regulations. However, climate change will have a direct impact on closure plans, as the government is responsible for rectifying any problems and environmental impacts incurred after a mine's remediation and closure. In addition, the WQSOG is based on historical water flows and other measurements. As climate change could affect the baseline of these measurements, the benchmarking measurements may need adjustment. The workplace and safety policy has a high degree of flexibility to react to relevant uncertainties and stressors, including climate change. It is recommended that updated climate change projections be considered in closure and remediation plans, and that these plans are adjusted accordingly, as

<sup>1</sup> Since there are six policies, and each individual can (in)directly support or hinder a specific action; the percentages are not out of 100.

they may affect the site. Also, the water measurement benchmarks may benefit from an assessment of their appropriateness under a climate change modelling study.

- **Support to Stakeholder Adaptive Capacity** (planned adaptability). The six determinants of adaptive capacity (access to economic resources, technology, infrastructure, information/skills, institutions/networks and equitable access to resources) were all addressed partially through the mining-relevant policies analyzed in this study. All policies provide indirect support to stakeholder adaptive capacity, including providing information about where to obtain access to technology and institutions/networks. Access to funding resources is not applicable to these policies, except under the Mines and Minerals Act, which provides a monetary incentive for exploration. Equitable distribution of resources is provided to applicable stakeholders, mining permit applicants and mine workers throughout all policies. Much of the focus is on the mining industry and mining companies; however, enhancing the capacity of communities affected (positively or negatively) by the mining activities is recommended, by identifying changes in water quality or other environmental changes and who to contact to advise on these changes.
- **Use of Multistakeholder Deliberation** (planned and autonomous adaptability). Five of the six policies incorporated stakeholder consultation and deliberation in the form of forums and written feedback in the design of the policy. The WQSOG is a living document; therefore, it involves ongoing public consultation. The target audience for these consultations, however, are experts with technical roles related to water quality. For the implementation of the policies, there is little multistakeholder deliberation in all policies, except for the EA, where consultations (public meetings and hearings) are held to seek feedback on proposals submitted under this policy. The report recommends an increase in true multiperspective deliberation where different viewpoints are gathered and incorporated to improve the robustness of the policy.
- **Enabling Self-Organization and Networking** (autonomous adaptability). The EA's public meetings and applicants' submission of control technologies are viable options to share best practices among mining stakeholders and to enable learning and self-organization. The Mining Association holds regular meetings involving the mining industry and the Mines Branch; the Mine Branch also holds one-on-one meetings with any interested stakeholders to help them navigate the provincial processes. Despite the degree of interaction between the Mines Branch and industry, however, there are no formalized tools in the policies that help mining actors to self-organize, such as annual forums and reporting on the results and next steps. Similarly, it is recommended that spaces are facilitated where mining workers can share best practices on health and safety in mines.
- **Decentralization** (autonomous adaptability). The suite of policies is sufficiently decentralized to the most appropriate level. The appropriate level ranges from the director to mine workers. Approval of proposals rest with senior-level government officials, whereas the guidelines and Workplace Safety and Health Act provide sufficient information for companies and workers to make informed decisions to respond quickly to unanticipated events.
- **Variation in Policy Instruments Employed** (autonomous adaptability). All policies reviewed in this study were regulatory instruments. However, the Mines and Minerals Act and Mine Closure Regulation and its guidelines provide additional set of instruments (economic, expenditure, institutional). As there are various policies that are influence the mining sector, both provincially and federally, these likely provide the full range of policy instruments available to the mining sector.

- **Formal policy review and improvement** (planned and autonomous adaptability). The policies under the Mines Branch have not been reviewed since their inception in the early 1990s, however there is a strong desire to review these policies in the near future. The EA, WQSOGR, and Workplace and Safety and Health Act do have a vigorous review process, both formal and informal. Once the policies under the Mines Branch go under review, it is recommended to take into consideration the elements of adaptive policies to strengthen their response to foreseeable and unforeseeable changes and needs. Moreover, the language within these acts should be strengthened to consider implications of climate change, primarily for the closure and remediation phase.
- **Comprehensive review for planned adaptation capacity.** Other key policies relevant to Manitoba's mining sector, including those pertaining to transportation and building/infrastructure should be reviewed. There is a high degree of non-applicability in the current suite of policies for adaptation needs that include transportation and building actions. Including policies that do provide this focus will enrich and better inform how anticipated adaptation needs are supported in the mining sector.

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## **Appendix A: Results of Vulnerability and Adaptation Action Analysis**

- **Policy 1:** Mine Closure Regulations 67/99 Guidelines
- **Policy 2:** Mine Closure Regulations 67/99
- **Policy 3:** Mines and Minerals Act
- **Policy 4:** Environment Assessment and Licencing under the Environment Act (EA)
- **Policy 5:** Water Quality Standards, Objectives, and Guidelines Regulations under the Water Protection Act (WQSOG)
- **Policy 6:** Manitoba Workplace Safety and Health Act W210: Operations of Mines Regulation
- **Abbreviations:** m = metal; nm = non-metal; m-ARD = metal – acid rock drainage

Mining Phase	Identified Vulnerability	Adaptation Need	Policy					
			1	2	3	4	5	6
Exploring and Siting	<b>Roads</b> (permanent and winter): energy, drilling on ice cover, fire season issues	Roads - Need to fly in equipment (potential show stopper for projects)	N/A	N/A	N/A	1	N/A	N/A
		Drilling on ice – barges (also potential show stoppers)	N/A	N/A	N/A	1	N/A	N/A
Development (construction of infrastructure)	<b>Roads</b> (access to site, transportation of materials): Increased extreme climatic events, such as floods and (snow) storms, can compromise the accessibility of roads to enter sites.	Roads – Need to fly in equipment (potential show stopper for projects)	N/A	N/A	N/A	1	N/A	N/A
		Drilling on ice – Barges (also potential show stoppers)	N/A	N/A	N/A	1	N/A	N/A
	<b>Foundation:</b> Permafrost (discontinued), identifying permafrost pocket melt, risk of sinking, slopes can degrade, foundation fails as permafrost degrades can create problems with infrastructure.	Avoiding water (winter roads)	N/A	N/A	N/A	1	N/A	0
		Use airships to fly in equipment and supplies	N/A	N/A	N/A	1	N/A	0
Operations (Processing and Waste Management)Extraction)	<b>Adequate amount of water for brining:</b> Lack or excess water can delay the process, affect recovery periods and increase amount of energy required to bring brine to adequate concentrations (nm -sodium sulphate).	Diversion of rivers; build storage unit to control water flow from rivers to lakes; use dikes to divert water to sections of lake	N/A	N/A	N/A	-1	-1	N/A
		<b>Passive contaminant reduction systems (e.g., wetland filtration):</b> Increased temperatures, particularly during the summers, can dry up water, re-exposing metals and contaminating the ground below (m).	Build backup systems	N/A	N/A	1	1	0
	<b>Invasive species—passive filtration system:</b> More use of natural bogs affecting water management plan; significant drying can lead to erosion; drought increases risk of fires.	Build backup systems	N/A	N/A	1	1	1	1
	<b>Waste piles and tailing:</b> For water cover (tailing or pit) increases in evapotranspiration and mean annual precipitation can reduce risk of drought effects but also increase risk of emergency discharge. In some regions where more seasonal drought is projected, increased risk of exposure of tailing to air (m -ARD).	Use alternative cover technology where more negative water balance is projected	N/A	N/A	1	1	1	1
		<b>Water treatment:</b> Failure and underperformance of other components can be caused by an increase in hydraulic (precipitation sensitive) or chemical loading (temperature sensitive) (m-ARD).	Hydraulic – increase mine water treatment system capacity (e.g., holding pond, flow)	N/A	N/A	1	1	1
	Chemical – process modifications, increase use of reagents		N/A	N/A	1	2	2	0
	<b>Open pits:</b> Increase in extreme precipitation can lead to an increase in flooding of pit and need for pumping treatment or emergency release; changes in chemical loading to pit water (m-ARD)	An increase in extreme precipitation can lead to a rise in flooding of pits and need for pumping treatment or emergency release.	N/A	N/A	1	1	1	N/A
	<b>Underground workings:</b> Increase in extreme precipitation can increase flooding of underground and can intensify use of pumping and treatment (m-ARD).	Plan for increased management of mine water (pumping and treatment), or enhance other and water storage options.	N/A	N/A	1	1	1	2
	<b>Other hydraulic structures (ditches, diversions, holding ponds):</b> With increase in extreme precipitation, current diversion ditches and channels are undersized resulting in more infiltration into or contact with acid generating material" (m-ARD).	Increase capacity of diversion and storage structures.	N/A	N/A	1	1	1	N/A
		<b>Dams:</b> Increase in permafrost degradation and in annual and extreme precipitation can escalate the amount of seepage in the foundation (m-ARD).	Design for stability in frozen and unfrozen state	N/A	N/A	1	1	1
	Design for no pond at closure (i.e., dry tailings)		N/A	N/A	1	2	1	1
	<b>Dams:</b> increase in extreme precipitation can cause overtopping in freeboard/spillway (m-ARD).	Provide additional freeboard; design with option to increase spillway capacity	N/A	N/A	1	2	1	1
	<b>Heating system:</b> Higher temperatures during the winter lower the cost for operational heating (m).	Use alternative heating system (cost savings)	N/A	N/A	N/A	0	N/A	1
	<b>Cooling system:</b> Higher temperatures in the summer could increase operating time, resulting in increased cost of acquiring/maintaining cooling systems.	Have workers take longer breaks, drink water. Install cooling system units.	N/A	N/A	N/A	N/A	N/A	1
	<b>Water intake capacity for mineral processing:</b> Changes in regional temperature and precipitation will affect the amount of water runoff collected in basins or rivers needed for mineral processing.	Incorporate climate change models into engineering designs (currently in need of detailed, local-level projections as most climate change models are generalized)	N/A	N/A	N/A	1	1	N/A
	<b>Transportation:</b> Road and rail networks are sensitive to extreme weather and changes in temperature and precipitation—e.g., road-related drainage infrastructure and the winter road system.	Flood winter roads to thicken structure.	N/A	N/A	N/A	2	N/A	1
		Monitor ice sheet thickness with ground penetrating radar	N/A	N/A	N/A	2	N/A	1
		Plowing snow off the road enhances freezing effect	N/A	N/A	N/A	N/A	N/A	1
		Restricting hauling to hours of darkness towards the end of the season when the ice sheet is stronger	N/A	N/A	N/A	N/A	N/A	1
	<b>Buildings:</b> Infrastructure built on or near steep slopes are at risk of slopes slumping and sliding as underlying frozen material loses cohesion due to melt as extreme flooding, ice storms and wind events are projected to increase in some regions.	TBD	N/A	N/A	1	N/A	N/A	1
<b>Buildings:</b> Buildings erected on thaw-sensitive land could see their foundations settle and shift—and in worst-case scenarios, collapse—as permafrost melts, increasing maintenance expenditures and causing potential operational delays.	Use of thermosyphon technology can help keep permafrost cool, ultimately help maintain structure integrity during permafrost degrading conditions	N/A	N/A	1	0	N/A	1	
<b>Service infrastructure:</b> Dry seasons, hotter temperatures may increase the risk of wildfires that can affect access to operations and damage communications and power infrastructure.	TBD	N/A	N/A	N/A	0	N/A	1	
<b>Roads and waterways (access to site, transportation of outputs):</b> Increased extreme climatic events, such as floods and (snow) storms, can compromise the accessibility of roads to enter sites.	TBD	N/A	N/A	N/A	2	N/A	1	
<b>Roads and waterways (access to site, transportation of outputs):</b> Higher temperatures and longer ice-free season in Artic waterways may also lengthen the operating season in some ways.	TBD/N/A	N/A	N/A	N/A	-1	N/A	N/A	
<b>Raw tailings:</b> Increased temperatures can lead to increased evapotranspiration from tailing ponds, potentially exposing raw tailings to sub-aerial weathering (m).	TBD	N/A	N/A	1	1	1	1	

**2013 ADAPTtool APPLICATION**

Adaptive Policy Analysis of Mining Policies in Manitoba

Mining Phase	Identified Vulnerability	Adaptation Need	Policy					
			1	2	3	4	5	6
Exploring and Siting	<b>Roads</b> (permanent and winter): energy, drilling on ice cover, fire season issues	Roads - Need to fly in equipment (potential show stopper for projects)	N/A	N/A	N/A	1	N/A	N/A
Closure and Remediation	<b>Waste piles and tailing:</b> Higher temperatures can create less entrained ice and less settlement of future reclaimed surface, positively affecting the tailings storage.	The construction of a smaller dam, if needed	2	1	N/A	1	N/A	N/A
	<b>Waste piles and tailing:</b> Change in mean annual and extreme precipitation can affect storage and release cover leading toward an increase percolation, increase erosion or metal uptake, erode the cover, and affect surrounding vegetation to adapt properly (and with increase in temperatures, vegetation runs higher risk to forest fires) (m - ARD).	Increase vegetation (more or new); Increase thickness/capacity of storage layer	1	1	1	2	1	0
		Increase erosion resistance	1	1	1	2	1	0
	<b>Waste piles and tailing:</b> Soil infiltration barrier can be affected by eroded cover and increase percolation caused by increased mean annual and extreme precipitation (m-ARD).	TBD	1	1	1	1	1	N/A
	<b>Waste piles and tailing:</b> When the protection layer is eroded due to increased precipitation (mean annual and extreme), the synthetic infiltration barrier runs the risk of being damaged (m - ARD).	Increase erosion resistance of protection layer where required	1	1	1	1	1	N/A
	<b>Waste piles and tailing:</b> For water cover (tailing or pit), increase in evapotranspiration and mean annual precipitation may reduce risk of drought effects but also increase risk of emergency discharge. In some regions where more seasonal drought is projected, there is an increased risk of exposure of tailing to air. (m -ARD)	Use alternative cover technology where more negative water balance is projected	-1	0	1	2	1	N/A
	<b>Waste piles and tailing:</b> Seasonal water scarcity can affect the site's water levels, particularly in already water-stressed areas, and negatively affect the long-term effectiveness of water tailings.	TBD	1	0	1	1	0	1
	<b>Water treatment:</b> Failure and underperformance of other components can be caused by an increase in hydraulic (precipitation sensitive) or chemical loading (temperature sensitive)	Hydraulic – increase mine water treatment system capacity (e.g., holding pond, flow)	2	1	1	1	1	N/A
		Chemical – process modifications, increase use of reagents	2	1	1	1	1	1
	<b>Open pits:</b> An increase in extreme precipitation can lead to a rise in pit flooding and the need for pumping treatment or emergency release; changes in chemical loading to pit water.	Plan for increased use of pits as storage ponds for extreme events, increased treatment of pit water, or enhance other diversion structures and storage options	1	2	1	1	1	N/A
	<b>Underground workings:</b> A rise in extreme precipitation can increase flooding of underground workings and can intensify use of pumping and treatment.	plan for increased management of mine water (pumping and treatment), or enhance other and water storage options	1	N/A	1	1	1	2
	<b>ARD biochemical process (i.e., sulphide oxidation rate):</b> An increase in the rate of the sulphide oxidation process due to higher average temperature (other factors considered constant).	Implement water treatment or make process modifications to existing water treatment to address increased chemical loading (e.g. increased use of reagents)	1	1	1	1	1	N/A
	<b>Dams:</b> An increase in permafrost degradation and in annual and extreme precipitation can escalate the amount of seepage in the foundation (m-ARD).	design for stability in frozen and unfrozen state	0	N/A	1	2	1	1
		design for no pond at closure (i.e. dry tailings)	0	N/A	1	1	1	1
<b>Dams:</b> Changes in permafrost degradation can affect the settlement of the foundation.	provide additional freeboard	0	N/A	1	2	0	1	
<b>Dams:</b> A rise in precipitation (mean annual and extreme) can slope foundations due to rising phreatic surface.	flatter slop ore buttress required	0	N/A	1	0	0	1	
<b>Dams:</b> An increase in extreme precipitation can cause overtopping in the freeboard/spillway.	provide additional freeboard; design with option to increase spillway capacity	0	N/A	1	1	1	1	

**2013 ADAPTtool APPLICATION**

Adaptive Policy Analysis of Mining Policies in Manitoba

## Appendix B: Conclusions and Recommendations for Specific Policies

Adaptive Policy Questions	Score	Mine Closure Regulation 67/99 Guidelines
<b>Program's Ability to Support Anticipated Adaptation Needs (Planned Adaptability, score out of 10)</b>	<b>4</b>	<b>Recommendation</b>
Are anticipated adaptation actions supported by the policy?	0.8	The guidelines seek the use of appropriate technology and infrastructure, but building codes run on historical data to determine what is appropriate. As some of the infrastructure will remain in the mine site after closure, climate change projections can show how these will withstand climate change and variation and limit any unintended consequences to nearby communities and the environment.
Is the policy itself vulnerable to the stressor?	1	The design of closure plans are dependent primarily on historical events and current conditions. The guidance for the design of these plans require the use of climate change models to ensure the infrastructure is adequate to withstand projected climate change and variations (decrease in permafrost, increase in temperatures, increase in extreme weather events, including droughts and floods), as well that the planting of vegetation is robust enough to these changing conditions and reduce the risk of soil erosion.
Can the existing suite of programs enhance the capacity of actors within each sector to undertake the anticipated adaptation actions?	1	Based on the continual interaction between the Mines Branch and the mining companies, there is a high degree of information exchange, primarily in relevant information and skills, access to institutions (both inter-governmental and outside government). There is an equitable distribution of resources to any of the mining applicants. Access to relevant technology and infrastructure is minimal or non-existent. This is not surprising as the mining companies would be well versed on the relevant mining technologies and infrastructure. The high degree of information flow allows the Mines Branch to be a conduit of information that can inform some mining companies needing this type of information where to find the technologies/infrastructure.
Was multistakeholder deliberation used in the design of the policy?	1	Input from industry would have been sought during the scope and design of the policy. This would include a forum setting as well as feedback on the drafts of the policy. There was no indication that foresight methods were used.
<b>Program's Ability to Enable Sector Responses to Unanticipated Events (Autonomous Adaptability, score out of 10)</b>	<b>6</b>	
Is multistakeholder deliberation used in the implementation of the policy?	1	With the upcoming revision of regulations and act, multistakeholder feedback will be part of the process. Forum setting and written feedback will be used in the process. Within the review process, foresight methods are recommended, because, in mining, the closure phase is the most vulnerable to climate change impacts.
Does the policy enable self-organization and social networking?	1	There is a degree of interaction between the Mines Branch and mining industry, where best practices and lessons learned are exchanged. The specific policies can build in more tools to encourage self-organization.
Is decision making for policy implementation adequately decentralized?	2	Senior staff has quite a bit of authority, allowing those with a technical background to make informed decisions. There is one remote office in Flin Flon.
Is there adequate variety in the suite of policies and programs directed at the policy issue?	n/a	
Does the policy have a regular formal policy review?	0	Since its approval in the early 1990s, this policy has not had a review. There is talk that this policy will be reviewed in the near future. The suggestions in this workbook can help integrate any appropriate measure to ensure the policy can support adaptive capacity and be adaptive to both anticipated and unanticipated needs due to climate change impacts on the sector.
Are anticipated adaptation actions supported by the policy?	0.9	The regulations require the use of appropriate technology and infrastructure, but building codes run on historical data to a determinant that is appropriate. Because some of the infrastructure will remain in the mine site after closure, climate change projections can show how these will withstand climate change and variation and limit any unintended consequences to nearby communities and the environment.
Is the policy itself vulnerable to the stressor?	1	The design of closure plans are dependent primarily on historical events and current conditions. The guidance for the design of these plans requires the use of climate change models to ensure the infrastructure is adequate to withstand projected climate change and variations (decrease in permafrost, increase in temperatures, increase in extreme weather events, including droughts and floods) and that planting of vegetation is robust enough to reduce the risk of soil erosion in these changing conditions.
Can the existing suite of programs enhance the capacity of actors within each sector to undertake the anticipated adaptation actions?	1	Based on the continual interaction between the Mines Branch and the mining companies, there is a high degree of information exchange, primarily in relevant information and skills, access to institutions (both inter-governmental and outside government). There is an equitable distribution of resources to any of the mining applicants. Access to relevant technology and infrastructure is minimal or non-existent. This is not surprising as the mining companies would be well versed on the relevant mining technologies and infrastructure. The high degree of information flow allows the Mines Branch to be a conduit of information that can inform some mining companies needing this type of information where to find the technologies/infrastructure.
Was multistakeholder deliberation used in the design of the policy?	1	Input from industry would have been sought during the scope and design of the policy. This would include a forum setting as well as feedback on the drafts of the policy. There was no indication that foresight methods were used.
<b>Program's Ability to Enable Sector Responses to Unanticipated Events (Autonomous Adaptability, score out of 10)</b>	<b>6</b>	
Is multistakeholder deliberation used in the implementation of the policy?	1	With the upcoming revision of regulations and act, multistakeholder feedback will be part of the process. Forum setting and written feedback will be used in the process. Within the review process, foresight methods are recommended, because, in mining, the closure phase is the most vulnerable to climate change impacts.
Does the policy enable self-organization and social networking?	1	There is a degree of interaction between the Mines Branch and mining industry, where best practices and lessons learned are exchanged. The specific policies can build in more tools to encourage self-organization.
Is decision making for policy implementation adequately decentralized?	2	The most appropriate level of decentralization is within the senior level. The guidelines provide information for stakeholders, including industry and mining associations, to make informed decisions on how to implement an appropriate closure of the mine, rehabilitating it back to an environment similar to that prior to mining.
Is there adequate variety in the suite of policies and programs directed at the policy issue?	n/a	
Does the policy have a regular formal policy review?	0	Since its approval in the early 1990s, this policy has not had a review. There is talk that this policy will be reviewed in the near future. The suggestions in this workbook can help integrate any appropriate measure to ensure the policy can support adaptive capacity and be adaptive to both anticipated and unanticipated needs due to climate change impacts on the sector.

Adaptive Policy Questions	Score	Mines and Minerals Act
<b>Program's Ability to Support Anticipated Adaptation Needs (Planned Adaptability, score out of 10)</b>	<b>5</b>	<b>Recommendations</b>
Are anticipated adaptation actions supported by the policy?	1	The act is written with language that allows the Mines Branch and the mining company to work together to find the appropriate solutions to most challenges throughout the lifespan of the mine. However, to keep synergy on sustainable development, stronger language on climate change is recommended to ensure proper steps are taken from early stages to minimize the impact that projected climate change hazards may have on the mine, and the unintended consequences that may result to the environment and nearby communities.
Is the policy itself vulnerable to the stressor?	1	There is potential for the Mines Research Council Advisory Committee to play a role in directing funding in research and development to improve the resilience of the sector against climate change impacts; however, it appears this committee is either dormant, or low key. The Mines Branch does not know the current status of the committee. The rehabilitation efforts may fall short long after the mine is closed, with the cost of properly rehabilitating the mine falling on the province. The act should incorporate climate change language (particularly projections and that infrastructure be built according to projected changes) to ensure that after a mine is closed, all remaining infrastructure is maintenance free.
Can the existing suite of programs enhance the capacity of actors within each sector to undertake the anticipated adaptation actions?	2	Based on the continual interaction between the Mines Branch and the mining companies, there is a high degree of information exchange, primarily in relevant information and skills, access to institutions (both inter-governmental and outside government). There is an equitable distribution of resources to any of the mining applicants. Access to relevant technology and infrastructure is minimal or non-existent. This is not surprising as the mining companies would be well versed on the relevant mining technologies and infrastructure. The high degree of information flow allows the Mines Branch to be a conduit of information that can inform some mining companies needing this type of information where to find the technologies/infrastructure.
Was multi-stakeholder deliberation used in the design of the policy?	1	Input from industry would have been sought during the scope and design of the policy. This would include a forum setting as well as feedback on the drafts of the policy. There was no identification if foresight methods were used. It is recommended to incorporate foresight methods in future reviews.
<b>Program's Ability to Enable Sector Responses to Unanticipated Events (Autonomous Adaptability, score out of 10)</b>	<b>6</b>	
Is multistakeholder deliberation used in the implementation of the policy?	1	With the upcoming revision of regulations and act, multistakeholder feedback will be part of the process. Forum setting and written feedback will be used in the process. Within the review process, foresight methods are recommended, because, in mining, the closure phase is the most vulnerable to climate change impacts.
Does the policy enable self-organization and social networking?	1	There is a degree of interaction between the Mines Branch and mining industry, where best practices and lessons learned are exchanged. The specific policies can build in more tools to encourage self-organization.
Is decision making for policy implementation adequately decentralized?	2	The most appropriate level of decentralization is within the senior level. The guidelines provide information for stakeholders, including industry and mining associations, to make informed decisions on how to implement an appropriate closure of the mine, rehabilitating it back to an environment similar to that prior to mining.
Is there adequate variety in the suite of policies and programs directed at the policy issue?	n/a	
Does the policy have a regular formal policy review?	0	Since its approval in the early 1990s, this policy has not had a review. There is talk that this policy will be reviewed in the near future. The suggestions in this workbook can help integrate any appropriate measure to ensure the policy can support adaptive capacity and be adaptive to both anticipated and unanticipated needs due to climate change impacts on the sector.
<b>Adaptive Policy Questions</b>	<b>Score</b>	<b>Environment Assessment and Licencing under the Environment Act</b>
<b>Program's Ability to Support Anticipated Adaptation Needs (Planned Adaptability, score out of 10)</b>	<b>7</b>	<b>Recommendations</b>
Are anticipated adaptation actions supported by the policy?	1,1	The EA contains regulations that require mining companies to not inflict any negative impacts on the environment and natural resources (water, biodiversity). The proposal undergoes a vigorous review under the act, and any changes in the operations of a mine (tailing, dams, etc) must to be submitted in writing for approval by the EA. However, between the initial proposal and changes to the operations, there is minimal interaction between the mining company and Conservation and Water Stewardship. Some of these changes may be required after the environment has been negatively affected. On field visits, EA inspector can identify any potential problems and request necessary changes to mitigate negative impacts.
Is the policy itself vulnerable to the stressor?	2	Through the various assessments under this policy, the degree of adaptability is high, as the experts consider new information and make recommendations according to the environmental circumstances.
Can the existing suite of programs enhance the capacity of actors within each sector to undertake the anticipated adaptation actions?	1	The EA informs applicants where and how they can access relevant technology and information on the allowable limits of different environmental contaminants in the sector. It also enables access to institutions and networks through presentations to communities and companies on corporate social responsibility. Any areas that can enhance appropriate access to technology and infrastructure in the sector should be identified.
Was multistakeholder deliberation used in the design of the policy?	1	Although unconfirmed, it is assumed that there was probably multi-stakeholder involvement during the 1988 development of policy, as per government guidelines. However, the degree of multistakeholder participation is unknown. Environmental foresight methods should be included in current and future reviews of the policy.
<b>Program's Ability to Enable Sector Responses to Unanticipated Events (Autonomous Adaptability, score out of 10)</b>	<b>10</b>	
Is multi-stakeholder deliberation used in the implementation of the policy?	2	This policy has a strong public consultation component. The Climate Change Branch also comments on every proposal (as part of Technical Advisory Committee).
Does the policy enable self-organization and social networking?	2	The Technical Advisory Committee, which reviews the proposals, could suggest best practices. The public review process could also review lessons learned and best practices. This step may also ensure that the proponents are aware of precedents that the public participating in the review could bring up.
Is decision making for policy implementation adequately decentralized?	2	Mining companies can go back and look at other reviews to see what questions were raised and can learn from past proposals. Summaries and licenses are available online. The approval process is highly transparent.
Is there adequate variety in the suite of policies and programs directed at the policy issue?	n/a	Decision-making authority ultimately rests with the government, though a broad range of actors can be involved in the process (e.g., the proponent, technical advisors, the public). Decision making is not highly decentralized, but it may be at the appropriate level for this policy.
Does the policy have a regular formal policy review?	2	No mandated review, but it has been reviewed quite often since 1988 nonetheless. The minister recently announced that it is currently under review. Frequent changes occur as things come up (e.g., new information, court cases).

Adaptive Policy Questions	Score	Water Quality Standards, Objectives and Guidelines Regulation under the Water Protection Act
<b>Program's Ability to Support Anticipated Adaptation Needs (Planned Adaptability, score out of 10)</b>	<b>7</b>	<b>Recommendations</b>
Are anticipated adaptation actions supported by the policy?	0.8	Some references to "potential future risks" (p. i) and "proactive" management (p. i) could be viewed as a way to include climate change models in designs, though this is not explicitly stated. It just leaves a bit of an opening for such an approach.
Is the policy itself vulnerable to the stressor?	1	A lot of the standards are based on historical water flows. As these may change with climate change, some vulnerability may be indicated. The same can be said for other measurements, for example, temperature and sensitive species (climate change could change species composition, bringing in new sensitive species). These standards should be revisited/reviewed with climate change in mind.
Can the existing suite of programs enhance the capacity of actors within each sector to undertake the anticipated adaptation actions?	1	As the policy serves as a guideline and informs the EA, it does not provide direct access or information to financial resources, infrastructure or institutions and networks. Where possible, the flow of information regarding water quality standards to applicants and communities can be enhanced by institutions and networks.
Was multistakeholder deliberation used in the design of the policies?	2	A lot of consultation is done, as this is an ongoing document. Consultation may be involve more technical people than with the public (the policy is often quite technical, involving formulas etc.). In future reviews of the policy, foresight methods, particularly on baseline measurements, should be integrated.
<b>Program's Ability to Enable Sector Responses to Unanticipated Events (Autonomous Adaptability, score out of 10)</b>	<b>6</b>	
Is multistakeholder deliberation used in the implementation of the policy?	1	Implementation is through EA licensing, and this policy is used as guidance for proponents when developing proposals. So WQSOGS influences EA licensing. There is no local consultation/public discussion. Foresight integrated analysis can manage "potential future risks" and "proactive" management.
Does the policy enable self-organization and social networking?	0	For mining, no specific best practices are shared (unlike for human wastewater). Best practices would relate to Metal Mining Effluent Regulations. If representatives provide presentations to the Mining Associations and/or mining companies in a forum setting, best practices can be shared about water quality, including use of proper technology, and other practices.
Is decision making for policy implementation adequately decentralized?	2	The act provides information for stakeholders, including industry and mining associations, to make informed decision on how to implement appropriate mining operations that meet provincial water quality standards.
Is there adequate variety in the suite of policies and programs directed at the policy issue?	n/a	
Does the policy have a regular formal policy review?	2	There are both formal and informal reviews. A main trigger for review is new scientific information and experience gained in the administrative application. In addition, the policy is reviewed every five years to examine its effectiveness. This review requires consultation with any persons affected by the regulation.

Adaptive Policy Questions	Score	Manitoba Workplace Safety And Health Act – Operations of Mines Regulation W210
<b>Program's Ability to Support Anticipated Adaptation Needs (Planned Adaptability, score out of 10)</b>	<b>7</b>	<b>Recommendations</b>
Are anticipated adaptation actions supported by the policy?	0.8	The policy is centralized around the well-being of workers. It touches on most relevant safety issues in working around mines. One area it does not touch on is in the unloading of materials and equipment from helicopters or drilling on ice during the exploration and development phases. The practice of flying in materials/equipment may increase in the future if extreme weather events become more frequent and intense and block road access. If adjustments are made to sites after closure phase, then workers will be exposed to erosion or acid rock drainage.
Is the policy itself vulnerable to the stressor?	2	There are mechanisms and recommended actions in place to react accordingly if a worker's safety is in jeopardy throughout the various inspections.
Can the existing suite of programs enhance the capacity of actors within each sector to undertake the anticipated adaptation actions?	1	The policy gives workers access to relevant information and skills, and influences the appropriate infrastructure to ensure health and safety.
Was multistakeholder deliberation used in the design of the policies?	1	It is unclear how much deliberation there was when the policy was first created, but there is now consultation with mining companies and industry groups when changes are made.
<b>Program's Ability to Enable Sector Responses to Unanticipated Events (Autonomous Adaptability, score out of 10)</b>	<b>6</b>	
Is multistakeholder deliberation used in the implementation of the policy?	0	No local consultation and public discussion occurred. Despite having mine inspectors and technical experts involved in review of guide, the consultation should extend to the workers themselves, so that the concerns of those affected by the policy are taken into account. Inclusion of alternate transportation and delivery of materials and equipment (helicopters) should be considered with workers' safety in mind and foresight methods should indicate how erosion, toxic waste and other hazards may affect workers' safety in the future.
Does the policy enable self-organization and social networking?	1	There is no specific requirement in the policy to learn from other provinces (an example of social networking). However, the provinces do influence each other. For instance, Ontario influences Manitoba a lot. Best practices and lessons learned are passed along, though the policy does not necessarily play a part.
Is decision making for policy implementation adequately decentralized?	2	There is a good level of decentralization, allowing for quick decision-making. The worker can refuse to work in an unsafe environment, resulting in the committee convening and quickly responding.
Is there adequate variety in the suite of policies and programs directed at the policy issue?	n/a	
Does the policy have a regular formal policy review?	2	Policy is reviewed every 5 years. Sometimes reviews happen when items have accumulated. The last two reviews were in 2007 and 2012, but it is unclear is a report was generated from the review. The resulting policy itself is available online.

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