DISCUSSION PAPER | OCTOBER 2022

LAND
REMEDIATION
SECTION

MAKING CONTAMINATED SITES CLIMATE READY

BRITISH COLUMBIA
Ministry of
Environment and
Climate Change Strategy

MAKING CONTAMINATED SITES CLIMATE READY

DISCUSSION PAPER – October 2022

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1. INTRODUCTION

The Ministry of Environment and Climate Change Strategy (the ministry) is reviewing potential actions to address climate change adaptation and further incorporate sustainability in B.C.'s contaminated sites framework.

The purpose of this discussion paper is to:

1. Summarize recent work of the ministry in support of B.C.'s Climate Preparedness and Adaptation Strategy.
2. Report on themes and key messages heard from engagement with Indigenous groups on risk assessment and contaminated sites in a changing climate.
3. Communicate key concepts and potential actions to incorporate climate change adaptation and sustainability in B.C.'s contaminated sites policy and legislative framework.
4. Seek comment on outcomes and potential opportunities as the ministry considers moving forward with making contaminated sites climate ready.

Key Points

- The ministry is updating contaminated sites policies to prepare for impacts of climate change.
- Proposed outcomes support B.C.'s Climate Preparedness and Adaptation Strategy, and have been prepared following engagement sessions with Indigenous groups and reviews of policies and regulations in other jurisdictions.
- The ministry is considering three guiding principles to address adaptation to climate change and protect groundwater:
  – future climate conditions will change
  – understandings and uncertainties will evolve
  – viable groundwater aquifers should be restored wherever practicable
- The ministry is seeking comment on six outcomes and associated potential opportunities for making contaminated sites climate ready:
  1. Indigenous Peoples engagement
  2. Adaptation to current and predicted climate change
  3. Remediation alternatives evaluation
  4. Periodic review of remedial actions
  5. Remediation requirements for viable groundwater aquifers
  6. Financial security
- Interested parties are invited to comment using the questions included in the discussion paper, or in separate submissions, to site@gov.bc.ca

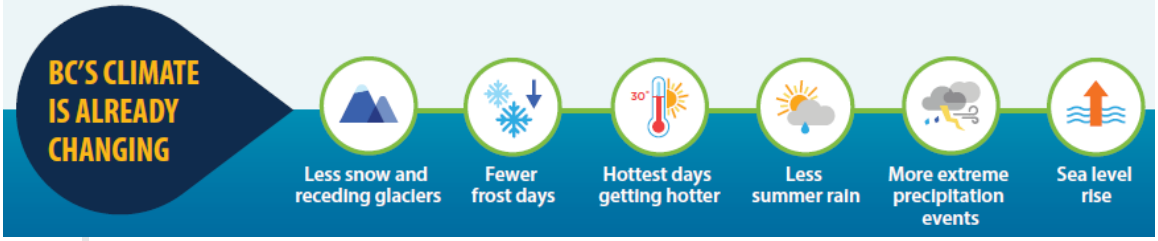

Figure 1: B.C.'s climate is already changing

2. B.C.'S CLIMATE PREPAREDNESS AND ADAPTATION STRATEGY

The work included in this discussion paper has been undertaken in keeping with and to support principles, pathways and actions outlined in B.C.'s Climate Preparedness and Adaptation Strategy (CPAS).

2.1 CPAS PRINCIPLES, PATHWAYS AND ACTIONS

CPAS is intended to strengthen the Province's capacity to anticipate and respond to impacts from climate change. The strategy builds on work underway in B.C. to prepare for climate change, lower long-term costs of impacts and help keep communities safe. It draws on a Preliminary Strategic Climate Risk Assessment conducted by the ministry in 2019, which examined some of the greatest risks to B.C. as a result of climate change.

Figure 2: B.C. Climate Preparedness and Adaptation Strategy goals

CPAS includes six guiding principles to inform work going forward:

1. Build a shared path on climate resilience with Indigenous Peoples
2. Take an equity-informed approach
3. Enhance health and well-being for all
4. Promote nature-based solutions to enhance community resilience
5. Align emissions reduction with climate adaptation
6. Take a proactive approach: the business case for adaptation

Four key pathways are outlined in the strategy:

1. Strengthen foundations for success, including expanding data, monitoring, education and partnerships
2. Enhance community climate resilience
3. Foster resilience of species and ecosystems in a changing climate
4. Advance a climate-ready economy and infrastructure

The pathways inform a comprehensive set of proposed actions for 2022-2025:

- Integrating the changing climate into governance and decision-making
- Expanding education on climate impacts and adaptation
- Supporting resilient community planning and disaster risk management
- Strengthening individual and community health and wellness in a changing climate
- Promoting watershed security and strengthening marine resilience
- Enhancing tools and approaches for managing ecosystems, parks and protected areas
- Increasing the resilience of our buildings and infrastructure
- Supporting business and industry to respond to climate risks

2.2 RELATED INITIATIVES

CPAS is one component of the Province's efforts to recognize and address the effects of climate change, strengthen watershed security and protect water quality. The outcomes and potential opportunities developed by the ministry described in this discussion paper are consistent with and intended to support CPAS and related initiatives, including:

- The CleanBC plan, which provides a pathway to reduce greenhouse gas emissions and build a cleaner future for everyone in British Columbia. For more information, visit: www.cleanbc.gov.bc.ca.
- The Watershed Security Strategy and Fund, proposed under the CPAS, is a related action intended to strengthen the management and stewardship of watersheds in a changing climate. In January 2022, the Province posted a discussion paper that outlined a set of proposed outcomes and opportunities for public consideration and comment.
- The recommendations of the B.C. Auditor General's report on improving drinking water management and source water protection.

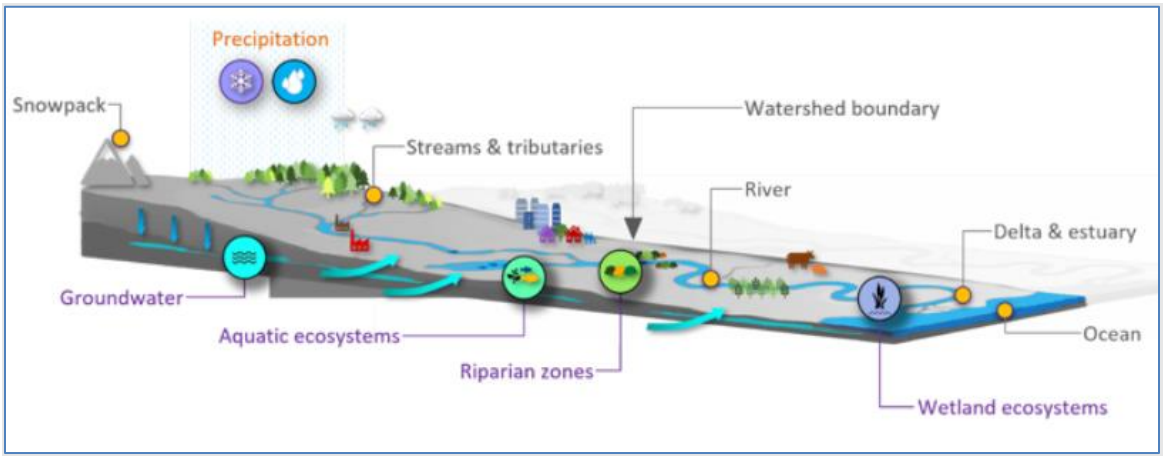

Figure 3: Groundwater – an integral component of watersheds
Source: B.C. ENV 2022 Watershed Security Strategy and Fund Discussion Paper

3. ENGAGEMENT WITH INDIGENOUS PEOPLES

As part of the Province's commitment to true and lasting reconciliation with Indigenous Peoples in B.C., the Province passed the *Declaration on the Rights of Indigenous Peoples Act* (*Declaration Act*) in November 2019. The *Declaration Act* aims to create a path forward that respects the human rights of Indigenous Peoples, while introducing better transparency and predictability in the work we do together.

In keeping with this commitment and the guiding principles of the CPAS, the ministry undertook a series of engagement sessions with Indigenous Peoples in early 2022. The sessions considered "risk assessment" and "contaminated sites in a changing climate."

As well as written notes, a live graphic summary was prepared to capture the discussions during each session. The following figures show examples of the graphic summaries.

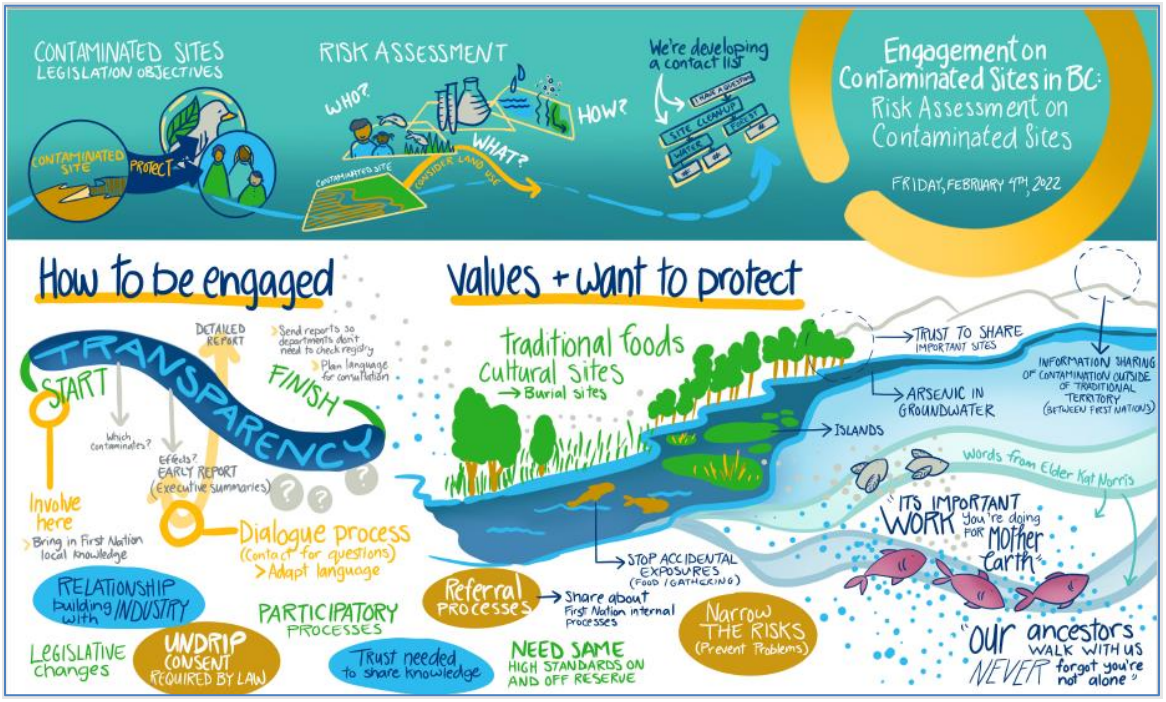

Figure 4: Risk Assessment on Contaminated Sites - graphic facilitation summary example

Key themes identified through sessions on risk assessment on contaminated sites[1] included:

- Early and consistent engagement with First Nations;
- Consultation is the priority, not just notification;
- Lack of capacity to protect lands and become fully engaged in assessment or the remediation process without the support of external funding;
- The extent and diversity of Indigenous knowledge across the province; and
- Unclear points of contact for First Nations with respect to contaminated sites.

[1] The key themes were recorded by the facilitation team through the sessions with the note that "there was no attempt to seek a consensus from participants or to gauge the weight of opinion on any issue."

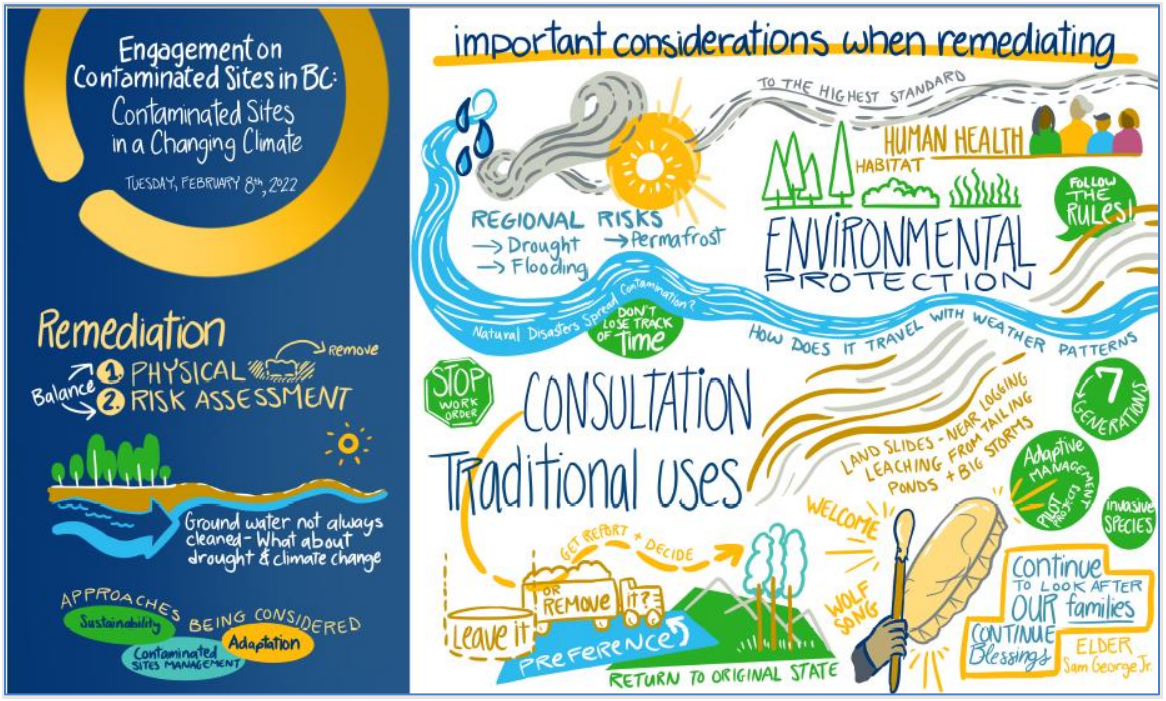

Figure 5: Contaminated Sites in a Changing Climate - graphic facilitation summary example

Key themes identified through sessions on contaminated sites in a changing climate included:

- The importance of considering climate change and examples of increases in extreme weather events (including wildfires, flooding, landslides and heat domes);
- Impacts of climate change and contaminated sites on current and future generations;
- The background information that First Nations need in order to act and provide informed recommendations; and
- The importance of testing older legacy sites that can become problems due to the effects of a changing climate.

The ministry also noted key themes heard through the sessions in a summary session held following the individual engagement sessions (see Figure 6).

Figure 6: Ministry summary of key themes and messages heard in Indigenous Nation engagement

Continued engagement and collaboration with First Nations will be integral to advancing policy that will ensure contaminated sites are climate ready.

4. JURISDICTIONAL SCANS

The ministry commissioned two jurisdictional scans in 2021-2022 to review how jurisdictions outside of B.C. address management of contaminated sites in a changing climate. The first scan reviewed climate adaptation and sustainable practices for remediation of contaminated sites across jurisdictions. The second scan focused on regulatory groundwater remediation requirements intended to protect current and future groundwater resources, with a focus on protecting drinking water aquifers.

Jurisdictions selected for review included those with similar climate, geological or hydrological settings; other Canadian provinces; and jurisdictions that have considered sustainability and/or climate adaptation in their remediation requirements.

Key findings from the scans are provided below, with more detailed summaries included in Annexes A and B of this discussion paper.

4.1 CLIMATE ADAPTATION AND SUSTAINABILITY IN REMEDIATION OF CONTAMINATED SITES

- Sustainability and/or inter-generational equity principles can be included as guidance on best management practices in remediation of contaminated sites.
- A sustainability assessment, such as a comparison of the footprint of remedial options, can strengthen assessment of remediation options.
- Opportunities for public and stakeholder consultation, as well as nation to nation (Indigenous) engagement, support consideration of sustainability in the remediation of a contaminated site.
- A requirement for financial insurance can be used to ensure that remediation is completed to regulatory standards.
- Canadian Council of Ministers of the Environment Guidance on Good Practices in Climate Change Risk Assessment, released in 2021, is a recent resource of potential value in consideration of climate resilience and adaptation in B.C.'s contaminated sites regulatory framework.
- Long-term monitoring of contaminated site remediation should include regular periodic reviews and consider observed and projected changes to climate conditions.

Figure 7: Possible impacts from climate change affecting contaminated sites

4.2 GROUNDWATER QUALITY AND REMEDIATION OF CONTAMINATED SITES

- The management of groundwater quantity is intrinsically linked with the management of groundwater quality.
- Groundwater aquifers are frequently identified and classed in terms of high value, vulnerability or area of protection.
- Remediation of high value groundwater resources may be a regulatory requirement.
- Assessment of remediation options can be a required component of managing contaminated sites.
- Permanent solutions are not feasible in any and every circumstance involving contaminated sites.
- Monitored natural attenuation is a commonly used tool in remediation of contaminated groundwater sites.
- Alternative requirements may be used for identified low threat contaminated sites, such as underground storage tanks.
- Control, remediation and monitoring of groundwater migrating to neighbouring parcels are important considerations in identifying the obligations of responsible parties.

Figure 8: Remediation and redevelopment of False Creek lands in Vancouver – undertaken within B.C.'s contaminated sites regulatory framework

5. HOW TO MAKE CONTAMINATED SITES CLIMATE READY

This section outlines potential direction and opportunities to make contaminated sites in B.C. climate ready. The principles, key concepts and outcomes were developed with consideration of provincial initiatives such as CPAS, the ministry's mandate, messages heard through Indigenous engagement, and the results of commissioned jurisdictional scans. They are intended to:

- Incorporate climate change adaptation and sustainability in B.C.'s contaminated sites framework; and
- Address remediation requirements to protect groundwater quality.

5.1 GUIDING PRINCIPLES

Incorporating Indigenous Peoples' intimate knowledge of their traditional lands, waters and the ecosystems that depend on them is key to ensuring contaminated sites policies protect human health and the environment for future generations.

In addition, the ministry is considering three guiding principles to address adaptation to climate change and protect groundwater resources in remediation of contaminated sites:

1. Future climate conditions in B.C. and worldwide are anticipated to change as greenhouse gas emissions continue, and understanding of the changes will evolve with climate science.
2. Prediction of future climate conditions is based on understandings and uncertainties at a given point in time, and needs to be continually re-evaluated to ensure the continued protection of human health and the environment over time.
3. Viable groundwater aquifers impacted by contaminated sites should be restored to beneficial use wherever practicable, drawing on Indigenous, community and other science-based knowledge. Water quality values, and the intertwined web of ecosystems, should be protected in the context of changing climate conditions, for the benefit of future generations.

Questions:

- What principles should guide the ministry in making contaminated sites climate ready?

5.2 KEY CONCEPTS

The following key concepts are central to the outcomes and potential proposed actions to manage contaminated sites in a changing climate and protect groundwater resources:

- Indigenous Peoples engagement
- Adaptation to current and predicted climate change
- Remediation alternatives evaluation
- Periodic review of remedial actions
- Remediation requirements for viable groundwater aquifers
- Financial security

5.3 OUTCOMES AND POTENTIAL OPPORTUNITIES

The outcomes and potential opportunities described in this section have been prepared by the ministry. They are intended to inform and generate discussion among Indigenous Peoples and interested parties on appropriate means of improving protection of human health and the environment when assessing and remediating contaminated sites in a changing climate.

The ministry is seeking comment on the proposed outcomes and potential opportunities. Discussion questions are included following each outcome, and collated with directions for providing comment in section 6.

OUTCOME 1: INCORPORATE ENGAGEMENT WITH INDIGENOUS PEOPLES AS A COMPONENT OF REMEDIATION PLANS

The *Declaration Act* establishes the United Nations Declaration on the Rights of Indigenous Peoples (UN Declaration) as the Province's framework for reconciliation. Honouring the spirit, intent and obligations of the *Declaration Act* and the UN Declaration will be central to ministry actions in moving forward with making contaminated sites climate ready.

Engagement with Indigenous Peoples and stakeholder consultation supports transparency, and facilitates input on contaminated site concerns, potential remediation alternatives and proposed remediation activities. The provincial government has an obligation under the *Declaration Act* to align laws with the UN Declaration in consultation and co-operation with Indigenous Peoples. This is further supported by the recent amendments to the *Interpretation Act* in Bills 18 and 29 where it states that every act and regulation must be construed as being consistent with the *Declaration Act*. This extends to policies as well under ministers' mandate letters.

Potential Opportunities:

- Additional requirements will be developed to support consistent and effective engagement and consultation as a core component of B.C.'s contaminated sites framework.
- Engagement and consultation principles and communications practices, as well as obligations of responsible parties, could be included in the requirements. Requirements should support shared understandings and consideration of risk assessment relevant to the remediation alternatives and long-term monitoring of remediation activities.

Questions:

- How can engagement and communication requirements be designed to take into account Indigenous Peoples' consideration of risk assessment and remediation?

OUTCOME 2: INCORPORATE CLIMATE CHANGE ADAPTATION IN THE CONTAMINATED SITES FRAMEWORK

- Investigation and remediation activities for contaminated sites currently involve an assessment of historical and current site conditions as the basis for predicting and addressing future conditions. However, future conditions under a changing climate may differ from historic ranges. Resilient remediation methods will ensure long-term effectiveness under changing climates. By accounting for regionally-specific climate change impacts like sea level rise, flooding and wildfires, we can better protect the significant investment in time, resources and money that make remediation happen. This could be described as future-proofing remediation activities and plans.

Resilience is the ability of a human or ecological system to anticipate, prepare for, adapt to, recover from, or withstand the impacts of climate change.

Potential Opportunities:

- Anticipated and/or predicted changes in site conditions under B.C.'s changing climate could be an explicit consideration as part of all contaminated site investigations and remediation alternatives evaluation.
- Where long-term remediation is proposed for a site, adaptation measures could be re-evaluated on an ongoing basis as part of risk management to ensure long-term protection of human health and the environment.

Questions:

- How should adaptation to climate change be addressed in B.C.'s contaminated sites framework?

OUTCOME 3: INCORPORATE REMEDIATION ALTERNATIVES EVALUATION MORE FULLY IN THE CONTAMINATED SITES FRAMEWORK

Section 56 of the *Environmental Management Act* (EMA), specifies that preference must be given to remediation alternatives that provide permanent solutions to the maximum extent practicable. A "remediation plan" defined in the CSR may include consideration of remediation alternatives and the evaluation methods used in identification of alternatives.[2] However, there are no regulations, policies or guidance that specify the process for identifying, considering and evaluating remediation alternatives.

[2] EMA 56 (1) A person conducting or otherwise providing for remediation of a site must give preference to remediation alternatives that provide permanent solutions to the maximum extent practicable, taking into account the following factors: (a) any potential for adverse effects on human health or for pollution of the environment; (b) the technical feasibility and risks associated with alternative remediation options; (c) remediation costs associated with alternative remediation options and the potential economic benefits, costs and effects of the remediation options; (d) other prescribed factors.

Potential Opportunities:

- Explicitly incorporate requirements for remediation alternatives evaluation (RAE) into B.C.'s contaminated sites framework. The ministry is considering the following new concepts that could be a part of RAE:
  – vulnerability assessment and adaptation (of the site and remediation alternatives to potential future climate change);
  – feasibility and use of green and sustainable remediation methods; and
  – intergenerational equity.
- Develop guidance to support evaluation of remediation alternatives.

Vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse impacts of climate change, including climate variability and extremes.

Vulnerability assessment is the process, or how to determine, the vulnerability (sensitivity, exposure and adaptive capacity) of a remediation alternative or remediation system to climate change.

The principles of *sustainability and intergenerational equity* can be described as meeting the needs of the present without compromising the ability of future generations to meet their own needs while achieving an acceptable balance between the impacts of undertaking remediation activities and the benefits those activities will deliver in terms of the environmental, economic and social indicators relevant to the site.

Questions:

- How should requirements for remediation alternatives evaluation be set out in B.C.'s contaminated sites framework?
- What process steps and criteria should be included in RAE?

OUTCOME 4: INCORPORATE PERIODIC REVIEW OF REMEDIAL ACTIONS FOR SITES WITH RISK ASSESSMENT OR RISK MANAGEMENT APPROACHES

In B.C.'s current contaminated sites framework, some sites using risk assessment or risk management as a remediation approach are required to review their long-term remediation plans and monitoring at specified intervals. However, the specified intervals and provisions are not consistent. Also, current provisions do not explicitly consider climate change or assess continued effectiveness of remediation considering changing climate conditions over time.

Figure 9: Remediation strategies for contaminated sites

Potential Opportunities:

- Consider requiring periodic review of sites with risk assessment or management[3] at regular intervals (e.g., every five years) and following extreme climate events (e.g., flooding, wildfire). The periodic review would consider potential changes in site contamination and vulnerability of the site's risk management strategy due to changing climate.
- Include sites with risk assessment alone (i.e., sites with in-situ contamination left in place) in requirements for periodic review, as the site conditions on which the risk assessment was undertaken may change with changes in climate.
- As part of the periodic review, consider including requirement for updating vulnerability and sustainability assessments and the conceptual site model.

Questions:

- What provisions for periodic review of sites should be considered for inclusion in B.C.'s contaminated sites framework?
- How should sites with risk management plans (i.e., sites with in-situ contamination) be monitored over time to assess changes due to changing climate?
- What elements should be included in guidance for periodic reviews?

OUTCOME 5: ESTABLISH REMEDIATION REQUIREMENTS FOR VIABLE GROUNDWATER AQUIFERS

The current contaminated sites framework specifies that drinking water use applies to viable aquifers as evaluated using criteria described in Protocol 21 (Water Use Determination). When an aquifer is classified as viable to support current or future drinking water use, site investigations must be completed to confirm if contamination is present; however, there is no requirement to physically remediate the aquifer to meet the drinking water standards. Instead, remediation can be based on risk assessment, where the risk is managed by adding institutional controls preventing the use of the aquifer for drinking water purposes. The water resource cannot be used for drinking water purposes without additional physical remediation.

Potential Opportunities:

- Consider options to require physical remediation of viable drinking water aquifers.
- Determine if viable drinking water aquifers should be classified and ranked based on the likelihood of future use (e.g., proximity to current uses, high aquifer productivity, high demand aquifer).

[3] Sites with "risk assessment or management" are those that have developed and implemented risk management plans and associated activities under the contaminated sites framework. Sites do not need to be "high risk" to have risk assessment as part of their remediation plan.

- Evaluate the use of differing remediation requirements based on aquifer classification and ranking (e.g., requiring "fast remediation" for sites with high ranking aquifers and allowing continued use of risk assessment on sites with low ranking aquifers).
- Finalize policy for using Monitored Natural Attenuation as a remediation technology.
- Consider if the ministry should require remediation of groundwater to be completed within a reasonable timeframe.
- Evaluate how to incorporate feasibility of groundwater remediation into remediation alternatives evaluation.

Monitored Natural Attenuation is a passive remediation approach that relies on natural attenuation processes within a carefully controlled site cleanup to reduce the levels of contam-inants in soil, sediment or groundwater within a time frame that is reasonable compared to that offered by other more active methods.

Questions:

- Should the ministry limit the use of risk assessment that use institutional controls preventing future use of the water for drinking water purposes?
- Should all viable drinking water aquifers be protected equally, or should remediation requirements depend on aquifer classification?
- Should sites with high-ranking aquifers be classified as high risk and require ministry oversight?
- Should the ministry impose a timeframe for remediation of differing classes of aquifers?
- What criteria should be used to evaluate feasibility and technical practicality of remediation options?

OUTCOME 6: INCORPORATE FINANCIAL SECURITY FOR SITES WITH RISK ASSESSMENT OR RISK MANAGEMENT PROVISIONS

B.C.'s contaminated sites framework includes requirements and a general approach to provision of financial security for remediation of contaminated sites (Protocol 8). Currently, financial security is applied on a case-by-case basis, generally for high risk sites. Amendments to financial security requirements are needed to ensure long-term protection of human health and the environment at sites where risk controls are in place.

Note that the Public Interest Bonding Strategy is a concurrent project led by the ministry that is looking to ensure active and new industrial projects have sufficient financial security (also known as financial assurance) in place for project owners to pay for environmental cleanup of these sites, even if they are abandoned.

Potential Opportunities:

- Review and revise financial security requirements to incorporate consideration of a changing climate, uncertainties in the prediction of future climate and site conditions, and the vulnerability of risk management plans and activities over time.
- Review existing data management practices for financial securities held across the ministry and identify integration opportunities.

Figure 10: Britannia remediation – water treatment facility

Questions:

- In what circumstances should financial security be required for contaminated sites to ensure long-term protection of human health and the environment?
- In the context of climate change, how should Protocol 8 be revised?
- Is there a need for a new form of financial security in addition to those already in use?
- How often should securities be reviewed in the context of climate change?

6. DISCUSSION QUESTIONS

Interested parties are invited to provide comment using the questions included below, or in separate submissions by:

- Using our online questionnaire; or
- Submitting comments to site@gov.bc.ca.

Note that all communications will remain confidential. However, comments and information you provide that identify you as the source may be publicly available if a Freedom of Information request is made under the *Freedom of Information and Protection of Privacy Act.*

Guiding Principles

Questions:

- What principles should guide the ministry in making contaminated sites climate ready?

Outcome 1: Incorporate engagement with Indigenous Peoples as a component of remediation plans

Potential Opportunities:

- Additional requirements will be developed to support consistent and effective engagement and consultation as a core component of B.C.'s contaminated sites framework.
- Engagement and consultation principles and communications practices, as well as obligations of responsible parties, could be included in the requirements. Requirements should support shared understandings and consideration of risk assessment relevant to the remediation alternatives and long-term monitoring of remediation activities.

Questions:

- How can engagement and communication requirements be designed to take into account Indigenous Peoples' consideration of risk assessment and remediation?

Outcome 2: Incorporate climate change adaptation in the contaminated sites framework

Potential Opportunities:

- Anticipated and/or predicted changes in site conditions under B.C.'s changing climate could be an explicit consideration as part of all contaminated site investigations and remediation alternatives evaluation.

- Where long-term remediation is proposed for a site, adaptation measures could be re-evaluated on an ongoing basis as part of risk management to ensure long-term protection of human health and the environment. This could be described as future-proofing remediation activities and plans.

Questions:

- How should adaptation to climate change be addressed in B.C.'s contaminated sites framework?

Outcome 3: Incorporate remediation alternatives evaluation more fully in the contaminated sites framework

Potential Opportunities:

- Explicitly incorporate requirements for remediation alternatives evaluation (RAE) into B.C.'s contaminated sites framework. The ministry is considering the following new concepts that could be a part of RAE:
  – vulnerability assessment and adaptation (of the site and remediation alternatives to potential future climate change);
  – feasibility and use of green and sustainable remediation methods; and
  – intergenerational equity.
- Develop guidance to support evaluation of remediation alternatives.

Questions:

- How should requirements for remediation alternatives evaluation be set out in B.C.'s contaminated sites framework?
- What process steps and criteria should be included in RAE?

Outcome 4: Incorporate periodic review of remedial actions for sites with risk assessment or risk management approaches

Potential Opportunities:

- Consider requiring periodic review of sites with risk assessment or management[4] at regular intervals (e.g., every five years) and following extreme climate events (e.g., flooding, wildfire). The periodic review would consider potential changes in site contamination and vulnerability of the site's risk management strategy due to changing climate.
- Include sites with risk assessment alone (i.e., sites with in-situ contamination left in place) in requirements for periodic review, as the site conditions on which the risk assessment was undertaken may change with changes in climate.

[4] Sites with "risk assessment or management" are those that have developed and implemented risk management plans and associated activities under B.C.'s contaminated sites framework. Sites do not need to be high risk to have risk assessment as part of their remediation plan.

- As part of the periodic review, consider including requirement for updating vulnerability and sustainability assessments and the conceptual site model.

Questions:

- What provisions for periodic review of sites should be considered for inclusion in B.C.'s contaminated sites framework?
- How should sites with risk management plans (i.e., sites with in-situ contamination) be monitored and assessed over time to assess changes due to changing climate?
- What elements should be included in guidance for periodic reviews?

Outcome 5: Establish remediation requirements for viable groundwater aquifers

Potential Opportunities:

- Consider options to revise the contaminated sites framework to require physical remediation of viable drinking water aquifers.
- Determine if viable drinking water aquifers should be classified and ranked based on the likelihood of future use (e.g., proximity to current uses, high aquifer productivity, high demand aquifer).
- Evaluate the use of differing remediation requirements based on aquifer classification and ranking (e.g., requiring fast remediation for sites with high ranking aquifers and allowing continued use of risk assessment on sites with low ranking aquifers).
- Finalize the policy for using Monitored Natural Attenuation as a remediation technology.
- Consider if the ministry should require remediation to be completed within a reasonable timeframe.
- Evaluate how to incorporate feasibility of groundwater remediation into remediation alternatives evaluation.

Questions:

- Should the ministry limit the use of risk assessment that utilize institutional controls preventing future use of the water for drinking water purposes?
- Should all viable drinking water aquifers be protected equally, or should remediation requirements depend on aquifer classification?
- Should sites with high-ranking aquifers be classified as high risk and require ministry oversight?
- Should the ministry impose a timeframe for remediation of differing classes of aquifers?
- What criteria should be used to evaluate feasibility and technical practicality of remediation options?

Outcome 6: Incorporate financial security for sites with risk assessment or risk management provisions

Potential Opportunities:

- Requirements for provision of financial security associated with contaminated sites and site remediation could be reviewed and revised to incorporate consideration of a changing climate, uncertainties in the prediction of future climate and site conditions, and the vulnerability of risk management plans and activities over time.
- Data management practices for financial securities held across the ministry could be reviewed and integration opportunities identified.

Questions:

- In what circumstances should financial security be required for contaminated sites to ensure long-term protection of human health and the environment?
- In the context of climate change, how should Protocol 8 be revised?
- Is there a need for a new form of financial security in addition to those already in use?
- How often should securities be reviewed in the context of climate change?

Thank you for your time and interest in climate preparedness and in making contaminated sites in B.C. climate ready

ANNEX A. JURISDICTIONAL SCAN – CLIMATE ADAPTATION AND SUSTAINABILITY IN REMEDIATION OF CONTAMINATED SITES

This Annex provides a summary of the first of two jurisdictional scans commissioned in 2021-2022 by the Land Remediation Section of the ministry. The scan reviewed climate adaptation and sustainable practices for remediation of contaminated sites across jurisdictions. Information was collected on how jurisdictions are considering, or have incorporated, climate change adaptation measures and sustainability principles as guidance or requirements as part of their contaminated sites cleanup process.

KEY FINDINGS

1. Incorporating sustainability principles in contaminated sites regulation

Ten of the eleven reviewed jurisdictions "either include the principle and/or definition of sustainability in their contaminated sites regulations, or provide guidance on best management practices (BMPs) for implementing sustainability or green technologies into the remediation of contaminated sites… In addition to the principle of sustainability, some jurisdictions add the principle of inter-generational equity in their regulation, which means that remediation should be completed in a timeframe that ensures the polluter bears the cost of remediation rather than future generations… [However, although] statements may be included in the respective regulations, there is no definition or follow-up requirement of a specific timeframe to complete contaminated sites remediation."

2. Sustainable site remediation

The scan found that "the type of guidance relating to sustainability [varies among the jurisdictions]… sustainability is most explicitly incorporated during the remediation planning, design and implementation phases… [Five of the reviewed jurisdictions] provide guidance on how to conduct sustainability assessments, typically during the ROE phase… As part of the [sustainability] assessment, a comparison of the footprint of each short-listed remedial option, as well as the 'no action' option, is often conducted."

3. Stakeholder and Nation to Nation (Indigenous) engagement

Seven of the eleven reviewed jurisdictions include "opportunities for public consultation and stakeholder engagement throughout the decision-making process of a contaminated site… The level of consultation is generally site-specific and varies depending on the scrutiny, risks and/or scale of the contaminated site… Australia provides [an example of guidelines that include Indigenous and stakeholder engagement] during the remediation of site contamination."

4. Incorporating climate resilience and adaptation in the contaminated sites regulatory framework

The scan found that Washington State "is the only reviewed jurisdiction which explicitly refers to climate change resilience in their contaminated sites regulation… [and] is currently working on updating [its regulations] to create a separate requirement that cleanup actions must be 'resilient to climate change impacts that have a high likelihood of occurring and severely compromising its long-term effectiveness'… Note [also] that the Canadian Council of Ministers of the Environment (CCME) released in 2021 a Guidance on Good Practices in Climate Change Risk Assessment."

5. Adaptive site closure

Eight of the eleven reviewed jurisdictions "require the implementation of long-term monitoring at contaminated sites (and impacted properties) where engineering controls (e.g., soil capping, vapour extraction system or hydraulic barrier) or institutional controls (e.g., restricted groundwater use or soil disturbance) are required to limit or reduce the risks to human health and the environment. This means that at any site where contaminants are left in place, including when monitored natural attenuation (MNA) is used as a remediation option, long-term monitoring is required." The scan found that "a periodic review of post-cleanup site conditions and monitoring data is typically required… this is referred to as the Five-year Review in USEPA and most US States."

The study found five of the eleven reviewed jurisdictions have "developed an online GIS-based tool which allows the visualization, plotting and downloading of downscaled climate change projections… and [six jurisdictions have] developed visualization tools that allow the analysis of climate change risks or impacts, or site vulnerabilities to climate change." The study noted several examples of "user-friendly GIS based tools… [including] project flooding (New Jersey), heat and flood (UK), sea level rise (California), groundwater levels, wildfires (California) and social vulnerabilities (UK)."

6. Financial insurance

The review noted that while "B.C. has the legislative tools.. for seeking financial insurance from responsible parties to ensure [that] remediation is completed to the satisfaction of [the ministry]… [only three of the eleven] reviewed jurisdictions seek mandatory insurance from the party responsible for the contamination."

ANNEX B. JURISDICTIONAL SCAN – GROUNDWATER AND REMEDIATION IN A CHANGING CLIMATE

This Annex provides a summary of the second of two jurisdictional scans commissioned in 2021-2022 by the Land Remediation Section of the ministry. The scan considered regulatory groundwater remediation requirements intended to protect current and future groundwater resources, with a focus on protecting viable drinking water aquifers. The jurisdictional scan focused on policies and legislation governing groundwater quality and remediation of contaminated sites in eleven jurisdictions in Canada, United States, United Kingdom, Australia and the Netherlands.[5] Jurisdictions selected for review included those with similar climate, geological or hydrological settings; other Canadian provinces; and jurisdictions that have considered sustainability and/or climate adaptation in their remediation requirements.

KEY FINDINGS

1. The management of groundwater quantity is intrinsically linked with the management of groundwater quality

While review of groundwater quantity management was outside of the scope of the legislative scan, it was noted that "in each of the reviewed jurisdictions (except California), the regulatory body administering groundwater quality is also in charge of managing groundwater quantity (i.e., groundwater extraction permit, sources of drinking water, watershed management, flood risks, etc.)."

2. Groundwater aquifers are frequently identified and classed in terms of "high value", "vulnerability" or "area of protection"

Seven of the eleven jurisdictions reviewed in the scan have a regulatory framework that includes differing levels of groundwater protection, based on "value" or "vulnerability" of specified aquifers, or their use as drinking water supply. "In areas where groundwater is the main source of drinking water, groundwater protection areas are defined with increasing radius of protection (e.g., Priority 1 is 500 m radius from drinking water supply, Priority 2 is 2 km radius, [etc.]) where specific land uses may be prohibited, limited or allowed but more strictly regulated."

3. Remediation of viable groundwater resources

The scan found that six of the eleven jurisdictions reviewed "require physical remediation of viable aquifers… depending on the jurisdiction, remediation of groundwater should be obtained to background levels… or [to] numerical standards… A risk assessment is often required as well to assess the exposure risk to human health and the environment."

4. Assessment of remediation options

[5] Province of Alberta, Province of Ontario, Province of Quebec, State of Washington, State of Oregon, State of California, US Environmental Protection Agency, State of New Jersey, United Kingdom, Netherlands, Australia.

Seven of the eleven reviewed jurisdictions "require a remediation option evaluation (ROE), which may have different names (e.g., 'feasibility study' in the US, or 'option appraisal evaluation' in the UK), to be completed as part of the environmental cleanup process… When required, the ROE is the key component of the remediation process… because it will determine whether it is feasible or practicable to remediate a site, and if not, what other options should be implemented to reduce the risk to human health and the environment at present and in the future."

5. Consideration of "permanent" solutions"

The scan found that "generally, the reviewed jurisdictions recognize that permanent solutions are not feasible in any and every circumstance… but rather a 'preference'… as such, an ROE should also include an assessment of how the ecosystem as a whole will be affected if each of the short-listed remedies are implemented, including greenhouse gas emissions, while trying to solve the contaminated site issue."

6. Use of monitored natural attenuation for remediation of contaminated groundwater

The scan found that "all reviewed jurisdictions allow the use of monitored natural attenuation (MNA) for remediation of contaminated groundwater, sometimes as a single remedy (i.e., only for low contamination), but generally in combination with other remedies, and always under certain conditions."

7. Use of alternative groundwater requirements

Seven of the eleven reviewed jurisdictions "use alternative groundwater requirements, usually for underground storage tanks, when the contamination is considered low risk."

8. Responsibility for control or remediation of off-site migration of groundwater

Six of the eleven reviewed jurisdictions "require a responsible party to control or remediate groundwater contamination that has migrated off-site from the source property and impacted neighbouring properties. [The responsible party is] generally required to reduce the contaminated groundwater plume to within the source property boundary, or at least demonstrate that the off-site plume is stable or shrinking and [that] long-term monitoring is in place."