2014 ADAPTool Application

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# Strengthening Adaptive Capacity in Two Canadian Provinces: ADAPTool analysis of selected mining policies in Manitoba and Saskatchewan

## A synthesis report

**Prepared by:**
International Institute for Sustainable Development

**Prepared for:**
Natural Resources Canada

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**With support from Natural Resources Canada through the Adaptation Platform**

Natural Resources Canada Ressources naturelles Canada
Canada

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# Executive Summary

## Introduction

Policy-makers and the public are increasingly aware of the potential impacts of climate change, increasing vulnerability to climate change and adaptation needs. *Adaptation* 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). Part of the growing efforts to plan for climate adaptation includes the mainstreaming of adaptation into policies, regulations and programs in multiple sectors. As a practical concern, governments want to know whether existing policies and programs, which were developed to address other goals and objectives, are themselves adaptive to changes, including a changing climate. Policies that are not adaptive are likely to fail to achieve their intended objectives as circumstances change, such as in the case of climate change.

In 2013 the Saskatchewan Water Security Agency and the International Institute for Sustainable Development (IISD), in collaboration with the provinces of Saskatchewan and Manitoba, acquired Natural Resources Canada funding to assess the adaptability of mining sector policies in Saskatchewan and Manitoba to climate change. A version of the Adaptive Design and Assessment Policy Tool (ADAPTool) was used to undertake the analysis. The ADAPTool was developed by IISD, Adaptive Resource Management Ltd and The Energy and Resources Institute (TERI) with financial and in-kind support from the International Development Research Centre, Natural Resources Canada's Prairie Regional Adaptation Collaborative, Manitoba Conservation, Manitoba Agriculture and Rural Initiatives and the Saskatchewan Watershed Authority. The ADAPTool is based on Swanson and Bhadwal (2009), which describes seven key guidelines for adaptive policies.

The ADAPTool assesses the adaptability of policies or programs in relation to any defined stressor or external change, such as climate. It produces two kinds of assessments: 1) it gauges the ability of existing policies or programs to support adaptation measures undertaken in response to the specified stressor by the policy target groups and 2) it assesses the general adaptability of the policies or programs themselves: are they likely to respond well under the influence of the anticipated as well as unanticipated changes?

The **objective of the project** was to test the ADAPTool in a broader range of contexts in order to refine and enhance the tool for wider application. Within each of the provincial ADAPTool pilots, or cases, provincial agencies sought to better understand the potential for the selected policies and programs to respond to changing climate conditions while still delivering their intended policy goals. In addition, the analysis was to help "mainstream" awareness and consideration of climate adaptation into mining policy processes.

In each of the two provinces (Saskatchewan and Manitoba), we produced at least an analytical report describing the results and the implications for policy adaptability. This synthesis report summarizes those results and presents aggregated analytical scoring results across all 15 of the policies assessed in the two provinces. The focus of this report is on the conclusions and lessons that can be drawn about how the tool worked in these applications and what it tells us about policy adaptability in these cases.

## Methods

There are two kinds of information that are important in any assessment of policy adaptability to climate change. The first is to understand the degree to which existing and proposed policies and programs can contribute to anticipated adaptation needs in specific sectors. This information illuminates potential policy gaps and identifies existing policies and programs that are particularly well suited for supporting adaptation efforts and ways to strengthen them even further. The second aspect to consider is to understand the ability of an existing policy or program to adapt itself to changing socioeconomic and environmental conditions brought on by climate change—both anticipated and unanticipated.

The ADAPTool is structured as a series of Excel spreadsheets that prompt analysts to identify the key climate stressor (such as droughts) and then list the key policies and areas of focus. This standardized tool allowed the project team to work with a number of policy-makers across Canada following the same methodology and allowed a comparison of the results across the assessments. The ADAPTool was applied in Manitoba and Saskatchewan to review the mining sector within each province. In each province, the application followed a similar process based on collaboration between the research team members and policy-makers.

In order to gain specific insights about the ADAPTool process, IISD also conducted a series of semi-structured interviews. This enabled us to explore key processes, challenges and lessons learned from applying the ADAPTool. Provincial participants shared their feedback on the experience, as well as insights gained about climate adaptation, the roles of sectorial policies in addressing adaptation needs and building policy adaptability.

## Overview of the Analyzed Policies

A total of 15 policies were assessed using the ADAPTool in the mining sector in Manitoba and Saskatchewan. For both provinces, four mining phases were identified: (1) exploring and siting, (2) development (construction of infrastructure), (3) operations (processing and waste management, extractions) and (4) closure and remediation. The primary stressor of interest in this analysis is climate change; specifically, increased drought, excessive moisture and increased temperatures were identified as climate change stressors of relevance to the mining sector. In Manitoba 37 vulnerabilities to these climate stressors and a corresponding 48 adaptation actions were identified through literature review and collaborative deliberation. In Saskatchewan, 44 vulnerabilities were identified in the mining sector, with 66 corresponding adaptation actions.

**TABLE ES1. OVERVIEW OF THE MINING SECTOR, VULNERABILITIES AND ADAPTATIONS IDENTIFIED FOR ANALYZED POLICIES ACROSS THE TWO PROVINCES**

| PROVINCE | NO. OF POLICIES | NO. OF PHASES/SUBSECTORS | NO. OF VULNERABILITIES | NO. OF ADAPTATION |
|---|---|---|---|---|
| Manitoba | 6 | 4 | 37 | 48 |
| Saskatchewan | 9 | 4 | 44 | 66 |

## Synthesis of Findings and Recommendations

Similarities and differences can be observed in both provinces in terms of their strengths and weaknesses in addressing planned and autonomous adaptation needs. From these, recommendations are drawn from the analysis to strengthen the suite of policies, including:

- From the identified adaptation actions, the selected policies from both provinces saw a lack of support in some actions, particularly transportation and building-related actions. While it is possible that there is support for these actions from policies that were not analyzed, this is worthy of some analysis to determine if these necessary adaptations are actually supported. If not, the sector can determine how best to identify this gap.
- It became evident over the course of the study that climate change adaptation is important for the mining sector and requires strong provincial buy-in for success. Climate adaptation strongly affects all mining phases and, in particular, the closure and remediation phase.
- Both provinces saw little deliberate use of foresight methods, such as scenario planning. Adaptive capacity in the sector would be strengthened by more foresight activities, particularly to determine the impacts of climate on the sector and determine specific ways to deal with the gaps.
- The use of historical baselines in both provinces would benefit from some updating and alterations informed by climate change projections. Historical baselines may not be adequate or accurate in the future, particularly in building codes and environmental (such as water quality) measurements.
- Policies that involve the creation of funds for closure, remediation and unforeseen events should incorporate climate projections and ensure periodic re-evaluation of plans to ensure long-term sustainability. The identified vulnerability of these policies stem from the fact that these funds may be inadequate to meet costs in projected climate change scenarios.
- All of the policies assessed were regulatory in nature. However, some of them provided access to additional instruments (such as the Manitoba Mines and Minerals Act and Mine Closure Regulations and its guidelines, which provide economic, expenditure and institutional instruments, and the Saskatchewan Mine Closure policy, which has an assurance fund). Since having a mix of instruments may increase adaptive capacity, it might be worthwhile ensuring that the mining sector is supported by other policy instruments that complement these regulatory policies.

## Acknowledgements

The ADAPTool was developed by the International Institute for Sustainable Development (IISD) with support from Adaptive Resource Management Ltd, Novel Futures Corporation and The Energy and Resources Institute (TERI) and with financial and in-kind support from the International Development Research Centre, Natural Resources Canada's Prairie Regional Adaptation Collaborative, Manitoba Conservation and Water Stewardship, Manitoba Agriculture, Food and Rural Initiatives and the Saskatchewan Water Security Agency. The ADAPTool is based on the 2009 book *Creating Adaptive Policies: A Guide for Policy-Making in an Uncertain World* (Swanson & Bhadwal, 2009).

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# 1.0 Introduction

Policy-makers and the public are increasingly aware of the potential impacts of climate change, increasing vulnerability to climate change and adaptation needs and the role that policies play in fulfilling this growing need. There is a growing body of knowledge on the importance of planned adaptation actions in national and subnational strategies for reducing vulnerability to climate change (Intergovernmental Panel on Climate Change [IPCC], 2012; Biesbroek et al., 2010). *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 (IPCC, 2007).

Approaches to adaptation planning and policy-making vary globally. Part of these efforts is mainstreaming adaptation needs into policies, regulations and programs in multiple sectors. As a practical concern in climate adaptation policy, governments want to know whether existing policies and programs, which were developed to address other goals and objectives, are themselves adaptive to climate change.

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. It is anticipated that the mining sector will face some challenges related to climate change (Pearce et al., 2009; International Council on Mining and Metals, 2013). At the outset of this review it was not known to what degree existing policies enable adaptation to these challenges.

In 2013 the Water Security Agency (Saskatchewan) and the International Institute for Sustainable Development (IISD), in collaboration with the provinces of Manitoba, British Columbia and Nova Scotia acquired Natural Resources Canada funding to assess the ability of diverse sectorial policies to contribute to both anticipated and unanticipated adaptation needs in relation to climate change. One of the sectors of interest was the mining sector. The provinces of Manitoba and Saskatchewan were chosen as the focus areas for the mining sector analysis. Saskatchewan and Manitoba are both vulnerable to climate change, with climate experts informing us that drought, excess moisture and storms will be more common and severe in this region in the future.

A version of the Adaptive Design and Assessment Policy Tool (ADAPTool) developed by IISD in collaboration with the Prairie Regional Adaptation Collaborative was used to undertake the analysis. The analysis was performed by IISD personnel with the support and engagement of policy-makers from both provinces. The tool was used to analyze nine policies in Saskatchewan and six policies in Manitoba.

The ADAPTool assesses policies or programs in relation to a defined stressor or external change, such as climate change. It produces two kinds of assessments: 1) it gauges the ability of existing policies or programs to support adaptation measures undertaken in response to the specified stressor by the policy target groups and 2) it assesses the general adaptability of the policies or programs themselves: are they likely to respond well under the influence of the anticipated as well as unanticipated changes?

Public policy operates in a dynamic and complex environment. As conditions change, policies and programs may become less effective or even counterproductive. Adaptive policies and programs help avoid these kinds of failures. While policies aim to achieve certain objectives—for example, improve water quality or regulate forest harvesting—they also should avoid policy failures and unintended consequences as conditions change (Walker et al., 2002). Swanson and Bhadwal (2009) describe seven key guidelines for adaptive policies, based on observations of policies that perform well in the face of change and on insights from the recent policy literature dealing with complex systems. The ADAPTool was developed by IISD based on these guidelines, which are summarized below.

### *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.

### *Multistakeholder Deliberation*

Multistakeholder deliberation is a collective and collaborative 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 commitment and emerging issues, and by providing a comprehensive understanding of causal relationships. The key aspects of this process are that it involves participants, including the public, in sharing multiple perspectives in an attempt to reach consensus on a relevant decision. This process goes beyond stakeholder consultation.

### *Automatic Policy Adjustment*

Automatic adjustment mechanisms can speed up the process of 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 (both qualitative and quantitative) in which the understanding of the system is high, allowing for fine-tuning and making adjustments that help reduce risks and maintain performance. Automatic adjustment can be both fully and semi-automatic.

### *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 the ability of stakeholders to respond to unanticipated events through innovation.

These practices take advantage of the capacity of complex adaptive systems to generate solutions beyond 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 includes facilitating sharing and copying of best practices, providing resources to reduce barriers to self-organization and creating spaces for adaptive collaboration.

### *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 the 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.

### *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, to provide a range of alternative options 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 support the exploration of options.

### *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 have an impact on the policy's performance. A formal review mechanism can include triggers for the review (such as time intervals or other performance triggers), definition of the nature of the review and a learning process—that is to say, deciding who needs to be involved in the review, who will take action on the results and what kinds of action are to be considered.

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

The purpose of this project was to support mainstreaming of climate adaptation into mining sector-relevant policies at the provincial level. The project provided an opportunity to test the ADAPTool in diverse policy sectors, including emerging policies, and different contexts across Canada.

The objectives of the provincial analyses were:

- To provide the respective provincial agencies with a systematic assessment and understanding of the potential for their policies and programs to support climate change adaptation across a number of sectors, such as agriculture, forestry and water.
- To build the capacity of provincial program managers, raise awareness and "mainstream" consideration of climate adaptation into the policy process.
- To assess the general adaptability of the policies or programs themselves to determine if they are likely to achieve their goals in the face of anticipated and unanticipated stressors.

## 2.0 Methodology

The ADAPTool is meant to stimulate discussion and to expose knowledge that organizations such as the B.C. Ministry of Agriculture already hold. 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 or green colour to the scoring cell depending on the entry value. This allows the analyst an at-a-glance visual overview of dozens of scores in a complex sheet.

A full description of the analysis processes followed in each province can be found in each of the related reports (Echeverría et al., 2013; Zubrycki et al., 2013). The process was similar, including the following steps:

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

The spreadsheet analysis serves as the basis for scoring each of the programs in response to the assessment questions identified below 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 & Pilifosova, 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.

*Note: The wording and order of some questions or question components were changed in the subsequent version of the online tool and Excel-based workbooks to improve clarity and analysis quality.*

The level of involvement for each policy was scored using a four-level scale: "2" is highly supportive, "1" is partially supportive, "0" means not supportive and "non-applicable" indicates the actions/characteristics are not relevant for the analyzed policy. As applicable, we also included a -1 score that identifies areas where particular policies actually act as barriers or deterrents for necessary adaptation actions.

# 3.0 Results of ADAPtool Analyses

## 3.1 Support for Anticipated Adaptation Needs

For both of the provinces, vulnerabilities and adaptation actions were considered under four phases of mining: exploration and siting, development (construction of infrastructure), operations (processing and waste management, extraction), and closure and remediation. The lists of vulnerabilities and actions were developed through a review of relevant literature and engagement with relevant stakeholders, including provincial mining associations and government officials.

In Saskatchewan, 61 of 66 anticipated adaptation actions identified were directly (13) or partially (59) supported by at least one policy in the suite of policies considered. Five actions saw no direct or indirect support. Most of these unsupported actions (80 per cent) related to transportation in the operations phase.

In Manitoba, from the total 48 adaptation actions, 37 were directly and 46 were indirectly supported by at least one policy within the suite based on the general requirement under all policies to minimize environmental impact. Two adaptation actions encountered barriers by at least one policy within the suite. There were no adaptation actions that were (in)directly supported or hindered by at least one policy. Similar Saskatchewan policies that did not support any particular adaptation action were identified mostly with transportation and building codes in the operations and development phases.

It should be noted that findings regarding support for adaptation actions between the provinces are not directly comparable. The Manitoban analysis included the opportunity to score actions as “not applicable” to certain policies, whereas the Saskatchewan analysis did not. Therefore, direct comparison of results for these sections or for the overall adaptability of policies should not be undertaken.

## 3.2 Policy Stress

None of the 15 policies analyzed was acutely vulnerable to climate change. In Saskatchewan, 67 per cent (6 of 9) were not at all vulnerable, whereas 33 per cent (3 of 9) were marginally vulnerable. In Manitoba, 33 per cent (2 of 6) were not at all vulnerable, while 67 per cent (4 of 6) were marginally vulnerable. Much of the vulnerability in both provinces related to uncertainty during and after closure and remediation. Once a mine is closed, the onus generally returns to the government to cope with issues at the site. While policies such as *Guidelines for Northern Mine Decommissioning and Reclamation* include creating funds to pay for closure activities, climate change could stress these funds.

In addition, planning often relates to historical baselines. With a changing climate, these baselines could prove inadequate. Adjustments may be required to benchmark measurements for both provinces.

## 3.3 Support for Stakeholder Adaptive Capacity

The six determinants of adaptive capacity (access to economic resources, technology, infrastructure, information/skills, institutions/networks and equitable access to resources) offered moderate support for the adaptive capacity of stakeholders. For both provinces, access to relevant information and skills was one of the most highly supported elements. Ways in which policies contributed to this element included the involvement of expert reviewers in environmental assessments, training and education opportunities, detailed information in the policies themselves and contact information (e.g., phone number, email) in some policies on where to go for more information. Access to financial resources saw little support in either province, primarily as these policies do not involve the distribution of money. One exception in Manitoba is the Mines and Minerals Act, which provides incentives for exploration.

## 3.4 Use of Foresight Methods and Multistakeholder Deliberation

Many of the policies offered partial or full support for this element. Particularly supported was multistakeholder deliberation. Many of the policies involve consultation and deliberation opportunities in various forms, including forums, opportunities to provide written comments and feedback. While some policies, such as environmental assessments, help enable broad public deliberation, other policies were narrower in scope, for instance some sought the involvement of certain technical or industry stakeholders. One observation in Saskatchewan was that those policies that were most recently developed or reviewed were most likely to include multistakeholder deliberation. Only the *Hazardous Substance and Waste Dangerous Goods Regulations* (HSWDG) developed in 1989 had no support in this area; however, there is a plan to repeal it in the near future and include it in the Environmental Management and Protection Act (EMPA), which will likely then lead to more multistakeholder elements.

The use of foresight methods saw less support, with only two policies offering some evidence for this element. The preamble of Manitoba's Environment Assessment and Licencing under the Environment Act suggests that the spirit of the act is to integrate an important array of factors. It states: "The process exists to ensure environmental and human health protection, encourage early consultation, allow for full public participation, and ensure economic development occurs in an environmentally responsible manner." The other policy to demonstrate some support for deliberate foresight is *The Drainage Approval Process* in Saskatchewan, which considers a much broader flood standard—one in 500 year flood events—than do policies in other provinces, which generally have one in 100 or one in 200 year flood standards.

## 3.5 Enabling Self-Organization and Networking

For both Saskatchewan and Manitoba, many of the policies indirectly supported self-organization and social networking through intra-sectoral meetings between government departments and industry groups to discuss lessons, best practices and strategies for advancing on mutually approved actions; however, these are not formalized practices under the policies. For Manitoba, experiences with supporting self-organization and networking applied in the analyzed policies could be used to inform other policies, such as the Manitoba Water Quality Standards, Objectives, and Guidelines Regulations under the Water Protection Act and Health and Safety W210 Regulation, in these sectors and others. In Saskatchewan, the Environmental Assessment Act was the only policy to get a rating of "2" and, as such, it is recommended that other policies learn from this act and build in relevant aspects, where possible. The fact that the HSWDG Regulations do not provide support may not be a major concern, as this policy is being repealed and included in the EMPA in the near future. It is expected that self-organization and social networking will be supported in this area in the future. We recommend the government use the opportunity to strengthen the HSWDG topics (storage of hazardous substances).

## 3.6 Decentralization

In Manitoba, the suite of policies is sufficiently decentralized to the most appropriate level, ranging from senior level to mining workers. However, a detailed review of these procedures on decentralization and vertical decision making is recommended to make sure that they do not lead to unintended consequences—for example, by limiting choices and the abilities of local actors to make decisions. In Saskatchewan, the majority of the policies appear to be decentralized to the appropriate level, including the Environmental Assessment Act, the Environmental Management and Protection Act, 2002, and the Drainage Approval Process. The HSWDG is the only policy to be rated as "0." However, it is being repealed and included in the EMPA in the near future. This is an opportunity to increase decentralization, as appropriate.

## 3.7 Variation in Policy Instruments Employed

In both provinces, all policies reviewed are regulatory instruments; policies directly under the Mining Branches do provide additional policy tools. For example, in Manitoba, the Mines and Minerals Act and Mine Closure Regulation 67/99 and its guidelines provide an additional set of instruments (economic, expenditure, institutional). In Saskatchewan, the Mine Closure policy has a related assurance fund. Nevertheless, as there are other provincial and federal policies that influence the mining sector in both provinces, these should be reviewed in the future if the other mining-related policies provide a balance in policy instruments.

## 3.8 Formal Policy Review and Continuous Learning

The provinces scored differently here. In Manitoba, the policies outside the Mining Branch all include a formal review imbedded within the policy. The policies under the Mines Branch lack a formal review process, and in fact have not been reviewed since the early 1990s. It is anticipated that these policies will undergo a review, and it is recommended to include a formal review process to help detect emerging issues that can affect the policies' performance and effectiveness. For such review processes to be effective, particularly for autonomous adaptability, they should be triggered, either with indicators or with a timeline. Both analytical and deliberative processes should be applied for such formal review processes.

In Saskatchewan, most of the policies scored a "1" for policy review, indicating that reviews are either informal or not publicly reported. Only the Drilling Regulation scored a "2" due to the fact that it both conducts regular reviews and publishes them on the website. The main recommendation for this element is to make reports publicly available. The HSWDG Regulations has never been formally reviewed. We recommend that a review mechanism be included when it is repealed and included in the EMPA in the near future.

## 4.0 Discussion and Conclusions

Figures 1 and 2 show 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 axis of the adjacent diagram 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 the policy consulted with stakeholders during its 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 is contributing 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 support planned adaptability, including its ability to contribute to adaptation as well as to autonomous adaptability. The yellow area signifies that a policy is partially contributing and that 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 but their assessment with respect to adaptation and adaptive policy baselines.**

The high placement of the environmental assessment acts in both provinces is notable. These policies scored well for a number of reasons. Such policies are often quite broad and, at times, general wording offered opportunities for potential support. Environmental assessments also often offer the possibility for some degree of multistakeholder deliberation, such as public forums. They may also include the engagement of expert reviewers, resulting in access to information, skills, technology and networks. These analyses also observed strong characteristics in decentralization and social networking/self-organization. Such characteristics increase the degree of adaptive capacity in the policy.

One policy that bears comment is the *Hazardous Substance and Waste Dangerous Goods Regulations*, the only policy to fall into the red part of the graph. There are two reasons for this finding. First, it is a highly targeted policy, focusing on the storage of hazardous substances and waste and, as such, many of the vulnerabilities and adaptation actions were not applicable. Perhaps more importantly, it contributed little to stakeholder adaptive capacity, did not offer multistakeholder deliberation, did not enable self-organization and social networking, did not have adequate decentralization and did not have regular review (it has not been reviewed since 1989). These elements make it a low contributor to adaptive capacity. However, an opportunity arises in a planned repeal of the policy and its inclusion in the Environmental Management and Protection Act. The expert reviewer of the policy suggested that there is the potential and desire to build in many of these elements at this time. We see this as a positive development.[1]

[1] For more analysis and discussion, see the relevant reports for each province (Echeverría et al., 2013; Zubrycki et al., 2013)

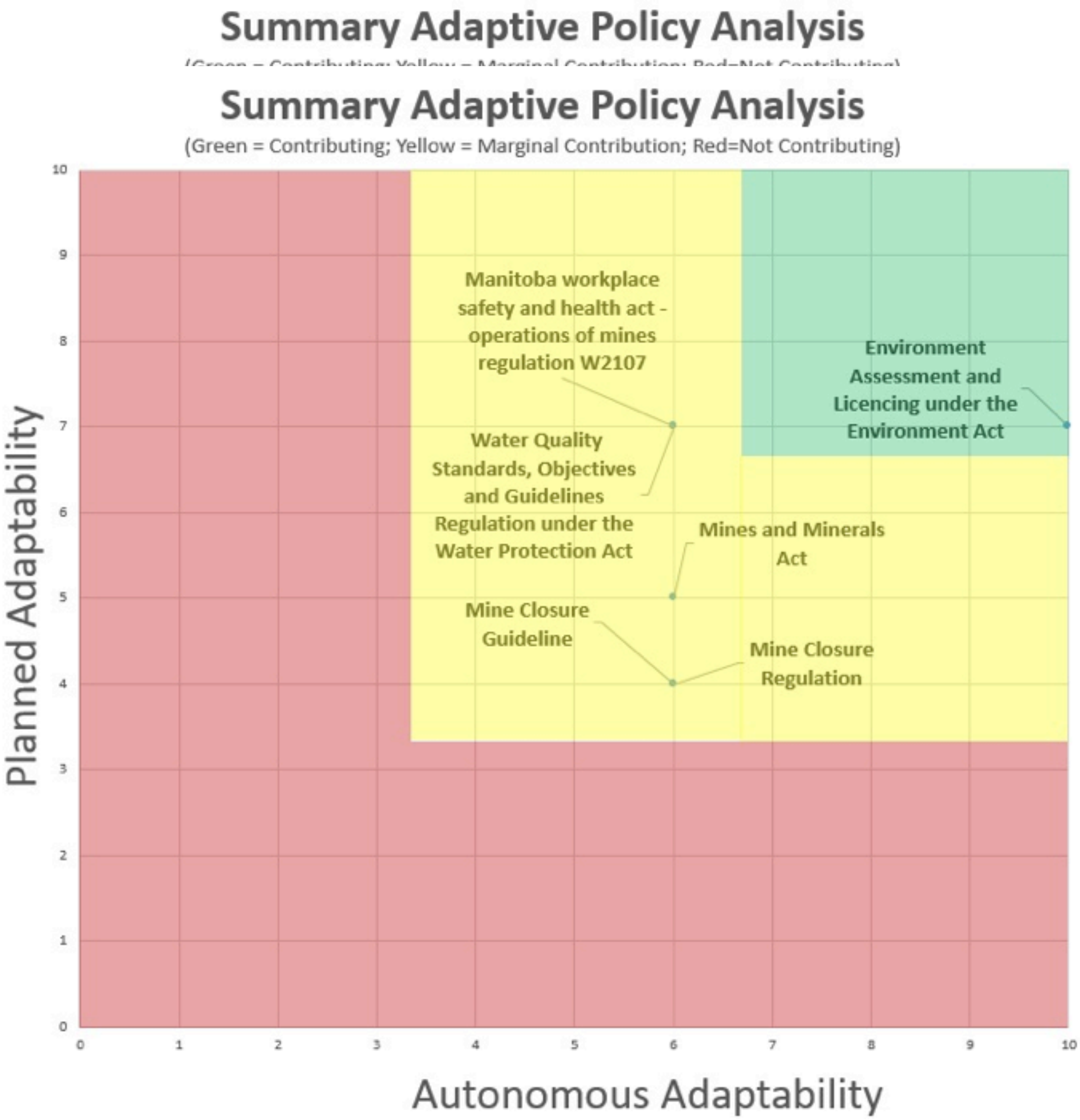


**FIGURE 2: SUMMARY OF THE MANITOBAN ADAPTIVE POLICY ANALYSIS**

*Note: Due to different approaches applied for Saskatchewan and Manitoba policy analyses, it should be emphasized that the placement of the policies on the graphs for Saskatchewan and Manitoba are not comparable.*

## 5.0 Recommendations

This synthesis of mining policy in two Canadian provinces allows for recommendations based on observations of similarities and differences in the analyses. Specific recommendations for each of the policies and provinces are available in the provincial reports (Echeverría et al., 2013; Zubrycki et al., 2013).

Observations and recommendations based on the synthesis include:

- Consider further the adaptation actions that saw little support in either province, particularly transportation-related actions. While it is possible that there is support for these actions in policies that were not analyzed (the review was not comprehensive of *all* policies relevant to mining and climate change adaptation adaptation), it is also possible that no such support currently exists. Based on the importance of such adaptation actions for provincial sector priorities, this gap needs to be further examined by policy analysts.
- It became evident over the course of the study that provincial buy-in for climate change adaptation in the mining sector is highly important. The province can be an important driver for adaptive capacity. This support does not necessarily have to be in legislation; it can also come through working closely with the mining sector to ensure good communication, knowledge sharing and understanding.
- Both provinces saw little deliberate use of foresight methods, such as scenario planning. Adaptive capacity in the sector would be strengthen by more foresight activities.
- The use of historical baselines in both provinces would benefit from some updating and alterations informed by climate change projections. Historical baselines may not be adequate or accurate in the future.
- Policies that involve the creation of funds for closure, remediation and unforeseen events should ensure periodic re-evaluation of plans to make sure that funds collected are sufficient to meet costs in likely climate change scenarios.
- All of the policies assessed were regulatory in nature. There was little in the way of economic, expenditure and institutional instruments. Having a mix of instruments may increase adaptive capacity. Therefore, a broader review to see if the comprehensive scope of policies relevant to mining and climate change should incorporate these other elements.
- Few of the policies had reports available from policy reviews. It would be good practice to ensure such reports are accessible.
- Create a multi-province, multistakeholder (primarily mining industry, technical experts and government) working group to discuss and deliberate how best to address mining sector vulnerability to climate change.

## References


Biesbroek, G.R., Swart, R.J., Carter, T.R., Cowan, C., Henrichs, T., Mela, H., et al. (2011). Europe adapts to climate change: Comparing national adaptation strategies. *Global Environmental Change, 20,* 440–450.

Echeverría, D.Swanson, D., Zubrycki K., & Roy, D. (2014). *Adaptive policy analysis of mining policies in Manitoba.* Winnipeg, MB: IISD.

International Council on Mining and Metals. (2013). *Adapting to a changing climate: Implications for the mining and metals industry.* Retrieved from http://www.icmm.com/publications

Intergovernmental Panel on Climate Change. (2007). Summary for policymakers. In M. Parry et al. (Eds.), *Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge, U.K.: Cambridge University Press.

Intergovernmental Panel on Climate Change. (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation.* A special report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge, U.K.: Cambridge University Press.

Pearce, T., Ford, J.D., Prno, J., Duerden, F., Berrang-Ford, L., Smith, et al. (2009). *Climate change and Canadian mining.* Retrieved from http://www.davidsuzuki.org/publications/downloads/2009/Climate_Change_And_Canadian_Mining.pdf

Smit & Pilifosova. (2001). Adaptation to climate change in the context of sustainable development and equity. In J.J. McCarthy and O.F. Canziani (Eds.), *Climate change 2001: Impacts, adaptation and vulnerability. Contribution of Working Group III to the 3rd Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 877–912). Cambridge: Cambridge University Press.

Swanson, D. A. & Bhadwal, S. (2009). *Creating adaptive policies: A guide for policy-making in an uncertain world.* Retrieved from http://www.iisd.org/publications/pub.aspx?id=1180

Zubrycki K., Roy, D., Huppe, G., Swanson, D., & Brodie, B. (2014). *Adaptive policy analysis of mining policies in Saskatchewan.* Winnipeg, MB: IISD.

## Appendix 1: Detailed Overview of Policies Analyzed

| POLICY | DESCRIPTION | RESOURCE LOCATION |
|---|---|---|
| **MANITOBA** | | |
| Environment Assessment and Licencing under the Environment Act | The act outlines the environmental assessment and licensing process for developments in Manitoba that may have potential for significant environmental and/or human health effects. Any development work in Manitoba must undergo an environmental assessment and licencing process prior to construction and operation. | http://www.gov.mb.ca/conservation/eal/publs/info_eal.pdf |
| Manitoba Mine Closure Regulations 67/9 | This policy provides regulations on the decommissioning and closure of a mine. | http://www.manitoba.ca/iem/mrd/mines/acts/closureguidelines.pdf |
| 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. | http://web2.gov.mb.ca/laws/regs/pdf/m162-067.99.pdf |
| 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 product in Manitoba, consistent with the principles of sustainable development. | http://web2.gov.mb.ca/laws/statutes/ccsm/m162e.php |
| The Workplace Safety and Health Act W210: Operations of Mines Regulation | The act looks at safe working environments in workers' activities in their workplaces as well as protection of other persons from risks to their safety and health arising out of, or in connection with, activities in mines. | http://web2.gov.mb.ca/laws/regs/pdf/w210-212.11.pdf |
| Water Quality Standards, Objectives, and Guidelines Regulations under the Water Protection Act (WQSOG) | These guidelines are one of many tools used to protect, maintain and, where necessary, rehabilitate water quality in Manitoba. | http://www.gov.mb.ca/waterstewardship/water_quality/quality/pdf/mb_water_quality_standard_final.pdf |
| **SASKATCHEWAN** | | |
| Drainage Approval Process | The Drainage Approval Process falls under the Water Security Agency and, with some exceptions noted in the policy, explains the approvals process for "any action taken or intended for the removal or lessening of the amount of water from land and includes the deepening, straightening, widening and diversion of the course of a stream, creek or other watercourse and the construction of dykes." | https://www.wsask.ca/Permits-and-Approvals/Regulatory-Info/Drainage-Approval-Process/ |
| Drilling Regulation | The Drilling Regulation falls under the Oil and Gas Conservation Act and pertains to such matters as licensing, operations, decommissioning and reclamation, testing and measurement, and reporting requirements for oil and gas drilling. | http://www.publications.gov.sk.ca/details.cfm?p=63704 |

| | | |
|---|---|---|
| Guidelines for Northern Mine Decommissioning and Reclamation | *The Guidelines for Northern Mine Decommissioning and Reclamation* "are intended to provide the proponent with an overview of the various factors to be considered during the development of a decommissioning and reclamation plan for a mining site" and include "an overview of the legal requirements for developing and implementing a decommissioning and reclamation plan," a review of basic planning principles, a review of "general closure criteria for the various components of a mining site" and "information on the role of public consultation in decommissioning and reclamation." | http://www.environment.gov.sk.ca/adx/aspx/adxGetMedia.aspx?DocID=e28770f9-33f5-4dfe-bc33-c2a255111b47&MediaID=1611&Filename=Northern+Mine+Decommissioning+and+Reclamation+Guidelines.pdf&l=English |
| Saskatchewan Environmental Code 2013 | This policy includes chapters on different environmental topics, with two proving to be the most pertinent to this analysis: Land Management and Protection (section B) and Forestry (section D). The guide used for this analysis includes explanations of changes to the code in 2013, FAQs for each topic, contact information for questions and explanations of legislative authority for each chapter. | http://www.environment.gov.sk.ca/adx/aspx/adxGetMedia.aspx?DocID=1ab21da4-740c-42c9-b10b-00be9ea8c4d4 |
| The Environmental Assessment (EA) Act | The EA Act assesses the impact of new developments, including mines, on the environment | http://www.publications.gov.sk.ca/details.cfm?p=488 |
| The Environmental Management and Protection Act, 2010 (EMPA) | The EMPA, 2010 is legislation for the protection of the air, land and water resources of the province through regulating and controlling potentially harmful activities and substances. It repealed the Clean Air Act, the Environmental Management and Protection Act, 2002, the Litter Control Act and the State of the Environment Report Act. | http://www.publications.gov.sk.ca/details.cfm?p=30313 |
| The Hazardous Substance and Waste Dangerous Goods Regulations, Section 17 | *The Hazardous Substances and Waste Dangerous Goods Regulations*, Section 17, regulates the storage of hazardous substances and hazardous waste. It also includes appendices on different classifications of substances. | http://www.publications.gov.sk.ca/details.cfm?p=671 |
| The Mineral Industry Environmental Protection Regulations | These regulations pertain to pollutant control facilities and their construction, operation, temporary closure, and decommissioning and reclamation. A pollutant control facility is a facility or area for the collection, containment, storage, transmission, treatment or disposal of any pollutant arising from any mining operations or from the development of or the exploration for any mineral. It also includes an assurance fund for decommissioning and reclamation. | http://www.publications.gov.sk.ca/details.cfm?p=1060 |
| The Mines Regulations, 2003 issued in pursuant to The Occupational Health and Safety Act, 1993 | This regulation falls under the Occupational Health and Safety Act and provides detailed and specific information on health and safety requirements for a wide range of mining activities and conditions. | http://www.publications.gov.sk.ca/details.cfm?p=678 |

## Appendix 2: Overview of Policy Scores in Manitoba and Saskatchewan

Policies Analysed:

- **Policy 1:** *Drilling Regulation*
- **Policy 2:** *The Environmental Assessment Act*
- **Policy 3:** *The Environmental Management and Protection Act, 2010*
- **Policy 4:** *The Mineral Industry Environmental Protection Regulations*
- **Policy 5:** *The Hazardous substance and Waste Dangerous Goods Regulations, Section 17*
- **Policy 6:** *The Mine Regulation, 2003*
- **Policy 7:** *Saskatchewan Environmental Code, 2013*
- **Policy 8:** *Drainage Approval Process*
- **Policy 9:** *Guidelines to Northern Mine Decommissioning and Reclamation*
- **Policy 10:** *Mine Closure Regulations 67/99 Guidelines*
- **Policy 11:** *Mine Closure Regulations 67/99*
- **Policy 12:** *Mines and Minerals Act*
- **Policy 13:** *Environment Assessment and Licencing under the Environment Act (EA)*
- **Policy 14:** *Water Quality Standards, Objectives, and Guidelines Regulations under the Water Protection Act (WQSOG)*
- **Policy 15:** *Manitoba Workplace Safety and Health Act – Operations of Mines Regulation W210*

| Adaptive Policy Questions | Policy | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Ability to Support Anticipated Adaptation Needs (score out of 10) | 5 | 6 | 7 | 5 | 2 | 6 | 5 | 4 | 4 | 4 | 4 | 5 | 7 | 7 | 7 |
| Are anticipated adaptation actions supported by the policies? | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0.9 | 0.9 | 1 | 1.1 | 0.8 | 0.8 |
| Is the policy itself vulnerable to the stressor? | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 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? | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| Were foresight methods and multistakeholder deliberation used in the design of the policies? | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ability to Respond to Unanticipated Events | 6 | 8 | 6 | 5 | 1 | 5 | 5 | 8 | 6 | 5 | 5 | 5 | 9 | 6 | 6 |
| Are foresight methods and multistakeholder deliberation used in the implementation of the policy? | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Does the policy enable self-organization and social networking? | 1 | 2 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| Is decision making for policy implementation adequately decentralized? | 1 | 2 | 2 | 1 | 0 | 1 | 1 | 2 | 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 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Do the policies have a regular formal policy review? | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 2 | 2 |

## Appendix 3: Results of Vulnerability and Adaptation Action Analysis in Saskatchewan

Policies Analysed:

- **Policy 1:** *Drilling Regulation*
- **Policy 2:** *The Environmental Assessment Act*
- **Policy 3:** *The Environmental Management and Protection Act, 2010*
- **Policy 4:** *The Mineral Industry Environmental Protection Regulations*
- **Policy 5:** *The Hazardous substance and Waste Dangerous Goods Regulations, Section 17*
- **Policy 6:** *The Mine Regulation, 2003*
- **Policy 7:** *Saskatchewan Environmental Code, 2013*
- **Policy 8:** *Drainage Approval Process*
- **Policy 9:** *Guidelines to Northern Mine Decommissioning and Reclamation*
- **Abbreviations:** m = metal; nm = non-metal; m-ARD = metal – acid rock drainage

| Mining Phase | Vulnerability | Adaptation Action | Policy | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Exploration and Siting | **Roads** (permanent and winter): Energy, drilling on ice cover, fire season issues | Roads: need to fly-in equipment (potential show stopper for projects) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Drilling on ice: barges (also potential show stoppers) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Increase in wetlands due to more precipitation:** Could affect location of exploration and increase regulation. | TBD | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| | **Increased forest fires:** Smoke could affect location of exploration. | TBD | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| Development (construction of infrastructure) | **Roads** (access to site, transportation of materials): Excess water could inhibit access to site. | Divert water around new site | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 0 |
| | **Water availability and siting:** Affects development location | Preferential sourcing of large water bodies that are unlikely to dry up | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | | Maximize water recycling | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | | More dry processes | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | Increased use of ground water | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | **Foundation:** Permafrost (discontinued), identifying permafrost pocket melt, risk of sinking, slopes can degrade, foundation fails as permafrost degrades can create problems with infrastructure. | Avoiding water on winter roads | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| | | Use airships to fly in equipment and supplies | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | **Climate change impacts on policy/ regulation:** changes to building codes for increased wind/storm activity. | TBD | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Operations (Processing and Waste Management, Extraction) | **Adequate amount of water for brining:** Lack of 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). | Divert rivers | 1 | 0 | -1 | 1 | 0 | 0 | 0 | 2 | 0 |
| | | Build storage unit to control water flow from rivers to lakes | 1 | 0 | -1 | 1 | 0 | 0 | 0 | 2 | 0 |
| | | Use dikes to divert water to sections of lake | 1 | 0 | -1 | 1 | 0 | 0 | 0 | 2 | 0 |
| | **Passive contaminant reduction systems (e.g., wetland filtration)**: Increased temperatures, particularly during the summers, can dry up water, re-exposing metals and contaminating the ground below (m). | Build backup systems | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | **Invasive species—passive filtration system:** More use of natural bogs affecting water management plan; significant drying can lead to erosion; drought increases risk of fires. | Build backup systems | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | **Waste piles and tailing:** For water cover (tailing or pit) rise in evapotranspiration and mean annual precipitation, which in turn may 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 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | **Water treatment:** 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) | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | | Chemical – process modifications, increase use of reagents | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | **Open pits:** Increase in extreme precipitation can lead to a rise in flooding of pit and need for pumping treatment or emergency release; changes in chemical loading to pit water (m-ARD). | 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 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | **Underground workings:** Increase in extreme precipitation can increase flooding of underground; 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 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | **Other hydraulic structures (ditches, diversions, holding ponds):** 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 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Dams:** 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 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | | Design for no pond at closure (i.e.. dry tailings) | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| | **Dams:** Increase in extreme precipitation can cause overtopping in freeboard/spillway (m-ARD). | Provide additional freeboard, design with option to increase spillway capacity | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | **Heating system:** Higher temperatures during the winter lowers the cost for operational heating (m). | Use alternative heating system (cost savings) | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | **Cooling system:** Higher temperatures in the summer could increase operating costs if cooling systems are required. | Take longer breaks | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | | Drinking water | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | | Installing cooling system units | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | **Water intake capacity for mineral processing:** 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 within engineering designs (currently in need of detailed, local-level projections as most climate change models are generalized) | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Transportation:** 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 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | | Monitor ice sheet thickness with ground penetrating radar | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | | Plow snow off the road to enhance freezing effect | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | | Restricting hauling to hours of darkness towards the end of the season when the ice sheet is stronger | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Buildings:** 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 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | **Buildings:** Buildings erected on thaw-sensitive land could see their foundations settle and shift—and in worst case 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 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Raw tailings:** Increased temperatures can lead to increased evapotranspiration from tailing ponds, potentially exposing raw tailings to sub-aerial weathering (m). | TBD | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | **Potash separation processes:** Increased temperature can disrupt potassium/sodium separation process. | Would require engineered cooling system | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Potash separation processes:** Increase in precipitation can create an increase in surface runoff and affects self-contained tailing ponds, making them less effective (lowers crystallization process). | Include in the design divisions/dams to control runoff | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| | | Energy-intensive technology | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Brine injection wells:** Process can be affected by extreme temperature +/- 30 degrees Celsius. | Technology design | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | **Northern mines:** Sensitive to increased forest fire activity and associated smoke. | TBD | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| Closure and Remediation | **Waste piles and tailing:** 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, in turn affecting surrounding vegetation to adapt properly (and with increase in temperature vegetation runs higher risk to forest fires)(m -ARD). | Increase vegetation (more or new) | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 2 |
| | | Increase thickness/capacity of storage layer | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| | | Increase erosion resistance | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| | **Waste piles and tailing:** Soil infiltration barrier can be affected by eroded cover and increase percolation caused by increase mean annual and extreme precipitation (m-ARD). | TBD | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| | **Waste piles and tailing:** When the protection layer is eroded due to increase 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 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| | **Waste piles and tailing:** Through higher permafrost degradation it can lead to increased percolation (m-ARD). | Rock cover thickness can be increased or alternative cover technology used | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| | **Waste piles and tailing:** For water cover (tailing or pit) rise in evapotranspiration and mean annual precipitation can increase MAP which in turn may 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 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Waste piles and tailing:** 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 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | **Water treatment:** 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) | 1 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 1 |
| | | Chemical – process modifications, increase use of reagents | 1 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 1 |
| | **Open pits:** Increase in extreme precipitation can lead to a rise in flooding of pit and need for pumping treatment or emergency release; changes in chemical loading to pit water (m-ARD) . | 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 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| | **Underground workings:** Rise in extreme precipitation can increased flooding of underground 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 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 0 | 1 |
| | **ARD biochemical process** (i.e., sulphide oxidation rate): Increase in rate of sulphide oxidation process due to higher average temperature (other factors considered constant) (m-ARD). | Implement water treatment or make process modifications to existing water treatment to address increased chemical loading (e.g., increased use of reagents) | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| | **Native species:** Changing climate could affect the types of native species that can be planted and survive on reclaimed land. | Adjust what is considered "native" to shifting bio regions | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| | **Dams:** 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 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| | | Design for no pond at closure (i.e., dry tailings) | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 1 |
| | **Dams:** Rise in precipitation (mean annual and extreme) can slope foundation due to rising phreatic surface (m-ARD). | Flatter slop ore buttress required | 1 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 1 |
| | **Dams:** Increase in extreme precipitation can cause overtopping in freeboard/spillway (m-ARD). | Provide additional freeboard, design with option to increase spillway capacity | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| | **Dams:** Change in permafrost degradation can affect settlement of foundation. | Provide additional freeboard | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |

# Appendix 4: Results of Vulnerability and Adaptation Action Analysis for Manitoba

- **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 – Operations of Mines Regulation W210*
- **Abbreviations:** m = metal; nm = non-metal; m-ARD = metal – acid rock drainage

| Mining Phase | Vulnerability | Adaptation Action | Policy | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| Exploration and Siting | **Roads** (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) | **Roads** (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 |
| | **Foundation:** 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 of airships to fly equipment and supplies | N/A | N/A | N/A | 1 | N/A | 0 |
| Operations (Processing and Waste Management, Extraction) | **Adequate amount of water for brining:** Lack of 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 |
| | **Passive contaminant reduction systems (e.g., wetland filtration)**: 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 | 1 |
| | **Invasive species—passive filtration system:** 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 |
| | **Waste piles and tailing:** For water cover (tailing or pit) rise in evapotranspiration and mean annual precipitation, which in turn may 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 |

| | | | | | | | | |
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| | **Water treatment:** 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 | 0 |
| | | Chemical – process modifications, increase use of reagents | N/A | N/A | 1 | 2 | 2 | 0 |
| | **Open pits:** Increase in extreme precipitation can lead to a rise in flooding of pit and need for pumping treatment or emergency release; changes in chemical loading to pit water (m-ARD). | Increase in extreme precipitation can lead to a rise in flooding of pit and need for pumping treatment or emergency release | N/A | N/A | 1 | 1 | 1 | N/A |
| | **Underground workings:** Increase in extreme precipitation can increase flooding of underground; 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 |
| | **Other hydraulic structures (ditches, diversions, holding ponds):** 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 |
| | **Dams:** 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 | 1 |
| | | Design for no pond at closure (i.e.. dry tailings) | N/A | N/A | 1 | 2 | 1 | 1 |
| | **Dams:** 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 |
| | **Heating system:** Higher temperatures during the winter lowers the cost for operational heating (m). | Use alternative heating system (cost savings) | N/A | N/A | N/A | 0 | N/A | 1 |
| | **Cooling system:** Higher temperatures in the summer could increase operating, resulting in an increased costs 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 |
| | **Water intake capacity for mineral processing:** 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 within 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 |
| | **Transportation:** 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 |
| | | Plow snow off the road to enhance 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 |
| | **Buildings:** 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 |

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|---|---|---|---|---|---|---|---|---|
| | **Buildings:** Buildings erected on thaw-sensitive land could see their foundations settle and shift—and in worst case 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 |
| | **Service infrastructure:** 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 |
| | **Roads and waterways (access to site, transportation of outputs):** 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 |
| | **Roads and waterways (access to site, transportation of outputs):** 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 |
| | **Raw tailings:** 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 |
| Closure and Remediation | **Waste piles and tailing:** 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 |
| | **Waste piles and tailing:** 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, in turn affecting surrounding vegetation to adapt properly (and with increase in temperature vegetation runs higher risk to forest fires)(m -ARD). | Increase vegetation (more or new) | 1 | 1 | 1 | 2 | 1 | 0 |
| | | Increase thickness/capacity of storage layer | 1 | 1 | 1 | 1 | 1 | 0 |
| | | Increase erosion resistance | 1 | 1 | 1 | 2 | 1 | 0 |
| | **Waste piles and tailing:** Soil infiltration barrier can be affected by eroded cover and increase percolation caused by increase mean annual and extreme precipitation (m-ARD). | TBD | 1 | 1 | 1 | 1 | 1 | N/A |
| | **Waste piles and tailing:** When the protection layer is eroded due to increase 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 |
| | **Waste piles and tailing:** For water cover (tailing or pit) rise in evapotranspiration and mean annual precipitation can increase MAP which in turn may 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 | -1 | 0 | 1 | 2 | 1 | N/A |
| | **Waste piles and tailing:** Seasonal water scarcity can affect the site's water levels, particularly in already water stressed areas, and negatively impact the long-term effectiveness of water tailings. | TBD | 1 | 0 | 1 | 1 | 0 | 1 |
| | **Water treatment:** 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 |
| | **Open pits:** Increase in extreme precipitation can lead to a rise in flooding of pits and 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 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Underground workings:** Rise in extreme precipitation can increase flooding of underground; can intensify use of pumping and treatment. | Plan for increased management of mine water (pumping and treatment), or enhance other water storage options | 1 | N/A | 1 | 1 | 1 | 2 |
| | **ARD biochemical process (i.e., sulphide oxidation rate):** Increase in rate of 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 |
| | **Dams:** 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 |
| | **Dams:** Change in permafrost degradation can affect settlement of the foundation. | Provide additional freeboard | 0 | N/A | 1 | 2 | 0 | 1 |
| | **Dams:** Rise in precipitation (mean annual and extreme) can slope foundation due to rising phreatic surface. | Flatter slop ore buttress required | 0 | N/A | 1 | 0 | 0 | 1 |
| | **Dams:** Increase in extreme precipitation can cause overtopping in freeboard/spillway. | Provide additional freeboard; design with option to increase spillway capacity | 0 | N/A | 1 | 1 | 1 | 1 |

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