



**Environmental and Social Impact
Assessment for the Troilus Mine Project**

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Environmental and Social Impact Assessment for the Troilus Mine Project

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Acronyms and abbreviations

IAAC	Impact Assessment Agency of Canada
COMEX	Environmental and Social Impact Review Committee
DPD	Detailed project description
ESIA	Environmental and Social Impact Assessment
GBA+	Gender-based analysis plus
IAA	Impact Assessment Act
LQE	Environment Quality Act
LSA	Local Study Area
MELCCFP	Ministry of Environment, the Fight Against Climate Change, Wildlife and Parks
PDA	Project Development Area
RSA	Regional Study Area
VC	Valued Component

7. Methodology

This chapter describes the methods used in the Environmental and Social Impact Assessment (ESIA) to evaluate the potential impacts of the Troilus Mine project ("the project"), which has been structured to meet the requirements of the Impact Assessment Act (IAA) and the Environment Quality Act (LQE). Methods were guided by federal and provincial regulatory requirements, with particular regard to the Directive pour le projet minier (Directive from the Ministry of Environment, the Fight Against Climate Change, Wildlife and Parks [MELCCFP]) issued in August 2022 (see Appendix A.1 of the ESIA), and the Tailored Impact Statement Guidelines for the Troilus mining project (federal guidelines) dated May 2023 (see Appendix A.2 of the ESIA).

7.1 Scope of Assessment

The scope of assessment includes selection of Valued Components (VCs) and rationale for their selection, description of temporal and spatial boundaries, identification of potential impacts, description of measurable parameters, identification of potential project interactions with VCs and proposed mitigation and enhancement measures. An assessment of cumulative impacts and a description of impacts to help characterize the extent to which impacts are significant will also be carried out.

7.2 Project Scope

The scope of the project is defined by the components and activities required for the construction and operation of the project's temporary and permanent facilities (including site preparation for construction), and decommissioning and closure of the project's site at the end of its life.

Project description is presented in Chapter 3 of the Impact Assessment. Alternative means of carrying out the project are presented in Chapter 2 of the ESIA, along with an assessment of alternatives for achieving the project objective. Mitigation measures incorporated as part of planning and design to reduce potential negative impacts are presented in Chapter 3, as well as in Chapters 8 to 25 of the ESIA. A compilation of all the mitigation measures listed in the impact study is also included in the summary of residual impacts (Chapter 27 of the ESIA).

7.3 Assessment Framework

The methodology used to prepare the impact assessment is based on a structured approach in line with international best practice in environmental impact assessment, notably the International Association for Impact Assessment's *Principles of Environmental Impact Assessment Best Practice* (IAIA, 1999), and the methodology used by Stantec for assessments of other major projects assessed under the IAA.

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The assessment methodology is structured to:

- Identify and describe project components and activities.
- Predict and evaluate potential environmental changes and possible impacts on identified VCs.
- Consider key issues raised by Indigenous communities, agencies, scientists, Troilus, stakeholders and the public.
- Incorporate technically and economically feasible measures to mitigate negative impacts and enhance positive impacts.
- Determine remaining residual impacts and describe the impact to help characterize the extent to which impacts may be significant after implementation of mitigation measures.
- Develop follow-up and monitoring programs to verify the accuracy of the impact assessment and the effectiveness of mitigation and enhancement measures.

The methodology focuses on identifying and assessing the project's potential negative impacts on VCs.

Throughout project planning, Troilus implemented design measures and proposed management strategies to avoid or reduce the project's potential negative impacts. The impact assessment methodology used in preparing the ESIA is based on a cautious and conservative approach. Conservative assumptions were generally applied to overestimate rather than underestimate potential negative impacts. Certain aspects of the project were carefully considered and planned to avoid or reduce impacts. The level of confidence in the conclusions of the assessment of potential impacts is discussed in the chapter for each VC (Chapters 8 to 24), and inherent gaps, assumptions and uncertainties are identified.

Consideration and integration of indigenous knowledge was an integral part of the preparation of the impact assessment. Community and indigenous knowledge gained through public participation and engagement with indigenous groups and shared with Troilus was integrated into the ESIA. Chapter 4 of the ESIA includes a description of the methodology used to engage indigenous groups.

7.3.1 Influence of Consultation and Engagement on the Assessment

The preparation of this ESIA and, subsequently, the impact assessments were influenced by Troilus' engagement with potentially affected Indigenous groups, agencies, stakeholders and the public.

Each VC chapter (Chapters 8 to 24) provides a summary of the key information, including indigenous knowledge, and concerns identified through engagement efforts. It also summarizes the influence that the results of this engagement have had on the assessment.

7.3.2 Gender-based Analysis Plus

Federal guidelines require a Gender-Based Analysis Plus (GBA+) to determine how subpopulations and subgroups within the Local Study Area (LSA) and Regional Study Area (RSA) may be disproportionately impacted by the project. Sub-populations and sub-groups may include women, indigenous groups, visible

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minorities, people with disabilities, youth and the elderly, among others, as well as groups with an intersection of these characteristics.

Qualitative and quantitative data were used to describe baseline conditions in diverse or distinct subgroups, where GBA+ factors may be relevant to understanding the impacts of a particular VC. Following a review of environmental conditions, GBA+ was integrated into the overall impact assessment for the applicable VCs (see section 7.7), and appropriate mitigation and monitoring measures were identified when necessary.

7.4 Selection of Valued Components

7.4.1 Definition of a Valued Component

The Impact Assessment Agency of Canada (IAAC) defines a VC in the ESIA as follows:

"Environmental, health, social, economic and possibly other elements of the natural and human environment that are identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic significance."

As the federal guidelines emphasize, VCs are elements that are of particular importance or value to participants and are likely to be affected by the project. The value of an element is not only linked to its role, but also to the value people place on it.

7.4.2 Using Valued Components in the Impact Assessment Process

VCs are a tool used to measure the potential environmental and social impacts of a project. Given the large number of elements of the natural and human environment (e.g. species, habitats) that could be found in the vicinity of the project, the ESIA focuses on those elements deemed to be of some importance. Considerations relating to the selection of VCs for the project are detailed in section 7.4.5.

7.4.3 Factors Considered when Selecting Valued Components

The following factors were considered when selecting VCs:

- Regulatory guidelines and requirements, such as those included in the MELCCFP directive and federal guidelines.
- Concerns raised by Indigenous groups, the public, federal, provincial and municipal authorities or other stakeholders, and the potential for positive or negative impacts on their concerned VC.
- The extent to which the VC relates to indigenous interests or the rights of indigenous peoples, and whether an indigenous community has requested the VC.
- The presence of VCs in the project area; Project Development Area (PDA), Local Study Area (LSA) and Regional Study Area (RSA).
- Can the project's potential impacts on a VC be measured and/or controlled, or would they be better determined by assessing another VC, for example, health.

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- Existing environmental conditions in the PDA and the interconnections between the physical, biological and human components of the environment.
- The extent to which the potential impacts of the project and related activities are likely to interact with the VC.
- The extent to which the VC may be affected by other past, existing or future projects, activities or natural processes.
- The potential for a significant contribution to sustainability.
- Information from any ongoing or completed regional or strategic assessment processes.
- Experience and lessons learned from similar mining projects.
- Expert opinion or professional judgment.

7.4.4 Valued Component Selection Process

During the preparation of the detailed project description (DPD), Troilus began compiling a list of potential VCs that could be applied to the project. This selection considered comments and concerns raised during consultation and engagement activities. A summary of these activities is available in the DPD (IAAC, 2022a). They continued during the preparation of the ESIA (see Chapter 4).

The components identified in section 7.2 of the federal guidelines are important to consider in the assessment, as well as the biological, health, social and economic conditions specified in sections 8 to 11 of the federal guidelines were considered (Appendix A.2 of the ESIA). The elements identified in section 5.1 of the MELCCFP directive were also taken into account (Appendix A.1 of the ESIA). Troilus also consulted the COMEX in September 2023 on the issues and VCs selected for the ESIA.

7.4.5 Selected Valued Components

The following VCs have been identified for assessment as part of the impact analysis:

- Atmospheric environment, including air quality and light.
- Climate, including greenhouse gas emissions and carbon sinks.
- Acoustic environment, including noise and vibration.
- Surface water quality, including quantity and quality of surface water and geochemistry.
- Groundwater quality, including quantity and quality.
- Vegetation, Riparian and Wetland Environment, including banks (no plant species with special designation listed).
- Fish and fish habitat (no species with special designation listed).
- Terrestrial and avian fauna, including mammals, herpetofauna and avifauna, as well as species with special designation.
- Land and resource use.

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- Infrastructure and services.
- Economic conditions.
- Health, including biophysical components of health and social determinants of health
- Landscape.
- Rights and interests of the Cree, including their physical and cultural heritage, current use of lands and resources for traditional purposes, health, social and economic conditions and rights.

Archaeological resources were not included as a Valued Component. In fact, the PDA has been the subject of archaeological studies (Chapter 5 of the ESIA). Excavations were carried out in areas with archaeological potential. A new prehistoric archaeological site (EfFp-1) was discovered in the future southwest pit, consisting of a single artifact (a biface blank made of local rhyolite). No other archaeological evidence was found. The artifact will be turned over to the Laboratoire et Réserve d'archéologie du Québec. It may subsequently be transferred to the Aanischaaukamikw Cultural Institute. The mining project can therefore continue without any archaeological constraints. Should any archaeological remains be discovered during subsequent work, Troilus will implement mitigation measures. Work will be stopped immediately, and the person responsible for the work will notify the Ministère de la Culture et des Communications. Work will be suspended until the Ministry gives authorization to continue.

7.5 Boundaries

7.5.1 Spatial Boundaries

The spatial boundaries of the assessment were chosen on the basis of the geographical extent over which project activities and their impacts on VCs are likely to occur, as well as other ecological, technical, social and indigenous knowledge considerations.

Three geographical areas were defined for the assessment of the selected VCs:

- Project Development Area (PDA): encompasses the project footprint and is the anticipated area of physical disturbance associated with project construction, operation, decommissioning and closure.
- Local Study Area (LSA): area in which project-related impacts (direct or indirect) can be predicted or measured with a significant level of accuracy and confidence. LSA encompasses the PDA and is specific to the VC, as it is based on the possible geographical extent from which project-related impacts can be predicted.
- Regional Study Area (RSA): the area that sets the context for determining the significance of project-specific impacts. It is also the area within which potential cumulative impacts - the residual impacts of the project combined with those of past, present and reasonably foreseeable projects - may extend. RSAs include the PDA and VC-specific LSAs, where applicable.

VC-specific LSAs and RSAs are described and illustrated in each VC chapter (chapters 8 to 24).

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7.5.2 Temporal Boundaries

The temporal boundaries of the assessment concern potential impacts during the construction, operation and decommissioning phases of the project over relevant time scales. These temporal boundaries are used for the assessment of residual impacts and are also considered applicable to the assessment of cumulative impacts. Temporal boundaries apply to all VCs.

The temporal scope of the assessment includes all phases of the project, from the start of construction to the end of closure. Based on the current project schedule, the project phases are as follows:

- Construction (year -3 to year -1)
- Operation
 - Operating phase 1 (years 1 to 21): milling with ore extraction
 - Operation phase 2 (year 22): milling without ore extraction
- Decommissioning and closure
 - Active closure (years 22 to 24)
 - Passive closure (year 24+)

Chapter 3 of the ESIA provides a detailed description of the project components and activities planned for each phase.

7.6 Description of Existing Conditions

Existing conditions for each VC are established on the basis of data collected during baseline studies including literature reviews, field inventories, consultation and engagement, and indigenous knowledge. An overview of the existing environment is presented using current information on existing conditions. The influences of past and present projects and activities on VCs to date are presented, along with a discussion of the current state of each VC. A portrait of existing conditions is presented in Chapter 5 of the ESIA, and a more detailed description is provided in each VC chapter (Chapters 8 to 24).

7.7 Impact Assessment Methodology

7.7.1 Identification of Potential Impacts and Measurable Parameters

For each VC, one or more measurable parameters were selected to facilitate the measurement of the project's potential impacts and interactions with the environment and social environment, depending on the nature and scope of that VC. When available, indigenous knowledge was considered in determining existing conditions and identifying potential impacts and project interactions. Existing conditions were generally considered as a reference point against which potential impacts were measured. This highlighted the changes that existing conditions would undergo as a result of the project.

For each VC, the potential impacts and their pathways, as well as the measurable parameters, are presented in a table as shown in the following table.

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Table 7.1 Example of Potential Impacts and Measurable Parameters table

Potential Impact	Impact Pathway	Measurable Parameters and Unit of Measurement
Impact 1	Pathway 1	Measurable parameter 1 Measurable parameter 2
	Pathway 2	Measurable parameter 1 Measurable parameter 2
Impact 2	Measurable parameter 1	Measurable parameter 1 Measurable parameter 2
	Measurable parameter 2	Measurable parameter 1 Measurable parameter 2

The scope of the factors considered in the ESIA is detailed for each VC in its respective chapter, which includes a description of the methods and measurable parameters that were used to assess the VC and meet the requirements defined in the federal guidelines and the MELCCFP directive (appendices A.1 and A.2 of the ESIA).

7.7.2 Potential Project Interactions with Valued Components

For each VC, a table is used to assess the potential interactions between the environment and social milieu and the proposed project activities and components, as described in Chapter 3 of the ESIA. The physical activities likely to interact with the VC are listed for each project phase. For each potential impact, physical activities likely to interact with the VC are listed by project phase, and symbols are used to indicate potential interaction or absence of interaction. If no interaction or associated impact is anticipated, further assessment of the interaction is considered unnecessary. If an interaction may occur or may result in an impact of concern, further assessment is justified and provided in the corresponding section of the VC impact assessment. An example of a table of potential project interactions is provided in Table 7.2.

Table 7.2 Example of a Project Interactions table

Physical Activities	Potential Impacts (before mitigation)			
	[Impact 1]	[Impact 2]	[Impact 3]	[Impact 4]
Construction				
[Activity 1]	-	-	√	√
[Activity 2]	√	√	-	√
Operation				
[Activity 1]	√	-	√	-
[Activity 2]	-	√	√	√
Decommissioning and Closure				

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Physical Activities	Potential Impacts (before mitigation)			
	[Impact 1]	[Impact 2]	[Impact 3]	[Impact 4]
[Activity 1]	√	√	-	√
[Activity 2]	-	√	√	√

Notes:

- √ = Potential interaction
- = No interaction

7.7.3 Pathway Assessment

For each potential impact, the specific project activities likely to interact with the VC and result in an environmental impact (i.e. a measurable change likely to affect the VC) are identified and described. The pathway assessment is presented in the various chapters of the VC assessment. Components and activities that do not interact with the VC are also identified, and the reason for the lack of interaction is explained.

7.7.4 Mitigation and Enhancement Measures

Mitigation measures that will avoid, eliminate, reduce or control potential impacts, and enhancement measures that will increase positive impacts, are identified and described for each VC. Mitigation and enhancement measures that are technically and economically feasible and constitute standard practice have been taken into account in assessing the impacts of the project. Mitigation and enhancement measures may also include VC-specific measures to alleviate VC-specific problems (e.g. habitat compensation, replacement or planned environmental management and intervention measures). Proposed mitigation and enhancement measures are identified in each chapter of the VC (Chapters 8 to 24).

7.7.5 Characterization of Residual Impacts associated with the Project

Once the environmental, health, social and economic impact trajectories and mitigation measures have been analyzed, the residual impacts (i.e. the impacts remaining after mitigation measures have been applied) are described. The characterization of residual impacts (i.e. the severity of impacts) is based on the following impact attributes, which, if available and relevant, can be combined with or replaced by quantitative thresholds or reference criteria:

- Direction: the relative change compared to existing conditions (e.g. positive, adverse).
- Magnitude: the extent of change of a measurable parameter or variable compared to existing conditions, defined qualitatively for each VC (e.g. not measurable, low, moderate, high), or quantitatively, where applicable.
- Geographical extent: the geographic area where the residual impact occurs (e.g. PDA, LSA or RSA).
- Timing: Considers when the residual impact is expected to occur, where relevant to the VC, in an assessment of sensitivity, including high (e.g., critical life stage of a species or culturally significant

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period such as a festival), moderate (e.g., impact may occur at the beginning or end of a critical period), or no sensitivity (not during a critical life stage or timing has no bearing on the VC);

- Duration: the time required for the measurable parameter to return to its initial state, or for the residual impact to cease to be measurable or perceivable in any other way (e.g. in the short, medium or long term).
- Frequency: indicates how often the residual impact occurs and how often during the project or a specific phase of the project (e.g.: a single event, multiple irregular events, multiple regular events, continuous).
- Reversibility: this refers to whether a measurable parameter or VC can be returned to its initial state after the end of the project activity (e.g.: reversible or irreversible).

The unique environmental, health, social and economic characteristics or value of a sector, community or ecosystem likely to be affected by the project, or the importance of VC to the functioning of an ecosystem or community of people (resilience) provides a context that considers existing conditions as well as the results of engagement and traditional knowledge.

The above definitions of each term are the default definitions for all VCs but may be modified for some VCs to improve contextualization. A summary of the characterization of residual impacts for each VC is provided in the corresponding VC chapters (chapters 8 to 24). An example of a summary table is provided in Table 7.3.

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Table 7.3 Example of a Residual Impacts table

Residual Impact	Residual Impact Characterization							
	Project phase	Direction	Magnitude	Geographic extent	Timing	Duration	Frequency	Reversibility
Impact name 1	C, O	A	L	LSA	MS	ST	IR	R
Impact name 2	O, D	P	M	RSA	NS	MT	R	I

Project Phase
 C: Construction
 O: Operation
 D: Decommissioning and closure

Direction:
 P: Positive
 A: Adverse

Magnitude:
 NMC: No Measurable Change
 L: Low
 M: Moderate
 H: High

Geographic Extent:
 PDA: Project Development Area
 LSA: Local Study Area
 RSA: Regional Study Area

Timing
 NS: No sensitivity
 MS: Moderate sensitivity
 HS: High sensitivity

Duration:
 ST: Short-term
 MT: Medium-term
 LT: Long-term
 N/A: Not applicable

Frequency:
 S: Single event
 IR: Irregular event
 R: Regular event
 C: Continuous

Reversibility:
 R: Reversible
 I: Irreversible

7.7.6 Characterization of the Extent of Adverse Impacts

Adverse impacts are characterized using a ranking system of negligible, low, moderate or high, as described in the IAAC guide: Impact Description and Significance Characterization (IAAC 2023a).

Negligible or low: impacts are likely to be of negligible or of lesser significance if they are of negligible or low magnitude, of short duration, infrequent, of small geographic extent, reversible or easily avoidable, and to generate few or minor impacts in social or ecological contexts. Mitigation measures will allow existing conditions to remain largely unchanged.

Moderate: Impacts are likely to be of moderate significance if they are of moderate magnitude, moderate duration, occasional, possibly/partially reversible and generate a moderate level of impact in social or environmental contexts. Mitigation measures may not fully eliminate, reduce, control or compensate for impacts, but should enable affected communities to maintain their economic and social well-being, and should prevent the diminution or loss of key elements of the environment and its ecologic functions.

High: Impacts are likely to be of high magnitude if they are large, permanent/long-term, frequent, irreversible and extend over a large area or into an area of exclusive/preferred indigenous use or ecologically/environmentally sensitive. High levels of impact in social or ecological contexts are expected. There is a high degree of uncertainty about the effectiveness of mitigation measures, or mitigation measures are unable to fully address impacts, so that VC are diminished or lost.

While the above describes the final basis for the assessment and conclusion of scope of significance, these rankings are based on the previous results of the characterization of the project's residual impacts described above in section 7.7.5. This "sliding scale" of significance (i.e. on a spectrum from low to high) takes into account references (e.g. thresholds, standards, guidelines, descriptors or objectives, where they exist), criteria (e.g. magnitude, geographic extent, timing, frequency, duration, reversibility and uncertainty) and environmental, health, social and economic conditions specific to each VC. It should be noted that a conclusion on the impact attribute of "high" magnitude does not necessarily mean a "high" conclusion on the extent of significance, since the latter depends on a wider set of considerations.

When thresholds are not set by guidelines or regulations, a threshold is developed using the measurable parameters established for the VC, as well as the professional judgment of the evaluators. Thresholds define the limits of change in a measurable parameter or VC condition beyond which the degree of importance in the ranking system is determined, based on resource management objectives, community standards, scientific literature or ecological processes (e.g., desired states for habitats or fish or wildlife populations). Quantitative thresholds are preferred, but qualitative thresholds of importance may be used in the absence of quantitative thresholds. Reference points are established prior to analysis.

The value attributed to the impact by indigenous community and the public is also taken into account, and conclusions about impact significance are based on a reasonable assessment of all the evidence and justification provided.

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7.7.7 Confidence in Predictions

The characterization of residual project impacts and residual cumulative impacts includes a discussion of the level of confidence in the prediction. Confidence in prediction is based on professional judgment, previous experience and scientific certainty regarding:

- The quality and quantity of data and understanding of pathways.
- Known or estimated effectiveness of proposed mitigation measures.

7.8 Cumulative Impacts

Cumulative impact assessment identifies and addresses residual adverse impacts of the project that are likely to interact in a cumulative manner to result in changes to the environment, health, social, cultural and economic conditions when the residual impacts of the project combine with the impacts of other existing, past and reasonably foreseeable projects and physical activities. The approach used to carry out the assessment of the project's cumulative impacts is based on the Strategic Framework for Cumulative Impact Assessment under the IAA (IAAC, 2023b) and on federal guidelines and the MELCCFP directive.

The assessment considers historical site activities, past conditions recognized for their contribution to current conditions, which combined (past and current) represent the conditions against which potential additional cumulative impacts are assessed. Past and current project impacts relative to pre-project conditions contribute to these baseline conditions against which project impacts are assessed. Pre-project conditions are generally considered to be similar to the currently undisturbed areas of the RSA for each VC. Changes in the intervening period (e.g. from the start of site activities to the present day), if any, are reflected in the description of existing conditions for each VC. These existing conditions form the basis for determining the residual impacts and cumulative impacts associated with the project.

Future projects and activities included in the cumulative impact assessment include those that are considered certain and reasonably foreseeable, i.e. those that have been publicly announced with a defined project implementation period and sufficient detail to enable a meaningful assessment, that are currently the subject of an impact assessment/environmental assessment or permitting process, that are identified in an approved development plan, or that are approved and under construction (but not yet operational).

Two conditions must be met to initiate a cumulative impact assessment on a VC:

- The project is considered to have residual negative impacts on a VC.
- The project's residual negative impacts may overlap in space and time with the residual impacts of other physical activities on a VC.

If either of these conditions is not met, the cumulative impact assessment will not be carried out. The temporal overlap between the residual impacts of the project and the residual impacts of other physical activities on a VC takes into account the project phases and temporal boundaries described in section 7.5.

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Cumulative impact assessment follows the same iterative process and format used for project impacts: analysis and determination of pathways, identification of potential mitigation and enhancement measures, impact description, followed by impact characterization. The cumulative impact assessment also drew on information from engagement activities and regulatory bodies. The results of the cumulative impact assessment are described in Chapter 25 of the impact study.

7.9 Follow-up Programs

After the determination of significance, follow-up and monitoring programs are recommended to verify impact predictions or to assess the effectiveness of proposed mitigation measures. Appropriate monitoring is proposed to feed adaptive management (chapter 30). The sharing of information obtained from indigenous community as part of the consultation process (discussed in Chapter 4 of the ESIA) has been used to support the follow-up and monitoring program presented in the impact assessment. These programs will form part of the environmental management and monitoring system for the project.

If the monitoring or follow-up programs detect impacts different from those predicted, or the need to improve or modify design features, adaptive management will be implemented. This may involve increased monitoring, modifications to plans or additional mitigation measures.

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7.10 References

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