11. SUMMARY OF PROPOSED ENVIRONMENTAL AND OPERATIONAL MANAGEMENT PLANS

11.1 ENVIRONMENTAL MANAGEMENT SYSTEM

11.1.1 Introduction

This chapter describes the Environmental Management System (EMS) that KGHM Ajax Mining Inc. (KAM) will use to support undertaking the proposed Ajax Project (the Project) in a sustainable manner conforming to recognized practices and standards for environmental management.

As guided by the KGHM International Environmental Policy, KAM believes that protection of the natural environment is fundamental to the success of its operations and projects. Emphasizing its core value of "Zero Harm", KAM will use environmental and natural resource management tools and practices to minimize environmental risk during the evaluation, exploration, planning, design, construction, operation and closure phases of the Project.

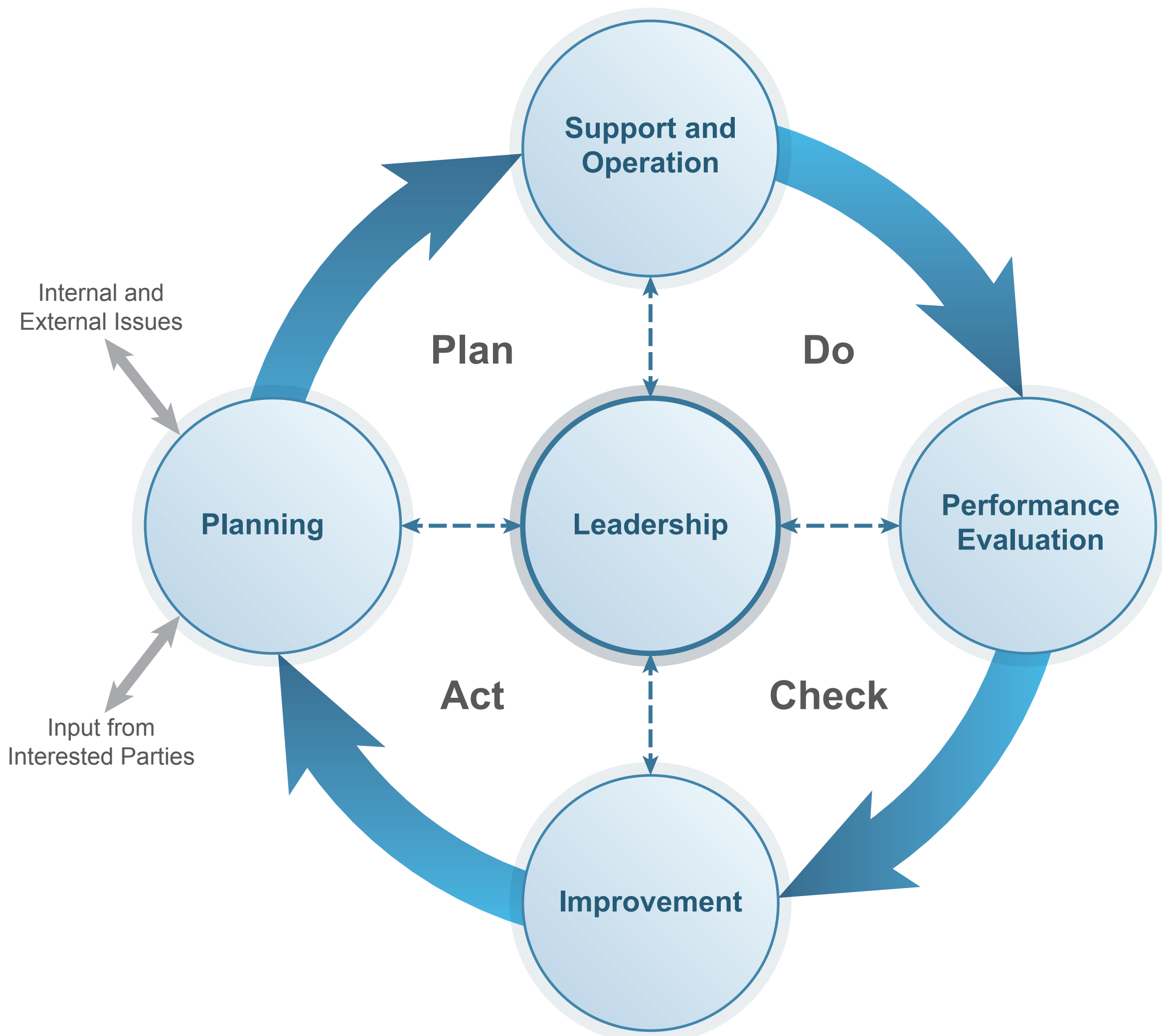
An EMS is a requirement of the *Mines Act* permit for mines in BC, and must be based primarily on *Mines Act* (1996) and *Environmental Management Act* (2003) requirements. It provides the high-level framework to manage the Project's environmental risks and opportunities in a comprehensive, systematic, planned and documented manner. This framework includes the organizational structure, planning and resources for developing, implementing and maintaining minimum environmental performance and compliance expectations for the Project. The EMS is the overall framework within which EMPs and other environmental programs are developed, implemented, and maintained during Construction, Operation, Decommissioning and Closure and Post-Closure stages of the Project.

The Project is committed to developing, implementing, and maintaining its EMS and continually improving environmental performance in accordance with industry recognized standards at each stage of the mining lifecycle. The Project's EMS is developed in alignment with the the internationally recognized ISO 14001 standard for environmental management systems and the Mining Association of Canada Towards Sustainable Mining requirements. Many of the Project's Environmental Management Plans are prepared to comply with the Towards Sustainable Mining standards and the EMS will help to manage implementation and continual improvement.

11.1.2 KAM Environmental Management System

The EMS functions as a series of standards that outline the minimum expectations and interrelated processes to effectively control environmental risks and opportunities. These standards and their associated detailed plans, programs and procedures provide the documented framework that supports consistent integration of the EMS into the Project. The basis for the environmental management framework is founded on the concept of Plan, Do, Check, and Act (PDCA) and is shown in Figure 11.1-1. The PDCA model is an iterative process used to achieve continual improvement in process and performance. Each of the PDCA components is described below:

Figure 11.1-1
Environmental Management System "Plan, Do, Check, Act" Model



- **Plan:** establish objectives and processes necessary to deliver results in accordance with the KGHM International Environmental Policy.
- **Do:** implement the EMS processes.
- **Check:** monitor and measure processes against the Environmental Policy, objectives, compliance obligations, and operational controls, and report the results.
- **Act:** take actions to continually improve.

The EMS guides environmental management across the entire lifecycle of the Project and is progressively developed as the Project moves through the Application/EIS, permitting, construction, operations, closure and and post-closure stages. The first stage of EMS development begins with preparation of the Environmental Management Plans (EMPs) as part of the Application/EIS. The EMPs are commitment-based and broad in their level of detail. As the Project progresses to the permitting stage, the level of detail of the EMPs are expanded upon as more Project details are known. For the construction phase of the Project, the EMPs form the basis for what will be managed as part of the Construction Environmental Management Plan (CEMP) and are organized using the systematic PDCA model. This same PDCA model is used to manage environmental risks and opportunities during the operations, closure and post-closure phases of the Project.

The EMS provides the framework, including minimum standards and management processes to manage and monitor potential environmental effects. The scope of the EMS is informed by the needs of interested parties and internal and external risks and considerations that have the potential to affect the Project. Each major component of the environmental management system is summarized in the following sections.

11.1.2.1 Policy and Leadership

<u>Policy</u>

The KGHM International Environmental Policy (November 1, 2012; KGHM 2012) applies to the Project and is a publically available document that emphasizes the Project's core value of Zero Harm to the environment. The Environmental Policy states:

> *KGHM International believes that environmental protection for the natural environment is fundamental to the success of our operations and projects. Emphasizing our core value of "Zero Harm", we will use environmental and natural resource management tools and practices to minimize environmental risk during the evaluation, exploration, planning, design, operation and closure phases of new and existing projects.*
>
> *KGHM International line management is accountable for providing environmental leadership by measuring performance against recognized industry standards and communicating commitments and results to employees, contractors, local communities, regulators, and the general public. Environmental professionals and committees will support the drive to "Zero Harm" to create workplaces where everyone personally commits to a culture of environmental protection.*

In fulfilling our commitment to "Zero Harm" we will:

- *Develop, implement and regularly evaluate environmental management systems to continually improve performance, consistent with defined objectives and targets.*
- *Prevent and minimize environmental impacts.*
- *Respond to public inquiries regarding environmental matters in an open and forthright manner.*
- *Meet or exceed all environmental laws and regulations and other requirements to which we subscribe.*

Leadership and Commitment

All those working at KAM, or on its behalf, have a responsibility for meeting the Project's environmental goals. Senior Management demonstrates their leadership and commitment with respect to the environmental management system by:

- ensuring that the environmental policy and objectives are compatible with the strategic direction of the Project;
- giving consideration to environmental performance in strategic planning;
- ensuring the integration of the EMS requirements into business processes;
- ensuring the resources needed for the EMS are available;
- communicating the importance of effective environmental management and of conforming to EMS requirements;
- ensuring that the environmental management system requirements are fulfilled and achieves its intended outcome(s) are achieved;
- directing and supporting persons to contribute to the effectiveness of the EMS; and
- promoting continual improvement.

Roles, Responsibilities, and Authorities

Roles, responsibilities and authorities for relevant roles within the EMS are assigned and communicated within the Project organization, including ensuring that the EMS conforms to recognized practices and standards for environmental management, and reporting on the status of the EMS, and its resulting environmental performance, to Senior Management and the public, as needed.

The President and Board of Directors (BoD) of KGHM have the ultimate responsibility for environmental management, both in terms of statutory compliance as well as corporate citizenship, and will direct, instruct, and approve the execution of such management for the Project.

The Mine Manager has overall responsibility for the construction and operation of the Project, and responsibility for onsite environmental monitoring and compliance relating to construction activities. The Mine Manager reports to the President/BoD and coordinates with the corporate Vice

President, Environmental and Regulatory Affairs to ensure that objectives and compliance reporting are being met.

The Project's Environmental Manager will ensure an effective EMS is developed, implemented, and maintained through planning, oversight, monitoring, awareness training, and reporting. The Environmental Manager will be supported by dedicated KAM Environmental Engineers and Environmental Technicians assigned to defined tasks as required.

Refinement and confirmation of roles and responsibilities will emerge as the permitting process progresses.

An Independent Environmental Monitor (IEM) will be employed by KAM to complete regular site inspections and provide a report on their observations. The IEM's reports will be provided to the Environmental Manager, and also to regulatory agencies, as required by permits/authorizations.

11.1.2.2 Environmental Risks and Opportunities

Risk management is the cornerstone on which the EMS is built. The system defines environmental risk management processes to identify and assess risks, and establish the controls needed to effectively manage them. Control measures focus on risk elimination or mitigation to a level as low as reasonably practicable. Risk mitigation may come in the form of engineering controls, training requirements, operating standards, contingency planning, monitoring programs, compliance evaluation and audit and inspection requirements.

Risk management processes are applied throughout the Project lifecycle and are a critical component to continual improvement of environmental performance. Risks and opportunities are assessed, prioritized, and managed as appropriate according to the nature, scale, and impacts of the Project's operations and activities. Acknowledging the interrelated nature of environmental risks, the risk assessment and management process involves cross-functional teams, including employees, contractors and other stakeholders as appropriate, to ensure mitigation measures are effective as possible. Assurance programs, such as frequent inspections and audits, are used to ensure the effectiveness of risk control measures.

Environmental risks are recorded and maintained in a risk register. The register is reviewed and updated regularly, including when operational and management changes are applied and post incident investigation. Risks are evaluated by the appropriate level of management, commensurate with the significance of the risk.

11.1.2.3 Compliance Obligations

Procedures for the identification of compliance obligations related to environmental risks and the relevant requirements of its interested parties are implemented and maintained as part of the EMS. This information is documented, reviewed and updated on a regular basis, including a register of compliance obligations. Awareness and orientation training, along with other communications is used to ensure compliance obligations are understood by KAM employees, contractors and other stakeholders.

11.1.2.4 Environmental Objectives and Plans

Objectives and targets are established to drive continuous improvement in environmental performance and are consistent with the overall strategic goals of the Project and the Environmental Policy. Objectives are measurable (if practicable), monitored, communicated, and updated as appropriate. When planning how to achieve its environmental objectives, KAM will determine the required actions, resources, responsibilities, timelines, how they will be integrated into existing business processes, and how the results will be evaluated.

11.1.2.5 Competency and Training

Those working for KAM, or on its behalf, have the necessary competence to perform activities that may affect the Project's environmental performance. Competency is based on appropriate education, training, or experience. A competency needs assessment based on the roles and responsibilities of the individual identifies training needs and appropriate training will be provided. Records of training, including regulatory-required training, will be kept and maintained as evidence of competence.

When the results of the environmental risk assessment determine the need for operating procedures or specific training as a means of control for significant risks, specific training strategies/programs will be developed to ensure appropriate controls are implemented as intended.

Environmental awareness training is currently provided as a component of the site Environmental Health and Safety (EHS) orientation program. All individuals working for, or on behalf of, KAM are required to undertake the site-specific EHS orientation program. As a component of the four-hour EHS orientation session, the environmental awareness component includes communication of relevant compliance obligations, significant environmental aspects/risks, and associated programs and procedures in place to manage environmental risks. As the Project moves into the construction and operations phases, the orientation materials will be updated to include further specific details on mitigation of relevant environmental risks.

11.1.2.6 Communication

When planning its internal and external communications regarding environmental management, KAM takes into account the requirements of relevant interested parties, including but not limited to employees, contractors, regulators, and stakeholders. The EMS defines the frequency, methods and tools of communication. Environmental management system requirements will ensure internal and external communications are transparent, appropriate, credible, clear and reliable.

11.1.2.7 Operational Planning and Control

Processes are planned, implemented and controlled to meet environmental policy commitments, achieve objectives and targets, comply with statutory and corporate requirements and manage significant environmental risks. Effective and efficient operational controls are established throughout the lifecycle of the Project and are maintained and evaluated periodically for their continuing effectiveness. Operational controls can take various forms, such as procedures, work instructions, physical controls, training, or any combination of these. The choice of the specific control method depends on competency requirements and complexity of the operation risk significance. Once operational controls have been established, monitoring activities are implemented to ensure the continuing application and suitability of these controls, as well as the effectiveness of the controls and plans to improve them if needed.

11.1.2.8 Emergency Preparedness and Response

Potential emergency situations and accidents that can have adverse environmental impacts are identified so that Project-specific emergency preparedness and response plan(s) can be developed, implemented and maintained. Procedures and resources are in place to effectively respond to, report, and investigate significant environmental incidents and emergencies. The documented Emergency Response Plan defines resources and responses, including mitigating effects, which are tested and maintained. Emergency preparedness is addressed in a purpose-designed EMP in Section 11.14, Emergency Response Plan.

11.1.2.9 Monitoring, Measurement, and Performance Evaluation

The EMS processes used to manage environmental risks and opportunities, and the resulting performance, are measured, monitored, evaluated, and reported. The status and effectiveness of EMS implementation will be monitored through regular reviews and formal audits.

Monitoring programs are in place to provide assurance of the desired implementation and effectiveness of monitoring and measurement activities, and address:

- monitoring and measurement activities identified in Environmental Management and Monitoring Plans;
- key characteristics necessary to assure compliance obligations are met;
- operational controls used to control environmental risks;
- verification of the proper use and maintenance of monitoring and measurement equipment; and
- progress towards the Project's environmental objectives, using determined indicators.

Monitoring program results may trigger the need to reassess risks and opportunities and actions to prevent or correct identified deficiencies. This performance information is analyzed and used as an input to the management review for the evaluation of the effectiveness of the environmental management system.

The environmental information and data that is collected through monitoring and measurement activities is managed and integrated into management processes using an information management system.

11.1.2.10 Continual Improvement

Continual improvement is a key attribute of an effective EMS and it is accomplished through the progressive achievement of environmental objectives and enhancement of the management system processes. Ensuring continual improvement is the responsibility of KAM senior management, which conducts formal reviews of the EMS to evaluate its continuing suitability, adequacy and effectiveness. When opportunities for improvement are identified, they are evaluated to determine the actions to be taken. These actions are planned, and changes to the EMS are implemented in accordance with those plans.

11.1.3 Environmental Management and Monitoring Plans

The Project's management and monitoring plans, collectively referred to as Environmental Management Plans (EMPs), make up a fundamental component of the EMS that detail environmental conservation and protection measures to mitigate potential environmental effects. The EMPs describe the environmental practices and procedures to be applied during the planning, construction, operation, closure and post-closure phases of the Project. Additionally, the Ajax Project Application Information Requirements / Environmental Impact Statement Guidelines approved by the British Columbia Environmental Assessment Office (BC EAO; 2015), indicates EMPs are a key part of the EMS.

The EMPs are managed collectively under the umbrella of the EMS and its defined management processes. Individual EMPs describe management activities which are aligned with the PDCA model of the EMS, including guidance on addressing risks, identifying objectives, implementing processes and procedures, monitoring and measurement activities (Table 11.1-1.). As a condition of membership with the Mining Association of Canada, KAM is required to meet the requirements of the Towards Sustainable Mining protocols and frameworks. The requirements of the following Towards Sustainable Mining protocols and frameworks will be integrated into relevant EMPs:

- Aboriginal and Community Outreach;
- Energy and GHG Emissions Management;
- Tailings Management;
- Biodiversity Conservation Management;
- Safety and Health;
- Crisis Management; and
- Mine Closure.

The monitoring and management plans included in the Application/EIS are listed below, according to the following categories:

- Operational Management and Monitoring Plans:
  - Erosion and Sediment Control Plan,
  - Soil Salvage and Handling Plan,
  - Construction Waste Management Plan,
  - Metal Leaching and Acid Rock Drainage Management Plan,
  - Air Quality Monitoring and Dust Control Plan,
  - Water Management and Hydrometric Monitoring Plan,
  - Contaminated Sites Management Plan,

  - Solid Waste Management Plan,
  - Hazardous Waste Management Plan (including liquid effluent disposal),
  - Explosives Management Plan,
  - Risk Management Plan (Accidents and Malfunctions; including potential effects on the Kinder Morgan pipeline),
  - Natural Hazards Management Plan (e.g., landslides, floods),
  - Emergency Response Plan,
  - Fire Hazard Abatement Plan,
  - Spill Contingency Plan,
  - Invasive Plant Management Plan,
  - Archaeological Sites Management Plan,
  - Dark Sky Management and Monitoring Plan,
  - Transportation Management Plan,
  - Access Management Plan, and
  - Noise Management Plan.
- Environmental Effects Monitoring Plans:
  - Surface Water Quality Management and Monitoring Plan, and
  - Groundwater Quality Management and Monitoring Plan.
- Biodiversity Management Plans:
  - Fisheries and Aquatic Life Monitoring Plan,
  - Landscape Design and Restoration Plan,
  - Wildlife and Vegetation Monitoring Plan (including metal uptake by plants), and
  - Reclamation and Closure Plan.

Table 11.1-1. Environmental Management Plan Categories

EMP Category	Description
Operational Management and Monitoring Plans	Address management and/or monitoring Project environmental effects related to activities occurring within the mine site footprint.
Environmental Effects Monitoring Plans	Address management and/or monitoring Project environmental effects from mine site activities that have the potential to extend effects off-site.
Biodiversity Management Plans	Address planning, management and/or monitoring activities, over the mine lifecycle, related to biodiversity conservation and protection measures necessary to achieve an appropriate end land-use objective.

Additional EMPs may be developed and implemented as necessary to adequately manage environmental risks and opportunities as they are identified during construction, operations, closure and post-closure stages of the Project.

Some of the EMPs will be prepared in accordance with industry-wide standards, such as the Tailings Management Plan, which will be developed in accordance with the Mining Association of Canada guidance on Tailings Management Systems.

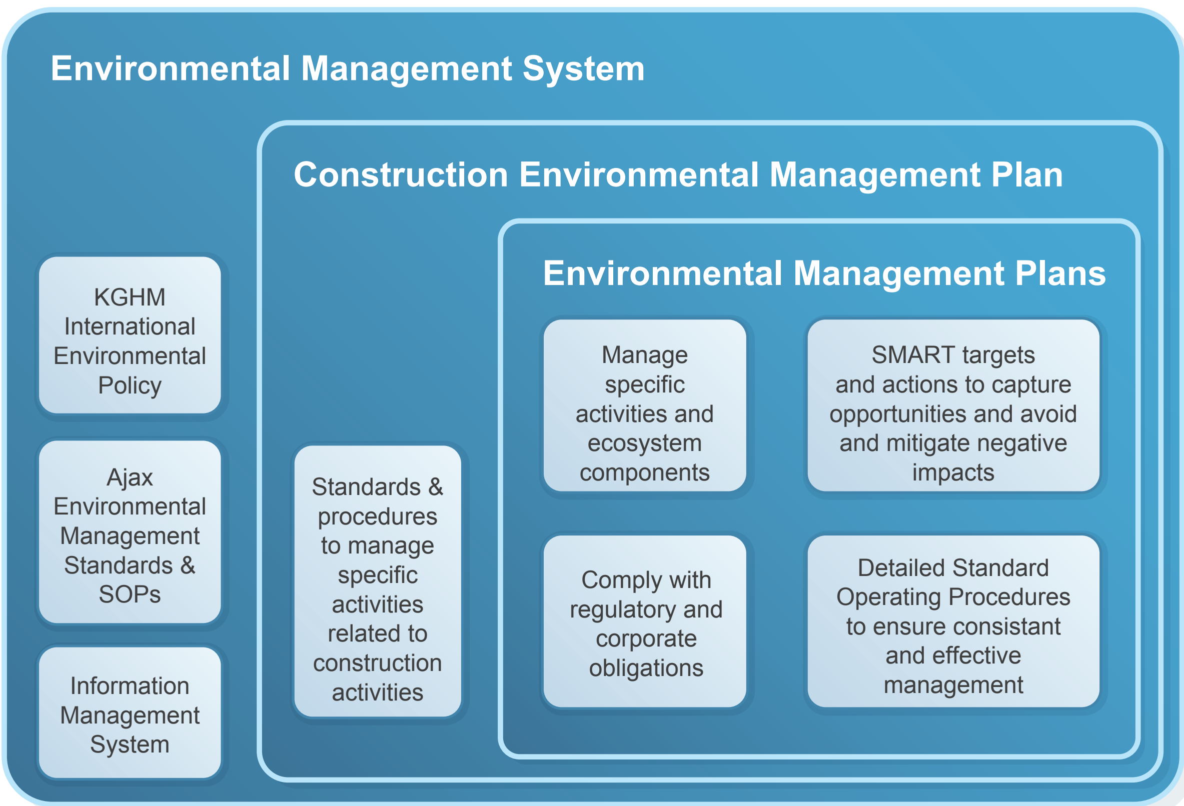
11.1.4 Construction Environmental Management Plan

The Construction Environmental Management Plan (CEMP) is a sub-component of the EMS and is specific to the construction phase of the Project. The purpose of the CEMP is to establish minimum environmental management expectations for the construction phase and to integrate the EMS and EMPs into contractual obligations for the various construction sub-projects that will occur. Like the overall Project EMS, the CEMP is managed using the PDCA model. There are specific EMPs that will apply to construction-related activities, both during development of the mine and for any large construction projects during operations.

Figure 11.1-2 shows the relationship between the Environmental Management System, Construction Environmental Management Plan, and the individual Environmental Management Plans.

Figure 11.1-2

Relationship between Environmental Management Frameworks Conceptual Model



11.2 EROSION AND SEDIMENT CONTROL PLAN

Mining activities have the potential to increase or decrease erosion in the mine area, and subsequently increase or decrease the generation of sediment to natural watercourses. These effects may include exposure of soils resulting from clearing, stripping, stockpiling, and replacement of topsoil and overburden during mine construction, operation, and closure. Conversely, check dams, detention basins, or stream interception (Figure 11.2-1) can limit the amount of sediment generation. Therefore, an Erosion and Sediment Control (ESC) Plan has been established to manage mitigation approaches designed to prevent or minimize erosion and contain sediment within the mine site.

Erosion and sediment control will be accomplished by applying the following principles:

- Minimize surface disturbance and restrict access to undisturbed areas;
- Preserve and enhance existing vegetation;
- Mine for Closure; i.e., practice progressive reclamation of disturbed areas;
- Separate runoff from disturbed areas where practicable;
- Maintain riparian buffers on permanent, seasonal, and ephemeral waterways (as per Vegetation Monitoring Plan Section 11.21);
- Establish vegetation to increase residency times and allow for natural removal of silt from water column;
- Emphasize natural erosion controls (e.g., slope micro-diversity, mulching, revegetation), which provide multiple environmental benefits if a disturbance or potential sediment source can be managed over the short-term without the need for further Best Management Practice (BMP) intervention;
- Construct interceptor ditches and sediment dams or use existing/modified water storage facilities to contain runoff; engineered structures will meet design parameters consistent with statistical runoff events identified in the water management plan (e.g. 1-in-200-year flood or a 1-in-10-year, 24 hr rainfall event);
- Time potentially erosion / sediment generating operations to avoid wet weather, when working in environmentally sensitive areas, to minimize storm water runoff and erosion risk; and
- Avoid handling soil during prolonged periods of dry and windy weather to minimize wind erosion and generation of dust.

The ESC Plan will be implemented by contractors under the supervision of KGHM Ajax Mining Inc. (KAM) and will be subject to monitoring by KAM's Environment Manager or other qualified professionals, as appropriate. Erosion prevention efforts associated with soil salvage, storage, and handling are discussed in the Soil Salvage and Handling Plan (Section 11.20). ESC planning specific to watercourses is also included in the Water Management and Hydrometric Monitoring Plan (Section 11.8).

11.2.1 Purpose

The purpose of this ESC Plan is to establish the planning, mitigation and monitoring approaches designed to prevent or minimize erosion and control sediment yield within the mine site during construction, operation, closure, and post-closure. The plan focuses on:

- Identification of specific construction activities and mine facilities that have the potential to generate sediment;
- Description of the associated erosion and sediment control issues associated with key proposed activity types;
- Description of design and planning measures and Best Management Practices (BMPs) to minimize or control potential surface erosion;
- Description of methods to intercept, and manage surface run-off and dust to minimize sediment release to the receiving environment; and
- Description of appropriate monitoring protocols to track sediment mitigation performance

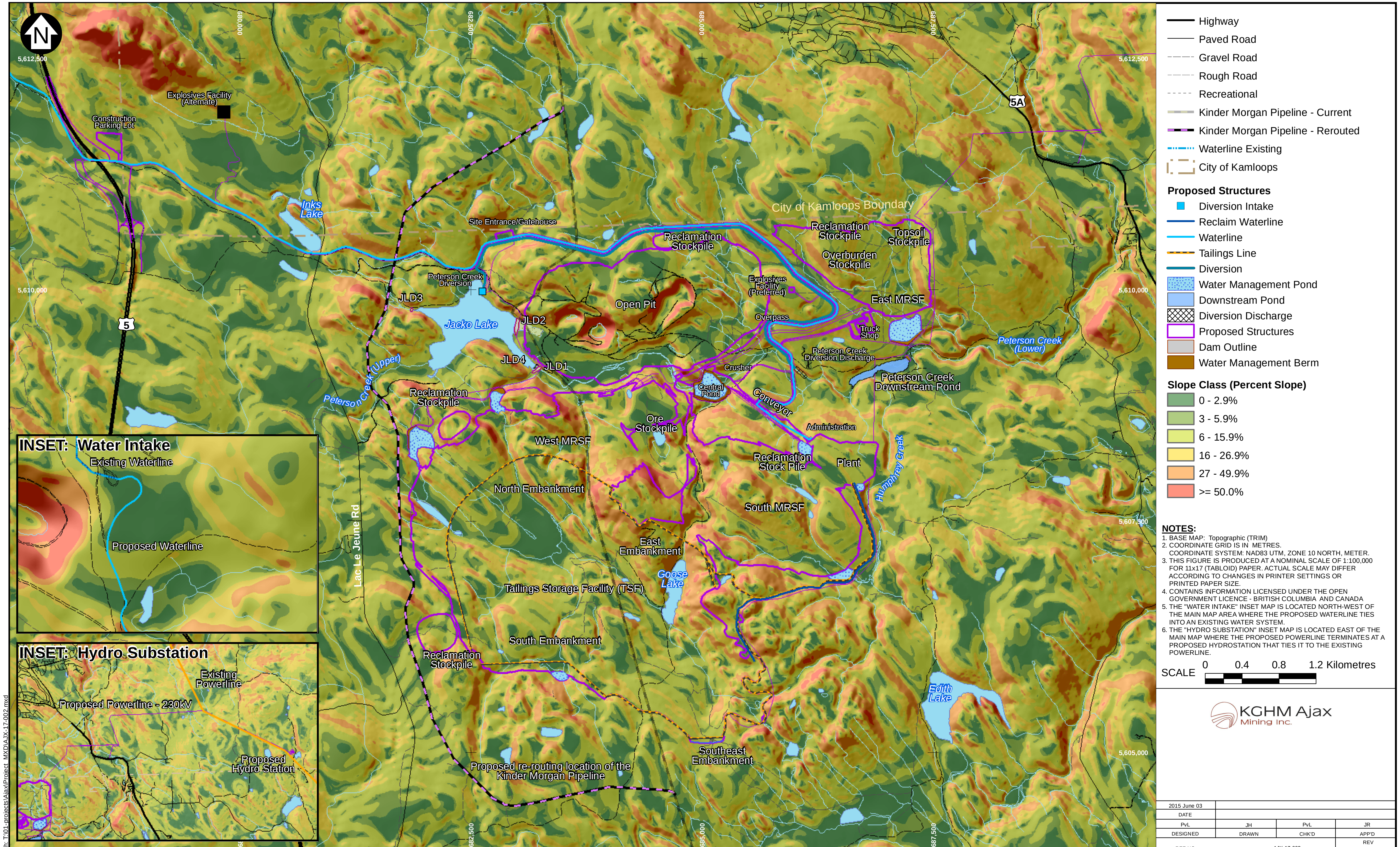
11.2.2 Performance Objectives

The key objectives of the plan are to protect critical topsoil resources against erosional loss or degradation and to protect local water bodies from sedimentation. The following list provides benchmarks for evaluating the success of these objectives:

- achieve compliance with provincial and federal water quality and freshwater aquatic life criteria (e.g., Total Suspended Solids (TSS): BC Water Quality Guidelines, Canadian Council of Ministers of the Environment (CCME) guidelines);
- identify roles and responsibilities of all individuals associated with the project whose actions may influence the effectiveness of erosion prevention (e.g., Environment Manager, contractors, and environmental monitors, etc.)
- ensure staff trained in erosion prevention are always available at critical periods (e.g., vegetation clearing, soil salvage, stockpiling, placement);
- ensure a sufficient stock of appropriate erosion and sediment control materials to adaptively manage sediment mitigation infrastructure should changes to proposed mine development activities occur or site conditions change;
- keep records of erosion events and applied mitigation techniques to continuously improve adaptive management strategies; and
- ensure that surface water monitoring programs persist post-closure to track and maintain water quality standards in downstream receiving waters (i.e., "cradle to grave" management of materials).

Figure 11.2-1

Ajax Project - Erosion and Sedimentation Control Features



11.2.3 Environmental Protection Measures

Environmental protection measures associated with mitigation of erosion and sedimentation focus on four key elements:

- Incorporation of erosion and sedimentation control into design and planning;
- Application of erosion control Best Management Practices (BMP);
- Application of sediment and runoff control BMPs; and
- Monitoring and maintenance.

The following sections discuss the proposed application of these key elements throughout the project's planning, construction, operation, closure, and post-closure.

11.2.3.1 Design Criteria

Planning

Provision of effective surface erosion protection and sediment control requires proactive planning to anticipate problems and develop procedural BMPs prior to site disturbance. The use of an ESC Plan itself can be considered a BMP since it is a proactive rather than a reactive approach to preventing sediment release to the aquatic receiving environment.

Surface erosion is directly related to surface runoff which is influenced by slope steepness, morphology and soil type and texture. Soils considered the most susceptible to erosion include unvegetated and unconsolidated sands and silts.

A risk assessment for potential soil loss will require soil sampling and particle size analysis of representative soil samples throughout the mine area, particularly where vegetation disturbance or overburden and soil stockpiling is likely. Soil loss estimation will be completed by applying the Revised Universal Soil Loss Equation or alternative methodology to assign a level of risk associated with construction of mine infrastructure (e.g., land clearing for mine rock disposal, lineal developments, plant and office/maintenance building sites), or with reclamation activities. The estimates will guide planning and direct the appropriate level of anticipated mitigation effort to achieve erosion control.

Minimize Disturbance

The construction and initial operation phases of the mine project will involve significant land disturbance, much of it associated with land clearing, road construction, and infrastructure development. Minimizing the total area of disturbance and staging vegetation removal to clear only the areas destined for immediate development will be a primary BMP for minimizing erosion. Disturbed landscapes will be stabilized using appropriate erosion control techniques and materials and re-vegetated as soon as possible with a suitable seed mixture (Conceptual Restoration Plan, Section 11.18). Particular attention will be given to cut, fill, and side-slopes associated with roads.

A land clearing permit system will be established to manage and minimize disturbance to undisturbed or rehabilitated land. The system will require that all disturbances must be pre-approved and signed-off by the Environment Manager or designate.

Progressive Reclamation

Wherever possible, disturbance areas will be stripped progressively (e.g., only as much as required at a particular time) to reduce erosion and sediment generation and to reduce the extent of topsoil stockpiles. Mining disturbances will be reclaimed as soon as practical to a stable, vegetated landform. Reclamation of disturbed land will be completed in accordance with the sequence, timing, and methodology contained in the detailed Mine Closure and Reclamation Plan (Section 3.17) and the Conceptual Restoration Plan (Section 11.18).

Scheduling

The scheduling of land disturbances will consider the time of year to take advantage of the growing season and reduce the time between disturbance and re-vegetation. Specific surface erosion protection needs associated with spring snowmelt or summer storm events will be factored into work schedule.

Traffic and Access Management

Traffic and vehicle access, including heavy equipment access, will be restricted to work areas and travel corridors. Signage and/or fencing or physical barriers will be used to identify authorized travel routes and work areas and prevent access to undisturbed areas and non-work areas. This will minimize surface disturbance and preserve existing vegetation.

Stockpile and Slope Design

Factors that influence erosion include vegetation density and type, slope length, gradient (steepness), roughness, precipitation, and physical characteristics of soil (the texture, cohesion, and structure). Slope inclination and length have the largest potential impact on erosion rates from sparsely vegetated surfaces. A combined increase in slope inclination and slope length expected in the constructed landforms will require an increase in the use of soil stabilization methods and sediment control structures. For an exposed slope surface, any management practice that shortens the length of a slope and disrupts surface flow paths will decrease the rate and amount of erosion. To limit the erosive effects of storm water flow, slope lengths shall be broken-up with erosion controls such as grooves, coir logs, straw wattles, or modified brush /rock layers installed along the slope contour at the following intervals:

- If the slope inclination is 1:4 (V:H) or flatter, the slope length will be modified with sediment controls at intervals no greater than 6.0 m.
- If the slope inclination is between 1:4 (V:H) and 1:2 (V:H), the slope length will be modified with sediment controls at intervals no greater than 4.5 m.
- If the slope inclination is 1:2 (V:H) or greater, the slope length will be modified with sediment controls at intervals no greater than 3.0 m.

Tailings Design

Due to its fine texture, tailings material is generally very susceptible to wind erosion. Placement of the TSF in the lowland area west of the natural ridge (Figure 11.2-1) is designed to protect its surface from the strongest, and locally most common, easterly winds. The thickened tailings (60% solids) are expected to decrease the time required for tailings settlement, which will allow earlier application of dust suppression materials to a larger surface of tailings.

Environment Management

The KAM Environment Department is tasked with managing the ESC Plan, ensuring it is properly implemented, monitored and that management practices are adaptive and dynamic. Environment staff will be trained on the requirements of the ESC Plan and associated compliance obligations. The Environment Manager or their delegate(s) will have the authority to shut down work or operations where activities are considered non-compliant with regulations or permits.

11.2.3.2 Construction

General Approach

Project construction will encompass nine landscape-level disturbances that include 42 structure types and a variety of disturbance activities (e.g., clearing, grubbing, topsoil stripping, earthworks, etc.) that support site preparation and construction of mine and mine-associated infrastructure (Table 11.2-1). Surface run-off drainage ditches will be constructed adjacent to areas to be disturbed, including sediment controls (e.g. silt fences, temporary settling basins, etc.) prior to disturbance of the area. All areas to be disturbed will have the appropriate drainage ditches in place prior to disturbance.

The first phase of construction includes development of access and haul roads, seepage dams, collection ponds, Tailings Storage Facility (TSF) starter embankment, reclamation stockpiles, ore stockpile, plant site, crusher, truck shop, and Peterson Creek diversion outlet footprints. Construction continues in the second phase with pre-stripping of the pits, explosives magazine and explosives manufacturing, central collection pond, the West and South Mine Rock Storage Facilities (MRSF) foundation works, the TSF starter area and starter embankment, the Peterson Creek diversion system, and two diversion ditches associated with the East MRSF. Construction during phase 3 concludes with haul road development and East MRSF foundation preparation. The TSF south embankment is not scheduled for construction until Year 10 of the project.

Mine components that will generate contact water during the construction period will require temporary erosion and sediment control measures until permanent water management infrastructure is completed (Table 11.2-1). Temporary water management in the construction phase will include:

- Infrastructure and activities at the plant site (including crusher and conveyor), mine rock storage facilities, ore, overburden and topsoil stockpile sites, tailings storage facility, truck shop, administration facilities (including buried services), and explosives facilities;
- Access and haul roads;

Table 11.2-1. Summary of Best Management Practices Anticipated during the Construction Phase

Civil Construction Disturbance	Structure	Activity	BMP's in Advance of Water Management Infrastructure Completion
Temporary Construction Works	Rock quarry	Clear, Grub, topsoil (TS) salvage	contained within pit; topsoil stockpile erosion control measures (ECM) (slope contouring, bio-engineering, seeding/mulching, silt fences, blankets, tarps)
Mining	Temporary haul road	Clear, Grub, Earthworks, Cap, Grade	silt fence, seeding
	Pre-stripping	Rock removal	contained within pit
	Haul roads	Clear, Grub, Earthworks, Cap, Grade	drainage ditch, catch-basin, silt fence, seeding
	Ore stockpile	Clear, Grub, Earthworks, Grade, Slope	temporary collection ditch, catch-basin, silt fence, seeding
	EMRSF	TS removal, Foundation preparation	temporary collection ditch, catch-basin, silt fence, seeding; ECM
	SMRSF	TS removal, Foundation preparation	temporary collection ditch, catch-basin, silt fence, seeding; ECM
	TSFMRSF	TS removal, Foundation preparation	temporary collection ditch, catch-basin, silt fence, seeding; ECM
Tailings Storage Facility	North embankment	Clear, Grub TS removal	temporary collection ditch, catch-basin, silt fence, seeding; ECM
	East embankment	Clear, Grub TS removal	temporary collection ditch, catch-basin, silt fence, seeding; ECM
	Basin preparation	Clear, Grub TS removal	temporary collection ditch, catch-basin, silt fence, seeding; ECM
Seepage Dams	Seepage dam 1	Clear, Grub, TS removal	temporary collection ditch, catch-basin, silt fence, seeding; ECM
	Seepage dam 2	Clear, Grub, TS removal	temporary collection ditch, catch-basin, silt fence, seeding; ECM
	North embankment seepage underdrains 1-4	Clear, Grub, TS removal	temporary collection ditch, catch-basin, silt fence, seeding; ECM
	East embankment seepage underdrain	Clear, Grub, TS removal	temporary collection ditch, catch-basin, silt fence, seeding; ECM
Water Management Ponds	Central collection pond	Clear, Grub, TS removal	silt fence; ECM
	EMRSF collection pond	Clear, Grub, TS removal	silt fence; ECM
	Plant Site collection pond	Clear, Grub, TS removal	silt fence; ECM
	Tailings emergency spill pond	Clear, Grub, TS removal	silt fence; ECM
	SMRSF collection pond	Clear, Grub, TS removal	silt fence; ECM
	Diversion ditches	Clear, Grub, TS removal	silt fence; ECM
Peterson Creek Diversion	Site development	Clear, Grub, TS removal	silt fence, seeding; ECM
Site Development	Adminstration/Central dry area	Clear, Grub, TS removal, earthworks	temporary collection ditch, catch-basin, silt fence; ECM
	Truck shop area	Clear, Grub, TS removal, earthworks	temporary collection ditch, catch-basin, silt fence; ECM
	Plant site	Clear, Grub, TS removal, earthworks	temporary collection ditch, catch-basin, silt fence; ECM
	Explosive magazine site	Clear, Grub, TS removal, earthworks	temporary collection ditch, catch-basin, silt fence; ECM
	Explosive manufacturing site	Clear, Grub, TS removal, earthworks	temporary collection ditch, catch-basin, silt fence; ECM
	Primary crusher site	Clear, Grub, TS removal, earthworks	temporary collection ditch, catch-basin, silt fence; ECM
	MSE wall	Clear, Grub, TS removal	temporary collection ditch, catch-basin, silt fence; ECM
Site Access Roads	Main access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
	Truck shop access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
	Plant site access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
	Peterson Creek access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
	Tailings and reclaim access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
	Explosive magazine access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
	Explosive manufacturing access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
	Seepage collection dam access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
	EMRSF collection pond access road	Clear, Grub, TS removal, earthworks, Grade, Surface	drainage ditch, catch-basin, silt fence, seeding
Fresh Water System	Kamloops Lake intake	Install	TBD
	Booster station	Install	TBD
	Ajax Booster station	Install	TBD
	Fresh water pipeline	Install	TBD

- Water management infrastructure (dams, collection ditches, ponds, and pits including sumps, pumps, pipelines and drains);
- Transmission lines; and
- General construction works on site.

Diversions or interceptor ditches will require measures that include armouring (where steep gradients are present), silt fencing, and inclusion of settling basins where appropriate. Temporary and permanent access road cut and fill side-slopes as well as other lineal developments will be seeded with an appropriate erosion control mix immediately following construction. Stripping and stockpiling of topsoil, recognized as an ongoing process throughout all phases of construction, will require progressive measures aimed at slope stabilization, surface runoff management, and soil conservation. BMPs will include contouring, bioengineering, mulching and seeding, silt fencing, and erosion control blankets. During initial construction, the establishment of long-term drainage control infrastructure is a primary focus. Consequently, interceptor ditches, settling ponds, the Central Collection Pond, and the tailings pond will be completed and made operational as soon as possible. Erosion and sediment control measures, associated with transmission line (9 km) installation, will target surface runoff management, slope stabilization, and stream crossings. Best Management Practices will include surface roughening, mulching and seeding, silt fencing, bioengineering, and water bars.

Erosion Controls

Temporary erosion control measures such as manually applied straw mulches, erosion control blankets, sediment fences, and/or hydraulically applied approved seed/mulch/tackifier mix will be used to provide short-term erosion control until permanent vegetation prescriptions are implemented. The utility of these measures will be considered when completing more detailed site-specific planning for unavoidable land disturbance in soils that are fine-textured and more erosive and in higher risk areas adjacent to existing watercourses.

Bio-engineered slope stabilization techniques such as coir logs, straw log wattles, wattle fences, or modified brush layers installed along the slope contour, at the intervals specified above for various slope angles, are effective at shortening slope lengths and decreasing the erosive power of downslope surface water flow. Heavy equipment will be used to create grooves, serrations, or micro-sites in the slope, for vegetation to establish. These BMPs will be considered on a site-specific basis for areas where more erosive protection is determined to be required.

Sediment and Runoff Controls

Temporary sediment and runoff control practices will be implemented immediately in conjunction with staged land clearing and road construction. Temporary ditching and construction of small, temporary sediment traps will be used for managing runoff and controlling sediment following clearing and grubbing. The purpose of this management practice is to capture and convey sediment-laden surface runoff either to stable, well vegetated areas or to small excavated sediment traps (i.e., settling basins) designed to allow surface water to infiltrate the ground.

Approved hardy, sod forming grass species will be established adjacent to transportation corridors and upslope of sediment basins to allow sediment laden runoff from upslope areas to be filtered by vegetation before discharging to the storm water system.

Seasonal or intermittent watercourses will be re-vegetated as soon as possible to slow the flow of water and filter sediments out of the runoff before they reach settling basins or watercourses. This will preserve soil and soil nutrients and maintain the long term effectiveness of settling basins.

Where required, collection drains and ditches will be constructed downslope of or within disturbed areas to convey runoff to sediment ponds or other storage facilities. Where possible, grassed waterways will replace collection drains as the preferred method of conveying runoff.

Engineered devices aimed at removing sediment as well as oil and grease from storm water runoff will be utilized near parking lots, truck shops, and the mill site to prevent contaminants from entering site surface waters.

Shallow marsh areas with established vegetation that may be created by certain sediment control infrastructure will help maintain residual populations of flora and fauna to support rapid recolonization of reclaimed areas. Treatment wetlands will have an irregular shape to maximize retention times and provide opportunities for the natural degradation of contaminants.

11.2.3.3 Operation

The mine footprint, outside of the pit and TSF, includes five mine rock storage facilities, an ore stockpile site, temporary reclamation areas, and stockpiles for overburden, and topsoil. Sediment mitigation infrastructure and contact water interception and routing measures are outlined below. A general arrangement of mine and water management infrastructure is provided in Chapter 3, Figure 1.

To the extent possible, the total area of land disturbance will be minimized during footprint expansion and all disturbed areas will be stabilized and revegetated as soon as possible using reclamation treatments consistent with land end use objectives identified in the Conceptual Restoration Plan (Section 11.18).

Ajax Pit

Precipitation, seepage from pit walls, and horizontal drains will introduce water into the pit. A system of ditches, pipes, and sumps will collect pit water. Water will be removed using a system of pumps and pipes leading to the Central Collection Pond. For this reason, the Ajax pit is not considered an erosion or sediment source during operations or post-closure.

Mine Rock Storage Facilities

During operations, all runoff from the mine rock storage facilities will be collected, allowed to evaporate, or pumped to the Central Collection Pond or to the TSF. The mine rock storage facilities will be constructed primarily of coarse fractured rock and will not pose an erosion concern until re-contouring and reclamation activities commence. The key BMPs for erosion prevention and sediment control include progressive reclamation techniques that focus on slope design, minimizing the area of exposed soils, timely seeding and planting, and the use of appropriate erosion control measures (e.g., site-specific application of erosion mats, geotextiles, polyethylene covers, silt fences, and ditch blocks) appropriate to the soil erodibility potential. Specific reclamation treatments will be consistent with land end use objectives as identified in the Mine Closure and Reclamation Plan (Section 3.17) and the Conceptual Restoration Plan (Section 11.18).

Plant Site and Infrastructure

The plant site, which incorporates the processing mill and related infrastructure, will be constructed on a pad with a balance of cut and compacted fill material from the cut areas. a Surface water runoff from the plant site will drain into to plant site water management pond. Drainage water will be returned to the process plant, or it will be pumped to the TSF.

Temporary Ore Stockpiles

The ore stockpile is located between the West MRSF and the South MRSF. Surface runoff draining from the stockpile will collect in seepage recovery systems established for each of the mine rock storage facilities or in the interceptor ditches leading to the Central Collection Pond. During extended periods of hot, dry weather, the ore stockpiles may yield windblown dust, which will be managed under the Air Quality Management Plan (Section 11.7).

Overburden and Topsoil Stockpiles

Overburden and topsoil stockpiles will be constructed as soil salvage activities progress. As portions of the stockpile become completed, the slopes will be re-contoured to a 2H:1V or shallower grade to minimize erosion and aid in vegetation establishment. As soon as practically possible, completed portions of the stockpile slope and platform will be seeded with an approved erosion control seed mix in order to establish vegetative cover. Any sediment-laden runoff draining from soil/overburden stockpile sites will be intercepted in a collection ditch that leads to the East MRSF pond, which in turn will transfer surface water to the Central Collection Pond.

Intensive summer storm events have the potential to accelerate soil erosion where vegetative cover remains in an early stage of development. Contingencies to abate potential mass wasting of stockpiled soils will include the application of geotextile and waste rock (as riprap) to buttress gullied areas, stabilize erodible soils from further wasting, channel water, and reduce surface run-off velocity. Settling basins placed immediately downslope of gullied areas will assist in collection and recovery of eroded soils.

Tailing Storage Facility (TSF)

Water management at the TSF will include ditches and ponds for collection of seepage and runoff from the embankments. Water from the seepage collection ponds will drain to the Central Collection Pond or will be pumped to the TSF. The crest elevations of both TSF pond dykes will provide sufficient storage capacity to safely contain the Probable Maximum Precipitation (PMP) event. The embankments and benches of the TSF will be covered with overburden and topsoil and re-vegetated progressively as the TSF is constructed. BMPs for erosion prevention and sediment control will focus on minimizing the area of exposed soils, timely seeding and planting, and the use of erosion control measures appropriate to the soil erodibility potential.

Explosives Manufacturing Facility Area

Runoff from the Explosives Manufacturing Facility and the Explosives Magazine will collect in a separate retention sump. All soil disturbances will be stabilized and re-vegetated as soon as possible using reclamation treatments consistent with land end use objectives identified in the Conceptual Restoration Plan (Section 11.18).

Exploration

Any exploration drilling undertaken during mine life will comply with the requirements for the disposal of muds and associated cuttings listed in the B.C. Oil and Gas Handbook (BC Oil & Gas Commission 2012) and in the *Oil and Gas Activities Act*, Drilling and Production Regulation (BC Reg. 282/2010). For example, all drilling waste, including drill cuttings and cement returns will be stored in suitable sumps (i.e., lined or excavated in clayey deposit free of gravel or sand lenses, cracks, fissures and root channels) and disposed of in accordance with the requirements of the Oil and Gas Waste Regulation (BC Reg. 254/2005) under the *Environmental Management Act* of British Columbia (2002).

Maintenance

Maintenance of erosion and sediment control and runoff management structures during mine operation is critical to their long-term effectiveness. As part of a commitment to contingency planning and monitoring, KAM will monitor and maintain sediment control and runoff management structure functionality by removing sediment captured in traps before it exceeds 15% loss of trap capacity. Re-vegetated areas will be monitored and if required, repaired. Additional erosion control seed mixture will be applied if necessary.

11.2.3.4 Closure and Post-Closure

Mine-affected water draining from areas of high porosity waste rock (South, East, and West MRSF) will be routed into the Ajax pit as long as required. During the post-closure period, the Ajax pit will gradually fill with runoff and groundwater inflow. Precipitation within the pit footprint, a small upslope area and runoff collecting at the three MRSF will contribute to the ultimate pool height in the long-term pit lake / ponds.

Erosion and sediment control within the TSF impoundment will be managed with native vegetation consistent with the reclamation plan. Re-vegetation of the beach with prescribed plant species will start as soon as soil moisture content is suitable. The TSF wetland area is expected to decrease over time. Once capping and re-vegetation of the TSF and MRSFs is complete, contact water will be eliminated and natural drainage will be restored. While no water will be discharged any more, surface waters will be monitored during this period to ensure they meet applicable provincial water quality criteria.

Monitoring and maintenance of all remaining facilities and structures will continue during closure and post-closure phases to ensure their proper function and uninterrupted mitigation of environmental effects. During the closure phase, reclaimed areas will be monitored annually until the vegetation cover and natural drainage patterns are well established. Mitigation measures will be applied as required. Slope instability or erosion will be treated by adding fill material, re-grading, and re-vegetating. During post-closure, the frequency of monitoring surveys is expected to decrease in step with the successful reclamation of disturbed areas. The length of post-closure monitoring will follow requirements established by relevant government agencies.

11.2.4 Monitoring

Effective implementation of the ESC Plan will require continuous monitoring so that management practices can be adapted to local conditions, properly executed, and, if needed, more detailed site-specific prescriptions can be completed. In this context, the ESC Plan is considered a working document that will evolve through the life of the mine. The site Environment Manager will be responsible for the implementation and updating of the ESC Plan, all associated monitoring, and record keeping.

An ESC monitoring program will be initiated early during the Project's construction phase. Monitoring will address:

- Erosion and associated mitigation measures;
- Runoff and sediment mitigation; and
- Water quality.

Erosion monitoring of topsoil stockpile areas has been previously identified as a critical soil conservation measure. Routine inspections, particularly after intensive rainfall events, will be undertaken to identify and prescribe site-specific BMP's to minimize soil loss. Routine inspections of sediment mitigation infrastructure will also be completed to identify where further maintenance (structure replacement or sediment removal) is required. Water quality monitoring will be undertaken the receiving environment to ensure that it meets the provincial guidelines. Erosion and sedimentation monitoring will be generally associated with ongoing construction and operations, whereas the water quality monitoring will extend from construction to post-closure.

As outlined in the AIR document, surface water quality was selected as an Environmental Value Component (VC), due to its importance for fish and wildlife, and use by humans as a source of drinking water, livestock and irrigation water, and recreation. Baseline water quality in the project area is being characterized by a project-specific water quality monitoring program that includes physical tests (e.g., turbidity) and chemical tests (e.g., dissolved ions, nutrients, organics, and metals). Suspended sediment and turbidity are notable variables that will be tracked to evaluate the effectiveness of mitigation measures to achieve performance objectives identified within the ESC Plan. The proposed monitoring program (Section 11.8) provides a sampling design to contrast water quality conditions in local streams above (background), within, and below the mine footprint.

Water samples will be collected at monthly intervals and decreased to weekly intervals during freshet. Sampling methods will adopt protocols established in the BC Field Sampling Manual (BC MOE 2013). Suspended sediment monitoring sampling frequency will be increased to include rainfall/storm events or expanded to establish a more robust data set by incorporating weekly measurements of turbidity. During construction, a correlation between laboratory-derived measurements of Total Suspended Solids (TSS) and Nephelometric Turbidity Units (NTU) versus field measurements of turbidity (NTU) will be developed over a range of sediment levels. Once generated, the relationship will allow a determination of suspended solids based on turbidity measurements collected in the field at multiple sites within the project.

Ambient measurements will be compared to established water quality guidelines (i.e., Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999) and Approved and Working Water Quality Guidelines (BC MOE 2015) to evaluate changing water quality variables and provide triggers to ensure that the guidelines and discharge limits are met. Guidance on sediment and turbidity criteria for water uses are provided in Table 11.2-2.

Table 11.2-2. Summary of Water Quality Guidelines for Turbidity, Suspended and Benthic Sediments

Water Use	Turbidity	Non-filterable Residue (Total Suspended Solids)	Streambed Substrate Composition
Raw drinking water with treatment to remove particulates	Change from background of 5 NTU at any time when background is ≤50 NTU	No Guideline	No Guideline
	Change from background of 10% when background >50 NTU		
Raw drinking water without treatment to remove particulates	Change from background of 1 NTU at any time when background is ≤5 NTU	No Guideline	No Guideline
	Change from background of 5 NTU at any time		
Aquatic life (fresh, marine, estuarine)	Change from background of 8 NTU at any one time for a duration of 24 h in all waters during clear flows or in clear waters	Change from background of 25 mg/L at any one time for a duration of 24 h in all waters during clear flows or in clear waters	% fines not to exceed: • 10% <2 mm • 19% <3 mm • 28% <6.35 mm at salmonid spawning sites
	Change from background of 2 NTU at any one time for a duration of 30 d in all waters during clear flows or in clear waters	Change from background of 5 mg/L at any one time for a duration of 30 d in all waters during clear flows or in clear waters	Geometric mean diameter not less than 12 mm (minimum 30-d intragravel DO of 6 mg/L)
	Change from background of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters	Change from background of 10 mg/L at any time when background is 25 - 100 mg/L during high flows or in turbid waters	Fredle number not less than 5 mm (minimum 30-d intragravel DO of 8 mg/L)

(continued)

Table 11.2-2. Summary of Water Quality Guidelines for Turbidity, Suspended and Benthic Sediments (completed)

Water Use	Turbidity	Non-filterable Residue (Total Suspended Solids)	Streambed Substrate Composition
Aquatic life (fresh, marine, estuarine) *(cont'd)*	Change from background of 10% when background is >50 NTU at any time during high flows or in turbid waters	Change from background of 10% when background is >100 mg/L at any time during high flows or in turbid waters	
Recreation and aesthetics	Change from background of 5 NTU when background is ≤50 NTU	No guideline	No guideline
	Change from background of 10% when background >50 NTU		
Wildlife irrigation	Change from background of 10 NTU when background is ≤50 NTU	Change from background of 20 mg/L when background is ≤100 mg/L	No Guideline
	Change from background of 20% when background >50 NTU	Change from background of 20% when background >100 mg/L	
Livestock watering	Change from background of 5 NTU when background is ≤50 NTU	Change from background of 10 mg/L when background is ≤100 mg/L	No Guideline
	Change from background of 10% when background is >50 NTU	Change from background of 10% when background is >100 mg/L	
Industrial water supplies	Change from background of 10 NTU when background is ≤50 NTU	Change from background of 20 mg/L when background is ≤100 mg/L	No Guideline
	Change from background of 20% when background >50 NTU	Change from background of 20% when background >100 mg/L	
Narrative:	No induced increase in turbidity or NFR that will interfere with established industrial water supplies		

Note: BC MOE 1988. Ambient Water Quality Guidelines for Turbidity, Suspended and Benthic Sediments. Distinct water quality guidelines for suspended sediment and turbidity are required for the protection of aquatic life during clear and turbid flow periods. The terms clear and turbid flow period are used to describe the portion of the hydrograph when suspended sediment concentrations are low (i.e., <25 mg/L or <8 NTU) or relatively elevated (>25 mg/L or > 8 NTU), respectively. For complete details (including definitions for background, clear flow, and turbid flow) see Caux et al. (1997) (http://www.env.gov.bc.ca/wat/wq/BCguidelines/turbidity/turbiditytech.pdf)

Initial monitoring frequency will be increased if parameter exceedances are noted in samples. To determine if guideline requirements are met for short-term (acute) exposures, hourly samples taken over a 24-hour period will be used to monitor changes in turbidity. For long-term (chronic) exposures, daily samples taken over a 30-day period will be used (BC MOE 2015).

Inspection of sediment mitigation infrastructure will be performed every two weeks, or more frequently during freshet periods or extreme weather events; similar inspection routines will be required for stockpiles susceptible to erosion. Inspections will document condition and capacity of interceptor/connector ditches and settling basins and will highlight those in need of clean-out (above 15% loss of the capacity) or maintenance. The frequency of inspections will be gauged by the type of activity, area of disturbed surface, and intensity and duration of intensive weather events. Alternatively, primary sediment basins receiving inputs from multiple detention ponds (i.e., the central pond) may require inspection on a more frequent basis.

If turbidity guidelines are exceeded in downstream receiving environments, mitigation and containment infrastructure improvements will be implemented to manage discharge. Bio-engineering measures may be upgraded to better manage surface run-off characteristics and meet overall performance objectives, if deemed necessary. Additional field turbidity sampling locations may be required to pinpoint/fine-tune early detection capability and improve environmental protection in a timely manner.

11.2.4.1 Work Planning and Schedule

Table 11.2-3 summarizes the proposed schedule of monitoring activities associated with the ESC Plan.

Table 11.2-3. Schedule of Monitoring Activities Associated with the Soil Salvage and Handling Plan

Monitoring Activity	Project Phase	Frequency	Season
Soil Erosion and Efficiency of Erosion Control Protection Measures	Throughout the Life of the Mine	Monthly until re-vegetated, then annually.	Year Around
Water Turbidity Testing	Throughout the Life of the Mine	Weekly in areas potentially affected by current activities, otherwise annually.	Year Around
Re-vegetation Quality	Throughout the Life of the Mine	Monthly until re-vegetated, then annually.	Year Around

11.2.5 Reporting

The ESC Plan will be submitted to the BC Ministry of Energy and Mines as part of the Effects Assessment / Mine Permit Application. The effectiveness of the ESC Plan will be assessed regularly (at least annually) in conjunction with other environmental monitoring assessments conducted for the Ajax Project. The reviews will reflect changes in environmental requirements, technology, and operational procedures. Assessment results will be reported in the Annual Report of Reclamation and Environmental Monitoring (BC MEMPR 2008) submitted to the BC Ministry of Energy and Mines (Table 11.2-4). Results of these assessments will also be incorporated into future erosion management planning to continually improve the effectiveness and success of the program.

In addition to the assessment of the effectiveness of the ESC Plan, the annual report will include a summary of monitoring data, brief descriptions of performed analyses, QA/QC procedures, interpretation of results, and discussion of any revisions to the Plan required to address emerging trends.

Table 11.2-4. Summary Table

		Report Submitted to	
Report Type	**Report Frequency**	**Provincial Regulatory Agency**	**Federal Regulatory Agency**
Annual Report of Reclamation and Environmental Monitoring	Annually	BC Ministry of Energy and Mines	x

Erosion inspection data will include a description of the type of erosion, existing control measures, and an assessment of their performance. A map showing the extent of the affected area, undertaken mitigation activities, and a log of dated photographs will be submitted. Water quality inspection data will include a list of sampling points, their UTM coordinates, a map showing their locations, and results of conducted analyses.

11.3 Soil Salvage and Handling Plan

11.3.1 Purpose

The Soil Salvage and Handling Plan outlines the approach to soil stripping, stockpiling, and replacement procedures with the goal of minimizing soil degradation and maximizing availability of suitable growth medium for reclamation. The purpose of the soil salvage and handling plan is to:

- identify salvage/stripping guidelines that:
  - best suit soil type and site conditions,
  - ensure effective topsoil removal techniques,
  - maximize the quality and volumes of suitable topsoil;
- identify best management practices that maximize topsoil viability during transport, stockpiling, and spreading;
- identify spatial and temporal soil handling protocols for reclamation use; and
- outline the scope of environmental monitoring required for successful implementation of the plan.

11.3.2 Performance Objectives

The following objectives provide benchmarks for evaluating the overall effectiveness of the soil salvage and handling plan:

- conserve adequate volumes of soil resources as specified in the Reclamation and Closure Plan (Section 3.17);
- manage and protect soil against degradation during handling and storage so that:
  - salvage of soil is conducted under appropriate soil moisture/weather conditions,
  - admixing of lower quality material (i.e., containing more than 35% coarse fragments) with topsoil[1] is prevented,
  - weather permitting, soil is seeded within one month of being stored at stockpile locations,
  - erosion control is established over soil stockpiles in a timely manner, so that the stockpiled soil will not experience uncontrolled erosion while being stored; and
- incorporate a staged (progressive) reclamation strategy to reduce soil storage time, accelerate vegetative recovery, and minimize the spatial extent of environmental disturbance.

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[1] The term "soil" encompasses organic horizons (litter and humus) and mineral A, B and C horizons. The organic horizons and the mineral A and B horizons are termed "topsoil" whereas the C horizon (subsoil) is considered as part of "overburden".

11.3.3 Environmental Protection Measures

Salvaged soils will be used during mine reclamation to facilitate the restoration of functioning ecosystems. In order for this to be achieved, soils must be salvaged, transported, stored, and redistributed in a manner that does not result in loss of volume or excessive loss of fertility.

Reclamation suitability rating of the soil map units (SMUs) is used to plan soil salvage and handling by determining which soils may present challenges during site construction and reclamation. The suitability of soils for reclamation purposes was assessed (Section 3.17) using criteria consistent with the BC *Mines Act* (BC MEM 1998) permitting requirements. Soils were rated as Good, Fair, Poor, or Unsuitable for reclamation according to soil profile characteristics. Limitations observed included elevated base saturation percentage, elevated metal concentration, excessive carbonate or coarse fragment content, high salinity, thin (shallow) soil profiles, adverse structure, and high erodibility. The soil reclamation suitability data provide a basis for soil management.

To protect the limited topsoil resources available on site (e.g., from admixing, compaction, or contamination) and to protect the environment (e.g., air quality/dust, soil erosion, or sedimentation of waterways), salvage and stripping operations will be supervised by a qualified personnel with expertise in soil science. KAM's Environment Manager will collaborate with the Construction Manager to plan and direct the handling of the site soils.

11.3.3.1 Design Criteria

Where possible, planning and management strategies employed during mine development and operation will attempt to minimize surficial disturbance and reclaim disturbed areas as early as possible. Progressive reclamation and direct placement of salvaged soil will maintain soil quality, increase effectiveness of erosion control, and reduce closure-related capital costs at the end of mining activities.

11.3.3.2 Construction

<u>General Measures</u>

Prior to any soil stripping activities, the KAM Construction Manager and the Mine Manager will ensure that appropriate clearance approvals have been obtained for activities in their respective areas. Stripping operations will be supervised by a qualified Reclamation Specialist. Responsibilities of this individual (in conjunction with KAM's Environment Manager as appropriate) will include:

- delineating areas for stripping operations;
- recording stripped volumes in the reclamation mass balance spreadsheet; and
- designating appropriate stockpiling locations based on soil material characteristics.

The Reclamation Specialist will be aware of soil chemical and physical characteristics within the proposed footprint. Adequate soil descriptions, maps, results of chemical analyses, and soil salvage suitability ratings will be included in the soil handling documentation. Soils unsuitable for salvage (e.g., due to elevated concentrations of metals, etc.), if stripped, will not be mixed with suitable, clean soils but will be stockpiled separately and used for reclamation of the areas where the original baseline metal concentrations were naturally elevated.

Soil will be stripped from the Project's footprint and stockpiled in dedicated facilities or windrowed adjacent to small disturbance areas such as roads and buildings. To avoid the prolonged exposure of bare soil to the elements, whenever possible, soil salvage will immediately follow vegetation clearing. Soil stripping will be accomplished sequentially, completing each salvage operation before moving to the next. A schedule of soil stripping will be created and maintained by KAM. A boundary delineating areas to be stripped will be established and maintained at all times. To minimize unnecessary soil degradation and compaction, natural areas outside of the proposed development will be avoided by all equipment and vehicles. Access points and haul routes will be pre-stripped. Vehicle travel over unstripped topsoil will be minimized; transit will occur on stripped overburden materials.

Site-specific sediment control measures will be established in advance of vegetation clearing and soil stripping operations. A V-ditch draining back to the stripped area or an appropriate sediment control structure will be installed around the work area to intercept surface run-off. At the end of each work day, all disturbed areas will be contained and controlled to limit erosion and sedimentation. Additional information related to erosion and sedimentation controls is provided in the Erosion and Sediment Control Plan (Section 11.2).

Soil Stripping

The term "soil" encompasses organic horizons (litter and humus) and mineral A, B and C horizons. The organic horizons and the mineral A and B horizons are termed "topsoil" whereas the C horizon (subsoil) is considered as part of "overburden". Topsoil and overburden will be stripped and stored separately.

The Proponent will implement the following procedures for stripping soils at the Ajax Mine site:

- Organic materials (including vegetation, if present) will be stripped and stored with the salvaged topsoil. Excess coarse woody debris (e.g., large tree limbs, root-balls, logs, etc.) will be chipped and used as mulch or removed from site for appropriate disposal at approved off-site facilities.
- When practical, mineral coarse fragments larger than 25 cm diameter (boulders) will be separated during salvage. This will enable equipment operators to effectively shape the soil stockpile. It will also improve the quality of the soil for use in future reclamation efforts. During reclamation boulders may be used for biodiversity/wildlife enhancements (e.g., boulder piles).
- Soil horizons with physical and chemical characteristics making them unsuitable for reclamation will be stripped and stockpiled separately. Parameters of particular concern include highly calcareous soil horizons and horizons with excessive coarse fragment content, which, if stripped, will be included with the overburden material.
- Stripping of frozen topsoil will be carefully evaluated to avoid stripping topsoil together with cemented overburden.

- If stripping occurs when snow is present, snow will be removed and windrowed separately from the stripped topsoils to prevent mixing.
- Topsoil will not be stripped at night as the colour differentiation between topsoil and overburden are not readily apparent in low light conditions.
- Soil salvage will not be conducted when soils are too wet or too dry. If required, soils will be wetted and stripped in a slightly moist condition to reduce dust generation and minimize deterioration of topsoil quality. Stripping and salvage operations will be suspended during excessively wet soil conditions in order to prevent rutting, compaction and deterioration of topsoil structure.
- If invasive plants are present in the areas proposed for salvage, weed control options will be reviewed by a qualified professional before the soils are stripped. If required, equipment used for transporting topsoil will be cleaned daily to avoid transporting weed seeds to the topsoil storage areas. The Wildlife/Vegetation Monitoring Plan (Section 11.29) provides mitigation measures to prevent the establishment and spread of invasive plant species.

In general, areas where salvage occurs will be cleared of vegetation and soils will be stripped shortly before construction access to these areas is required. Upon completion of soil salvage, stripped areas will be bladed to ensure ease of access in ensuing operations. However, in the cases when unexpected time delays occur between soil removal and construction activities, the surface will be left rough to reduce runoff and erosion.

Soil and suitable overburden storage will comply with the following guidelines:

- Stockpiles will be designed to be geotechnically stable. Storage berms will be located on stable foundations, on level ground where possible, and outside of environmentally or culturally sensitive areas.
- Stockpile design will incorporate setbacks to ensure materials are not inadvertently displaced outside approved areas.
- Soil and suitable overburden will be segregated in separate stockpiles.
- Stockpiles will be located in areas to minimize disturbance from operational activities and will be clearly marked with permanent signs. Information on soil quantity and quality will be recorded.
- The surface of the completed stockpiles will be left in a "rough" condition to improve surface water infiltration, reduce erosion hazard, slow down runoff, and promote re-vegetation.
- Stockpiles will be constructed as soil salvage activities progress. As portions of the stockpile become completed, the slopes will be contoured to ensure stockpile stability, minimize erosion, and to help vegetation establishment.
- Traffic in stockpile areas will be limited to stacking and shaping the stockpiles in an effort to minimize compaction. If required, stockpile areas will be lightly ripped (using a sub-soiler) to mitigate compaction, prior to seeding/planting activities.

- Stockpiles will have sediment control measures installed as required (refer to the Erosion and Sediment Control Plan, Section 11.2). This will involve, where practical and applicable, placement of the stockpiles within the catchment of a sediment control dam or the use of silt fencing or other sediment erosion control measures.
- Completed portions of topsoil stockpiles (both slope and top) will be re-vegetated to minimize soil erosion, enhance soil quality, and to provide fast growing competition against weedy species. Overburden stockpile surfaces will be fertilized and vegetated with a grass and legume mix to prevent erosion and weed establishment.
- After construction, access to the topsoil storage area will be controlled with signage and physical barriers to prevent the introduction of invasive species to topsoil berms by vehicle traffic.

Soil salvage operations will use a combination of equipment: scrapers, excavators, dozers, and trucks. To preserve soil structure and integrity, long distance blading will be avoided: soils will be loaded into trucks after reasonable pushing necessary to form a load and hauled to a storage location. Many soils have fragile silt loam textures and are highly susceptible to wind erosion. If excessive dust generation is observed loads will be covered with tarps.

<u>Soil Salvage Quality Control</u>

Failure to properly delineate soils prior to stripping can result in significant losses of topsoil or admixing with unsuitable soil horizons, particularly in areas of complex terrain, where high variability in the volume and quality of soil resources occurs. Topsoil salvage quality control will be directed by a qualified Reclamation Specialist and implemented by using a variety of approaches, including operator training, standard operating procedures, site supervision, and the use of techniques such as backhoe pits, pedestals, and ripping.

Skilled operators who understand the value of soil resources are critical to successful soil salvage. Equipment operators with responsibilities for soil salvage will be provided with training and instruction to ensure high quality and consistency of topsoil salvage operations. Training will be supported by clearly documented standard operating procedures for soil salvage, handling and stockpiling. Supervision and frequent inspections by a qualified Reclamation Specialist during stripping operations will ensure proper separation of soil horizons and ensure salvage of the suitable soil horizon depth.

Topsoil depths will be surveyed using backhoe pits (e.g., at 50 to 75 m intervals) prior to initiation of stripping (Alberta Transportation 2013). Backhoe pits permit inspection of topsoil horizons to determine their depth, color, texture, structure, coarse fragment content, and to assess soil moisture limits and presence of carbonate or salt aggregates. Pedestals provide critical visual reference points to determine the depth of topsoil horizons, reference original surface elevations, and ensure removal of all valuable topsoil, especially in deep deposits encountered in valley bottoms. Topsoil depths will be recorded on stakes. Pedestals of topsoil will remain in place at staking locations to verify stripping depths. Pedestals and survey control points will remain in place until the Construction Manager, Mine Manager, Environment Manager, or qualified Reclamation Specialist approves their removal. Upon clearance for removal, the pedestal topsoil will be salvaged. Areas between pedestals will be ripped to determine if any topsoil is still left on the ground.

11.3.3.3 Operation

Stockpiled soils are often exposed to erosion, compaction, destruction of soil structure, and loss of microbial activity. Since both the time and the volume of stored soil affect soil quality negatively, wherever feasible, the salvage and placing of topsoil on reclaimed slopes will occur sequentially as the footprints of the mine rock storage facilities (MRSF) expand. This will reduce the volumes and storage times of soil that need to be stockpiled.

To minimize the need for soil storage, the newly stripped soils will be moved to the available reclamation sites in a single operation. This will require monitoring and annual planning to account for changes in the footprint of the MRSFs and the locations and size of the newly re-contoured areas that are ready for reclamation.

Stockpiled soils are susceptible to colonization by noxious weeds and invasive plants that can hinder final reclamation efforts. To protect stored soils against degradation by invasive species, storage berms will be regularly inspected to identify weedy species and, if required, develop mitigation measures for invasive plant control specific to the stockpile. Soil fertility will be tested and, as required, an adequate form of fertilizer will be applied on the berm surface. Topsoil and overburden stockpiles will be also actively monitored and managed throughout the storage period to ensure erosion protection.

The following soil stockpile maintenance procedures will be conducted where on-going monitoring indicates the need:

- installation of additional erosion control measures;
- reseeding areas with poor establishment and ground cover;
- weed and invasive plant control; and
- topdressing with fertilizer.

11.3.3.4 Decommissioning and Closure

Upon facility closure, the soil replacement approach will vary depending on the proposed closure landform and specific end land use objectives. In general, after decommissioning of Project infrastructure, terrain re-contouring and soil decompaction, the proposed soil handling will include placement of 0.5 m of overburden over the reclaimed surface, followed by placement of 0.35 m of topsoil (Section 3.17).

Soils will only be removed from the soil storage area under the direction of the Construction Manager, Mine Manager, Reclamation Specialist or Environment Manager. Once soils are removed, they will be transported directly to the reclamation area for immediate placement. As soils are removed from the storage areas, the reclamation mass balance sheet will be updated.

On level areas, a “rough and loose” replacement technique will be used to minimize compaction and increase microsite variability. On slopes, topsoil will be placed by dumping at the top of the slopes and grading downwards and across the contour or dumped at the bottom of the slope and pushed up. An effort will be made to avoid a compacted or over-smooth finish. Site preparation will focus on creating diversity on slopes by creating small mounds and ripping subdued ground to help seedlings establish. The treatments will create microsites with favourable conditions to retain soil moisture and reduce desiccation by wind and sun. If significant compaction is encountered, it may be mitigated by ripping to encourage deeper rooting. Vehicles and equipment will be prohibited from entering areas once topsoil has been spread and seeding is complete.

During reclamation, topsoil that was windrowed for the construction of roads, buildings, or water management structures, will be replaced over the area from which it was removed.

An effort will be made to handle topsoil at optimum moisture content (slightly moist) to reduce damage to soil structure and minimize the effects to air quality. Fertilizers or additives will be used to enhance the capability of the reclamation material to support vegetation growth. Site conditions will govern where and when additives may be required. At closure, fertilizer application and seeding techniques will be guided by the Landscape Design and Restoration Plan (Section 11.26) and the Reclamation and Closure Plan (Section 11.31) and reviewed with appropriate regulators to ensure adherence to applicable guidelines. Monitoring of reclamation success, as identified in the Reclamation and Closure Plan (Section 11.31), will determine if soil amendments are required to meet the reclamation goals of the site.

Reclaimed areas will be regularly monitored and mitigation measures will be applied as required. Slope instability or erosion will be treated by adding fill material, re-grading and re-vegetating. If vegetation cover is poor in some areas, treatment will include roughening the surface to create favourable conditions for plant establishment and to reduce surface compaction before reseeding. A maintenance allowance has been made in the closure cost estimate for re-seeding up to 15% of the reclaimed areas.

11.3.3.5 Post-Closure

Monitoring and maintenance of all closed facilities and structures will continue during post-closure phase to ensure proper function and mitigation of environmental effects. The length of post-closure monitoring will follow requirements established by relevant government agencies with consideration given to site specific conditions and reclamation success.

During closure phase, reclaimed areas will be monitored annually until the vegetation is well established. During post-closure, the frequency of monitoring surveys is expected to decrease according to the successful reclamation of disturbed areas.

11.3.4 Monitoring

A number of monitoring programs will be developed to complement the management plans. The results of the monitoring programs will be used to measure the success of the management strategies and to identify where additional mitigation is necessary.

Soil stripping management plans will be reviewed weekly during the construction and development phases of the mine plan. This will include a review of soil depths, topsoil stockpiling locations, and the reclamation mass balance for the proposed mining period. The Soil Salvage and Handling Plan will be reviewed at least annually or as otherwise directed by KAM's Environment Manager in consultation with other relevant KAM Managers and government agencies. The reviews will reflect changes in environmental requirements, technology, reclamation success, and operational procedures. Topsoil stockpile locations, volumes, and date of soil stripping will be recorded daily in the reclamation mass balance spreadsheet and mapped by KAM Ajax's GIS department.

Soil contamination will be monitored before disturbance (as part of baseline program) and then every five years after soil salvage commences. The monitoring program will focus on detection of potential contaminant accumulation and metal deposition/mobility patterns. The program will involve a number of fixed sites located at established baseline sampling locations and in areas where project activities are anticipated to have the greatest impact on soils (e.g., near the mining pit, processing plant, tailing management facility, and main transportation corridors, where the levels of dust deposition/potential for spills could vary substantially). It is expected that the activities associated with Project development and operation will not cause any regulated substances (e.g., metals, hydrocarbons, pesticides, cyanide) to exceed concentration limits listed in the Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CCME 2013) or exceed the Soil Criteria for Toxicity to Soil Invertebrates and Plants listed in the Contaminated Sites Regulation (BC Reg. 375/96) included in British Columbia's *Environmental Management Act* (2004).

A soil erosion monitoring program will be initiated early during the Project's construction phase (Erosion and Sediment Control Plan, Section 11.2). Areas affected by erosion will be mapped and information including erosion type, intensity, the extent of the affected area, site UTM coordinates, and existing control measures and an assessment of their performance, will be documented. Affected sites will be regularly checked for evidence of erosion, particularly after rainfall events, until erosion is not a concern. Monitoring results will be used to trigger an appropriate adaptive management response.

The waterbodies adjacent to construction sites and soil stockpiles will be visually inspected for introduced sediment. Water sampling and/or turbidity testing may also be carried out if water discolouration occurs. Regular inspection of areas releasing sediment will be carried out and mitigation measure implemented until sediment is no longer released. Information will be documented and reported to designated personnel. These personnel will be trained in erosion and sediment control and will oversee the erosion monitoring program, maintain inspection reports, and provide guidance with the support of a qualified soil/geotechnical specialist as required.

The success of re-vegetation efforts and presence of invasive plants will be monitored from the beginning of Project construction (season or timing will be determined upon review of other plans to coordinate resources). The monitoring program will assess:

- the regeneration success of re-vegetated areas (on soil stockpiles and in reclaimed areas);
- extent and viability of plant populations in specific locations where invasive species have been previously identified;
- the effectiveness of treatments, where control activities were undertaken; and
- identification and implementation of additional mitigation measures where required.

Workers will be trained to identify and communicate concerns related to erosion and sedimentation, weed infestations, and contaminant releases. Supervisors (and if appropriate, senior managers and regulatory agencies) will be notified immediately about incidents in which fish and aquatic habitat could be adversely affected, including erosion and sediment release.

If the guideline limits are exceeded or the listed targets are not met, additional mitigation options will be developed through a corrective and preventive action program. Mitigation options will be considered according to the following hierarchy: initial efforts will be focused on effect avoidance, then on minimization, then on the on-site restoration, and finally on offset. All feasible measures at one level of the mitigation hierarchy will be considered before moving to the next level. A similar approach will be implemented if the condition of the environmental receptor becomes unacceptable or new and unexpected issues arise.

The monitoring results as well as corrective and preventive actions will be recorded and maintained as part of the Project's information and environmental management system. Results will be reported to the Project's senior management and regulatory agencies, as required.

The monitoring program will be reviewed and may be adjusted as needed to implement follow-up management activities, ensure continuous improvement and successful implementation of mitigation measures, and achieve the reclamation objectives.

11.3.4.1 Work Planning and Schedule

Table 11.3-1 summarizes the proposed schedule of monitoring activities associated with the Soil Salvage and Handling Plan.

Table 11.3-1. Schedule of Monitoring Activities Associated with the Soil Salvage and Handling Plan

Monitoring Activity	Project Phase	Frequency	Season
Soil Stripping	Construction and Operation	Daily	During Soil Salvage
Soil Contamination	Throughout the Life of the Mine	Baseline, then every 5 years	June
Soil Erosion	Throughout the Life of the Mine	Monthly until re-vegetated, then annually	Year Around
Re-vegetation Quality/ Invasive Plants	Throughout the Life of the Mine	Monthly until re-vegetated, then annually	Year Around

11.3.5 Reporting

The Soil Salvage and Handling Plan will be submitted to the BC Ministry of Energy and Mines as part of the Environmental Assessment / Mine Permit Applications. The effectiveness of the Soil Salvage and Handling Plan will be assessed regularly (at least annually) in conjunction with overall reclamation and environmental monitoring assessments conducted for the Project. The reviews will reflect changes in environmental requirements, technology, and operational procedures. Assessment results will be reported in the Annual Reclamation Report submitted to the BC Ministry of Energy and Mines. Results of these assessments will be also incorporated into future reclamation planning to continually improve the success of the program.

In addition to the assessment of the effectiveness of the Soil Salvage and Handling Plan, the annual report will include a summary of soil movement and monitoring data, brief descriptions of performed analyses and QA/QC procedures, interpretation of results, and discussion of proposed revisions to the management plan or the monitoring plan to address emerging trends.

Soil chemistry inspection data will include a list of sampling points, their UTM coordinates, and concentrations of recorded contaminates. A map showing the affected area and the assessment of available mitigation effectiveness will be submitted.

Erosion inspection data will include a description of the type of erosion, existing control measures, and an assessment of their performance. A map showing the extent of the affected area, undertaken mitigation activities, and a log of dated photographs will be submitted.

Vegetation reclamation assessments will include maps and information on the regeneration success of re-vegetated areas. A map showing the specific locations where invasive species have been identified, type of treatment, and the effectiveness of treatments where weed control measures were implemented will be submitted

11.4 CONSTRUCTION WASTE MANAGEMENT PLAN

11.4.1 Purpose

The purpose of the construction waste management plan (the plan) is to facilitate the proper management of wastes that are generated during the construction phase of the Ajax Project (the Project) and to promote an integrated approach to construction and waste management, throughout the duration of the Project. The KGHM Ajax Mining Inc. (KAM) Environmental Department will be responsible for communicating and implementing the construction waste management plan. Responsibilities will include setting performance objectives, ensuring compliance with regulatory requirements and adhering to the waste management principles of Reduce, Reuse, Recycle, Recover (4Rs):

> **Reduce:** The primary goal is to reduce the quantity of waste generated via effective procurement so that ordered supplies and perishable consumables do not exceed usage rates and generate unnecessary waste. This may also include using effective ways to package materials before they are shipped to site, thereby reducing the amount of packaging that requires disposal.
>
> **Reuse:** During site preparation and construction works, there are numerous opportunities for the beneficial reuse of materials and products in their original form and recycling of materials. This may include refurbishment of a product prior to its reuse provided the product can perform the same function for which it was originally intended. The subsequent reuse of materials in reconstruction works also reduces the quantities of waste which ultimately need to be consigned to landfill sites.
>
> **Recycle:** Recycling is the third option in the waste management hierarchy. Recycling involves recovering materials that can be processed into new products. With secondary recovery, a further distinction is often made on whether the recovered product can be used to reproduce the original item or whether it must be "downcycled" into a lower grade product. Downcycling can prolong the useful life of a material. In limited cases, site waste can be downcycled and used for alternative purposes. Although recycling does help to conserve resources or reduce wastes, there are economic and environmental costs associated with waste collection and recycling. For this reason, recycling should only be considered for waste which cannot be reduced or reused.
>
> **Recover:** Finally, it may be possible to recover materials or energy from waste which cannot be reduced, reused or recycled. Used materials are combusted to generate energy, which can be used to heat building or processes as well as to generate electricity. Energy recovery is a better option than simply incinerating the material because a useful product (heat) is being generated this will be employed by incineration of waste oil to heat facilities as opposed to transportation for off-site disposal.

The scope of the plan includes:

- construction waste quantity estimates by type;
- identifying construction wastes that are categorized as hazardous wastes that will be managed under the Hazardous Waste Management Plan and not included in the scope of this plan;

- determining appropriate disposal, recycling, or re-use options for construction wastes generated;
- setting performance objectives of the Construction Waste MP;
- tracking environmental performance (e.g., waste diversion) and evaluate mitigation measures to enable the implementation of adaptive follow-up programs as needed; and
- ensuring compliance with regulatory requirements.

11.4.2 Applicable Legislation and Standards

A number of legislative requirements are applicable to construction waste management and disposal including:

- *Environmental Management Act* (S.B.C. 2003, c. 53) and Hazardous Waste Regulation (B.C. Reg. 63/88) – cover management and disposal of wastes considered hazardous, as well as discharges to the environment;
- Waste Discharge Regulation (B.C. Reg. 320/2004) – regulates the discharge of wastes into the environment;
- *Fisheries Act* (R.S.C. 1985, c. F-14) – protects waters inhabited by fish;
- *Water Act* (R.S.B.C. 1996, c. 483) – overarching Act for the protection of water in British Columbia;
- *Mines Act* (R.S.B.C. 1996, c. 293) and Health, Safety and Reclamation Code for Mines in British Columbia (B.C. Reg. 126/94) – cover the permitting and reclamation activities associated with mining; and
- *Transportation of Dangerous Goods Act* (S.C. 1992, c. 34) – covers the transport of wastes which are waste dangerous goods.

11.4.3 Performance Objectives

The performance objectives for this plan are to ensure:

- Employee Waste Management Training - all employees and contractors on the site have at least overview training in waste management strategies on the site, achieved through site orientation training;
- Waste Storage Area Inspections:
  - every work area has a designated waste collection or disposal area;
  - signage and other container labels will be used to explain the materials designated for disposal in that area;
  - every waste collection or disposal area will have designated containers for disposal of specific waste types and where necessary containers or storage areas will be compatible with the waste type stored, and prevent leaks; and
- Waste Diversion Record – 4Rs of waste diversion will be recorded, maximized where practical and compared to targets.

In all cases where waste or recyclables are removed from site; waste disposal contractors (carriers and receivers) will be contractually required to provide documentation of all applicable regulatory compliance proof of pollution, liability and workers compensation insurance.

Although waste generation will vary over the life of the Project, an estimate of monthly and annual waste quantities for various waste categories is available in Section 3.13.8.

11.4.4 Environmental Protection Measures

Non-hazardous solid wastes will be stored in dedicated, commercially available skips or bins in the designated waste storage area. Putrescible waste and any other waste that will attract wildlife (e.g., food containers, recyclables, etc.) will be stored in commercial bear-proof containers.

The solid waste storage and transfer facility will be designed to safely contain:

- non-hazardous wastes from construction areas;
- putrescible waste in bear-proof containers; and
- non-hazardous recyclable materials in dedicated recycling bins.

Hazardous waste materials will be stored in accordance with the Hazardous Waste Management Plan, which will include dedicated storage areas and containers.

KAM personnel and contractors handling wastes will be trained on the segregation of wastes for temporary storage within the solid waste storage facility prior to disposal.

Table 11.4-1 provides a solid waste management matrix that outlines the handling, storage and disposal methods for each waste type.

Table 11.4-1. Handling, Storage, and Disposal of Solid Waste

Waste Type	Description	Storage prior to disposal	Preferred Disposal Location
Food waste	Putrescible food waste	Solid waste storage facility / Bear-proof containers	Offsite composting/landfill
Office waste	Non-putrescible waste, plastic food containers, waxed paper containers, tetra packs, textiles and garbage	Solid waste storage facility / Garbage bins and Bear-proof containers (for food packaging, etc.)	Offsite recycling / Onsite landfill
Manufactured wood products (particle board, MDF, etc.)	Construction materials	Solid waste storage facility	Onsite landfill
Cardboard	Packaging materials	Solid waste storage facility	Offsite recycle
Clean wood	Construction waste	Solid waste storage facility	Offsite recycling/Onsite landfill

(continued)

Table 11.4-1. Handling, Storage, and Disposal of Solid Waste (completed)

Waste Type	Description	Storage prior to disposal	Preferred Disposal Location
Soil	Construction waste	Where uncontaminated salvaged under the soil management plan (SMP)	See Soil Salvage and Handling Plan (Chapter 11.3)
Concrete	Construction waste	Solid waste storage facility	Onsite landfill
Paper	Packaging materials	Solid waste storage facility	Off-site recycle
Beverage and food containers	Plastics, aluminum	Solid waste storage facility	Off-site recycle
Brick	Construction waste	Solid waste storage facility	Off-site recycle
Ferrous and non-ferrous metals	Construction waste	Solid waste storage facility	Off-site recycle
Plastics	Construction waste	Solid waste storage facility	Off-site recycle
Gypsum wallboard	Construction waste	Solid waste storage facility	Off-site disposal*
Insulation	Construction waste	Solid waste storage facility	Off-site disposal*
Asphalt (shingles, pavement)	Construction waste	Solid waste storage facility	Off-site disposal*
Ceiling Tiles	Construction waste	Solid waste storage facility	Off-site disposal*
Carpeting	Construction waste	Solid waste storage facility	Off-site disposal*
Structural building materials (existing windows, doors, hardware)	Construction waste	Warehouse for materials deemed re-usable. For those which cannot be re-used they will be transferred to the solid waste storage facility.	Reuse or off-site disposal*
Used equipment oil, coolants, etc.	Construction waste – potentially PCB containing	Hazardous waste management facility	See Hazardous Waste Management Plan (Chapter 11.10)
Leftover architectural finishes	Glues, paints, adhesives glazes, etc.*	Warehouse for materials deemed re-usable. For those which cannot be re-used they will be transferred to the solid waste storage facility.	Reuse or off-site disposal*

**Materials which are deemed to contain asbestos or PCBs are hazardous wastes will be specifically managed under the Hazardous Waste Management Plan.*

Waste Characterization

Where wastes are generated and it is not known if they are hazardous or not, they will be classified in accordance with the Hazardous Waste Management Plan (Chapter 11.10). Documentation will be retained on site of the rationale used to characterize the waste stream.

Waste Reduction

Reducing the amount of material that is consumed is the most effective way of reducing the amount of waste that is generated. Examples of waste reduction include:

- product review, selection, and substitution – recyclable/reusable and non-hazardous materials used instead of non-recyclable/non-reusable and hazardous materials;
- ordering chemicals or lube products in bulk/returnable containers;
- ensuring materials are ordered on an "as needed" basis to prevent over supply to site keeping a workable minimum inventory to prevent expiration of products and resulting generation of waste;
- purchasing coverings, panelling or other materials in shape, dimensions and form that minimises the creation of excessive scrap waste on site;
- ensuring correct storage and handling of construction materials to minimise generation of damaged materials/waste, e.g., keeping deliveries packaged until they are ready to be used;
- assigning individual responsibility to sub-contractors for the purchase of raw materials and for the management of wastes arising from their activities, thereby ensuring that available resources are not expended in an extravagant manner at the expense of the main contractor;
- training personnel on waste minimization and reuse; and
- decreasing the amount of solid waste by reducing the use of disposable items and decreasing the amount of packaging on supplies by requesting that suppliers provide less packaging materials on over-packaged products.

<u>Reuse and Recycling</u>

Material that is generated shall be reused on site or salvaged for subsequent reuse to the greatest extent possible and disposal will be considered as a final option. Initiatives shall be put in place to maximize the efficient use/reuse of materials.

Excavated spoil/topsoil shall be carefully set aside and managed under the Soil Salvage and Handling Plan.

Innovative initiatives to avoid the need for disposal should be investigated (NCDWC 2006):

- architectural features (moldings, doors, windows) may be reused in the refurbishment of retained structures on the same site where possible;
- the warehousing of salvaged material can facilitate its reuse on future projects; and
- construction supplies shall be used to the maximum extent feasible, and where applicable, reused on the site. Examples of potentially reusable materials include:
  - scrap metal, conveyor belts, and wood;
  - chemical containers that can be returned to the supplier to be refilled, and
  - reuse of aggregate and asphalt in the construction of roads.

Recyclable materials shall be shipped off site to the nearest recycling facility and may include (GVRD 2008):

- cardboard;

- used oil filters (oil removed, crushed, and recycled separately);
- lead-acid and alkaline batteries;
- plastic petroleum pails;
- oil-based paints; and
- empty drums.

Recovery

Recovery is the fourth level of waste minimization and involves extracting usable material or energy as a by-product for other uses, also called Waste to Energy (WTE). Opportunities for recovery will be evaluated throughout the life of the Project. Typically, waste to energy options are sought after ruling out recycling or reuse as viable outlets for waste disposal. Currently there is one active WTE facility in British Columbia, located in Burnaby, BC (BC MOE 2010).

11.4.4.1 Design Criteria

Waste staging areas shall be established that take into account compatibility of various waste streams and the prevention of releases to the environment.

Specific design criteria will include:

- secondary containment for liquid waste streams including 100% of the volume for a single container and groups of containers; will include secondary containment for 100% of the largest container volume and 25% of the group;
- wildlife fencing and bear proof containers for putrescible and hydrocarbon waste staging areas;
- proper segregation for incompatible wastes;
- inspection access to all waste storage areas;
- weather protection where necessary to prevent release of waste into the environment (e.g., powders, oil covered metals, etc.); and
- protection of stored waste to ensure suitability for future reuse or recycling.

11.4.4.2 Pre-Construction

To ensure compliance with waste management regulations during the tender process, KAM will request documentation of permits and insurance from waste carriers and disposal/recycle locations in order to ensure that downstream vendors will operate in an environmentally responsible manner.

Contracts with construction vendors will be structured in a manner that minimizes waste generation.

During pre-construction activities, areas and facilities will be designed and prepared per required waste storage design criteria. An inspection and reporting schedule will be developed in order to monitor waste management procedures.

During the pre-construction phase, contractors will need to provide KAM with the list of products that will be used on site. KAM will review these products to ensure that no practical and less hazardous alternatives exist and to make sure the management associated with that waste stream will be available.

Construction waste handling procedures will include:

- location of waste storage areas including drums, dumpsters, and bins;
- waste segregation and labelling;
- pre-shipping and transportation;
- cross contamination prevention;
- chain of custody; and
- inspection and reporting.

11.4.4.3 Construction

During construction KAM will implement waste management procedures and confirm if the waste streams and estimated storage requirements are adequate.

Waste streams not anticipated during pre-construction will be reviewed for classification, the potential to reuse or recycle prior to off-site disposal or WTE opportunities.

In the event the waste stream is found to be hazardous under the BC Hazardous Waste Regulation, the Hazardous Waste Management Plan will ensure that any registration, storage or disposal requirements are followed. Materials likely to be generated during construction activities anticipated to be hazardous wastes include but are not limited to: chemicals, solvents, paints, gear oils, grease, oils, and hydrocarbon contaminated rags, batteries, aerosol containers, biomedical, filters and absorbents.

11.4.4.4 Post-construction

Following completion of the construction activities, KAM will ensure that all wastes, which are not planned for re-use on site have been removed from site.

Records of the disposal of wastes from the site along with documentation on the downstream vendors will be retained for a period of at least five years.

11.4.5 Monitoring

KAM will record details regarding storage, movements and treatment of waste during the construction stage of the Project. Each shipment of waste taken from the site will be subject to documentation, which will ensure traceability of the material to its final destination.

Monitoring will be completed through weekly inspections of the waste storage areas. Storage areas will be reviewed to ensure the handing procedures are followed to ensure zero discharge to the environment.

In addition to the weekly inspections, an annual internal audit will be taken to ensure the effective implementation of waste handling procedures (see Section 11.1 describing the function of the Environmental Management System [EMS]).

Issues identified on the weekly inspections or found during the annual audit will be documented; evaluated and corrective actions will be taken to prevent reoccurrence. Examples of corrective actions include modifying this plan and procedures, implementation, re-design of facilities, and re-training of employees and contractors.

11.4.6 Reporting

This plan will be reviewed at least annually to review success in meeting the objectives of the Construction Waste Management Plan to confirm that it remains current. Occasions such as a change in legislation related to waste management, discovering significant non-compliances or a change in the method used to manage waste streams should also trigger a review of this plan.

An annual report will be generated that will contain:

- evaluation of the effectiveness of the plan;
- assessment of additional mitigation measures taken to eliminate or reduce impacts unforeseen during the EA;
- describe and assess effects that mitigation measures have failed to eliminate or reduce, or circumstances in which effects could not be avoided;
- identify any emerging adverse environmental trends; and
- describe proposed revisions to the plan to address emerging adverse trends, or to adjust monitoring programs, if required.

The KAM Environmental manager is responsible for communicating internally the performance of the Construction Waste Management Plan, including the monthly and annual performance with respect to waste diversion.

11.5 Metal Leaching and Acid Rock Drainage Management and Monitoring Plan

11.5.1 Purpose

The purpose of the Metal Leaching and Acid Rock Drainage (ML/ARD) Management Plan is to formulate a series of operational procedures and closure activities that will avoid the development of acidic drainage from the Project MRSFs, TSF and ore stockpiles and minimize the impact of neutral metal leaching to the receiving environment from these facilities.

11.5.2 Performance Objectives

The ML/ARD Management Plan objectives are to establish a series of actions to be implemented for at Project facilities to protect water quality in Peterson Creek and the Peterson Creek aquifer. The key actions to be implemented at the major facilities include:

- MRSFs – Blended potentially acid generating (PAG) and non-potentially acid generating (NPAG) mine rock to prevent ARD, progressively covered during Operation and Decommissioning and Closure to minimize neutral metal leaching (except East MRSF).
- TSF Embankments & East MRSF – Constructed only of NPAG mine rock to prevent ARD.
- Tailings – Low-sulphur NPAG tailings deposited as a thickened slurry that will form a homogeneous, non-segregated tailings mass. The TSF will be covered at closure to limit infiltration and neutral metal leaching.
- Ore Stockpiles – Maintain neutral drainage during Operation and removal prior to closure.

The key management approach for the MRSFs is blending PAG mine rock with NPAG mine rock. This approach was selected considering a number of conditions at the Ajax site that make blending a suitable procedure, including:

- Calcite is the predominant form of NP in the NPAG materials that are used to blend with PAG mine rock. Calcite is the most soluble form of NP among the carbonate and silicate minerals that contribute to NP.
- Low sulphur content in mine rock results in low sulphide oxidation rates and low acid production rates from the Ajax mine rock. Kinetic tests demonstrate that the low rates of sulphide oxidation allow carbonate-depleted mine rock to buffer pH. The slow rate of sulphide oxidation also restricts acid build-up within PAG layers of the MRSFs and allows excess alkalinity from the NPAG to neutralize more effectively.
- Low precipitation and water infiltration rates are predicted for MRSF due to the arid climate. This allows for an increased water rock contact time, which allows for more effective consumption of the neutralization potential.
- Abundance of NPAG material from the Ajax Pit allows for the concurrent placement with PAG mine rock and provides a surplus of effective NP.

- Lack of acidic paste pH measurements in the ore, mine rock and tailings samples as well as the continued observed net neutral drainage at Ajax site from existing pit walls, tailings and MRSFs indicate the tendency for neutral drainage from Ajax mine rock and tailings.

Guidance for the development of the Ajax ML/ARD Management Plan and objectives was obtained from the following documents:

- Policy for Metal Leaching and Acid Rock Drainage in British Columbia (BC MEM and BC MELP 1998);
- Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia (Price and Errington 1998); and
- Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND 2009).

11.5.3 Geochemical Evaluation for Management

This section presents a focused evaluation of the geochemical characterization data that was presented in Lorax (2015a) to support the rationale for the ML/ARD management strategies presented in Section 11.5.4. This includes the operational measurement of NP and AP for segregation and scheduling of PAG mine rock into MRSFs and identifying mine rock characteristics with low neutral metal leaching potential that may be suitable for general construction purposes.

11.5.3.1 Operational NP Determination

NP determination for operational management will be based on a calculation of CaNP from the total carbon (TC) content of a sample for SLD, IMH and SLVH units. For the PICR and MAFV units, a slightly different approach is proposed. Due to the presence of significant non-carbonate NP in these units, a fixed NP value (25th percentile of the non-carbonate NP) is added onto the CaNP derived from TC analysis (Table 11.5-1). For rock types where CaNP can be used as a reasonable proxy, the method of carbon analysis needs to be considered. Using a LECO© furnace (which also returns total sulphur content) is a relatively rapid method to quantify the TC content of a sample. If considerable organic material is to be expected, however, the TC content may overestimate the abundance of acid-buffering carbonate minerals. In this case, the more time-consuming analysis of total inorganic carbon (TIC) using an acid-addition technique is warranted.

Table 11.5-1. Operational Determination of NP

Mine Material	NP Calculation
SLD, IMH, SLVH Mine Rock & Ore	NP (Kg $CaCO_3$ / t) = %TC x 83.33
MAFV Mine Rock and Ore	NP (Kg $CaCO_3$ / t) = (%TC x 83.33) + 8
PICR Mine Rock and Ore	NP (Kg $CaCO_3$ / t) = (%TC x 83.33) + 17
Tailings	NP (Kg $CaCO_3$ / t) = %TC x 83.33
Overburden	NP (Kg $CaCO_3$ / t) = (%TC – 0.42) x 83.33*

**Screening level calculation*

11.5.3.2 *Operational AP Determination*

The non-acid generating sulphate minerals, gypsum and anhydrite, are present in Ajax mine rock in the deeper portions of the pit. The presence of non-acid generating sulphur minerals requires that the AP used for NPR calculation is derived using non-sulphate S.

$$AP = [\text{total } S - \text{sulphate } S].$$

11.5.3.3 *Operational PAG Definition*

PAG mine rock will be determined based on the formulas listed in Table 11.5-2 below.

Table 11.5-2. Definition of PAG Mine Rock and Ore

Mine Material	PAG Definition	
	Above Gypsum Plane	Below Gypsum Plane
SLD, IMH, SLVH Mine Rock & Ore	(%TC x 83.33) / (S_{Tot} x 31.25) < 2.0	(%TC x 83.33) / [(S_{Tot} - S_{SO4}) x 31.25)] < 2.0
MAFV Mine Rock & Ore	[(%TC x 83.33) + 8] / (S_{Tot} x 31.25) < 2.0	[(%TC x 83.33) + 8] / [(S_{Tot} - S_{SO4}) x 31.25)] < 2.0
PICR Mine Rock & Ore	[(%TC x 83.33) + 17] / (S_{Tot} x 31.25) < 2.0	[(%TC x 83.33) + 17] / [(S_{Tot} - S_{SO4}) x 31.25)] < 2.0
Tailings	%TC x 83.33 / [(S_{Tot} - S_{SO4}) x 31.25)] < 2.0	

11.5.3.4 *Estimation of PAG and NPAG Mine Rock and Ore Quantities*

Ajax geomet units given in the mine production schedule were converted into the same major lithological units defined in Lorax (2015a) as listed in Table 11.5-3.

Table 11.5-3. Conversion of Geomet Mine Units to Geo Units

Unit #	Geomet Unit	Geo Unit
1	West SLD, weak or absent albitization	SLD – weak
9	East SLD, weak or absent albitization	
2	West SLD, moderate albitization	SLD – moderate
10	East SLD, moderate albitization	
3	West SLD, strong albitization	SLD – strong
11	East SLD, strong albitization	
4	IMH (east and west)	IMH
7	PICR (east and west)	PICR
8	West MAFV	MAFV
12	East MAFV	
5	West SVHYB, weak or absent albitization	SVHYB
6	West SVHYB, moderate albitization	
13	East SVHYB	

The quantities of PAG and NPAG mine rock and ore were estimated using the two procedures outlined below.

- Quantity of PAG for each geologic unit assigned equal to the proportion of PAG ABA samples for the unit.
- Quantity of PAG based on inverse distance from ABA samples in geologic block model.

Estimates on the proportions of PAG and NPAG mine rock from the distribution of PAG and NPAG ABA samples within each major geologic unit as determined by the modified NP method was presented and discussed in Lorax (2015b) and presented below in Table 11.5-5.

In order to obtain a more accurate estimate of PAG mine rock, an ARD block model was prepared by KAM using the non-sulphate S AP and carbonate NP data collected as part of the geochemical characterization program. The block model was created in Studio 3 (Datamine) and was based on detailed lithological interpretations as well as the existing Cu-Au Block Model. It was observed both statistically and visually (in sections and plans) that the geologic units have the greatest influence on the variability of the AP and CaNP values. A total of 7 lithological domains were created (SLD_West, SLD_East, SLD_SouthEast, IMH, MAFV, PICR, PXPP). Hard boundaries were established between the rock-type domains but soft boundaries were established for the SLD sub-domains. For example, samples from the IMH domain were used to estimate domain IMH only, while samples from domain SLD_West can be used to estimate domains SLD_West or SLD_East or SLD_SouthEast providing it is located within the search parameters of the respective sub-domains. AP and CaNP were estimated individually for each block using the Inverse Power Distance squared estimation methodology. The search parameters for each domain are listed in Table 11.5-4. Blocks that were beyond the search distance were assigned as “unclassified”. The minimum and maximum number of samples used for each estimate were 2 and 6, respectively. The NPR (CaNP/AP) for each block was calculated after the AP and CaNP were assigned to the blocks. A NPR = 2.0 criterion was used to code a block NPAG or PAG.

Table 11.5-4. Block Model Search Distance (m)

	Search Pass 1			Search Pass 2			Search Pass 3		
Domain	**X**	**Y**	**Z**	**X**	**Y**	**Z**	**X**	**Y**	**Z**
IMH	100	75	75	150	110	110	-	-	-
MAFV	100	75	75	150	110	110	-	-	-
PICR	100	75	75	150	110	110	-	-	-
PXPP	100	100	100	-	-	-	-	-	-
SLD_1_East	80	80	50	120	120	75	160	160	100
SLD_2_SE	90	90	60	135	135	90	180	180	120
SLD_3_West	75	75	50	110	110	75	150	150	100

The quantities of PAG and NPAG rock from each of the major ore and geologic units based on the static test proportions as well as the geologic block model are shown in Table 11.5-5. Note that PAG proportions predicted from the ARD block model were revised in accordance with an extrapolated reduction of PAG material as a result of using the modified NP over the CaNP. Another adjustment made is to account for the 'unclassified' blocks. Specifically, mine blocks identified as unclassified were partitioned as PAG/NPAG quantities in the proportions derived from the static test dataset for each mine rock unit (Lorax, 2015b).

Table 11.5-5. Proportion of PAG Samples Based on Proportions from the Static Test Database and the Mine Schedule Using the Modified NPR Criterion

Designation	Total Tonnage	Tonnage Estimate from Static Testing			Tonnage Estimate from Block Model		
		NPAG	PAG	% PAG	NPAG	PAG	% PAG
High-grade	176,796,145	118,453,417	58,342,728	33%	136,156,474	35,715,636	20%
Medium-grade	207,172,030	171,952,785	35,219,245	17%	162,915,777	44,256,253	21%
Low-grade	53,937,031	42,070,884	11,866,147	22%	41,969,247	11,967,783	22%
Mine Rock	1,004,760,848	925,080,263	79,680,585	8%	921,895,335	82,865,513	8%
Mine Rock Units							
IMH	604,612,894	604,612,894	0	0%	604,612,894	0	0%
SLD weak	109,690,783	81,171,179	28,519,604	26%	77,399,810	32,290,973	29%
SLD mod	122,097,286	95,235,883	26,861,403	22%	93,183,909	28,913,377	24%
SLD strong	1,905,888	1,905,888	0	0%	1,905,888	0	0%
MAFV	25,370,211	20,803,573	4,566,638	18%	20,075,673	5,294,538	21%
PICR	97,774,049	87,018,904	10,755,145	11%	90,983,676	6,790,373	7%
SVHYB	11,006,943	9,135,763	1,871,180	17%	8,531,960	2,474,983	22%
Other	32,302,794	25,196,180	7,106,615	22%	25,201,525	7,101,269	22%

The greatest quantity of NPAG material available for blending is from the IMH unit that is 100% NPAG and the greatest quantity of PAG rock is mined from the weakly and moderately albitized SLD and PICR units. The high-grade ore shows a higher predicted PAG rock content when estimated through the static test database versus the block model. However, the opposite is true for medium-grade ore. Overall, less than 10% of the mine rock is predicted to be PAG in both static test and block model based calculations.

Additional samples are being analysed to update the ARD block model for the Mines Act permit application. The purpose of the sampling is to provide a higher degree of confidence regarding the spatial distribution of PAG material and allow the mine plan and mine rock schedules to be refined and reflect future updates. Estimates of the quantity of PAG and NPAG rock will continue to be revised during permitting and operations. The ARD block model will be updated to account for additional sample results that will become available during these phases of the Project.

11.5.3.5 NPAG – PAG Proportions Required for Blending

Knowledge of the ABA characteristics for the PAG and NPAG materials used for blending is necessary for the development of management strategies. The MRSF schedules indicate that the most readily available NPAG mine rock is IMH, SLD-weak and SLD-mod. The statistical distributions of selected ABA parameters for the relevant Ajax PAG and NPAG sub-populations are shown in Table 11.5-6. The

PAG materials will typically have between 0.6 %S to 0.9 %S and the NPAG materials have 30 to 50 kg $CaCO_3$/t, based on the median values for each unit. These values form the basis for a spatial and temporal evaluation of the quantity of NPAG required for blending in a MRSF.

Table 11.5-6. Selected ABA Parameters for PAG Mine Rock Units and NPAG Units Used for Blending Estimates

		Total S	Sulphide S	Sulphate S	Non-SO_4 S	CaNP	Non-SO_4 AP	Mod. NP	Mod. NPR
NPAG		%				kg $CaCO_3$/t			ratio
IMH	**n =**	**179**	**13**	**179**	**179**	**179**	**179**	**179**	**179**
10th PCTL		0.010	0.010	0.010	0.010	9.2	0.31	16	23
median		0.010	0.010	0.010	0.010	29	0.31	34	72
90th PCTL		0.062	0.020	0.010	0.050	95	1.6	97	207
SLD - weak	**n =**	**83**	**7**	**83**	**83**	**83**	**83**	**83**	**83**
10th PCTL		0.050	0.010	0.010	0.010	12	0.31	18	2.6
median		0.22	0.020	0.010	0.13	27	4.1	32	7.9
90th PCTL		0.61	0.086	0.44	0.43	62	13	70	88
SLD - mod.	**n =**	**109**	**36**	**109**	**109**	**109**	**109**	**109**	**109**
10th PCTL		0.020	0.010	0.010	0.010	17	0.31	23	4.0
median		0.11	0.015	0.010	0.080	42	2.5	48	26
90th PCTL		0.76	0.060	0.44	0.39	144	12	130	143
PAG									
MAFV	**n =**	**7**	**1**	**7**	**7**	**7**	**7**	**7**	**7**
10th PCTL		0.32	0.51	0.010	0.31	4.8	9.6	15	0.93
median		0.58	0.51	0.010	0.58	8.3	18	19	1.1
90th PCTL		0.67	0.51	0.022	0.67	19	21	29	1.9
PICR	**n =**	**9**	**-**	**9**	**9**	**9**	**9**	**9**	**9**
10th PCTL		0.51	-	0.010	0.34	3.2	11	14	0.75
median		0.81	-	0.020	0.79	12	25	29	1.1
90th PCTL		1.3	-	0.17	1.3	19	40	38	1.9
SLD - mod.	**n =**	**33**	**3**	**33**	**33**	**33**	**33**	**33**	**33**
10th PCTL		0.43	0.37	0.010	0.37	8.7	12	15	0.42
median		0.97	0.65	0.020	0.86	23	27	27	1.1
90th PCTL		2.1	0.76	0.038	2.1	47	66	35	1.7
SLD - weak	**n =**	**31**	**4**	**31**	**31**	**31**	**31**	**31**	**31**
10th PCTL		0.47	0.32	0.010	0.32	7.5	10	12	0.44
median		0.79	0.62	0.020	0.71	17	22	20	1.1
90th PCTL		1.5	0.98	0.21	1.3	36	41	40	1.8
SVHYB	**n =**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**
Median		0.47	-	0.010	0.47	13	15	20	1.4

The proportion of mine rock tonnage required to obtain a blended NPR = 3.0 is listed in Table 11.5-7. The proportions are based on CaNP, which provide a conservative estimate of the total available NP in the mine rock. The IMH is the NPAG unit that is most available for blending in the South MRSF and West MRSF. The table illustrates that 1.7 t and 2.0 t of NPAG IMH mine rock would be required to achieve a blended NPR =3.0 with one (1) tonne of PAG SLD-w or SLD-m, respectively. Conversely, lower quantities (1.0 t, 0.5 t, 1.1 t) of NPAG IMH are required to achieve a blend with a tonne of PAG MAFV, PICR or SVHYB.

Table 11.5-7. Proportion of NPAG Mine Rock required to achieve a blended NPR =3

PAG			NPAG			NPAG : PAG Required for NPR=3 Blend
Unit	Median CaNP	Median AP	Unit	Median CaNP	Median AP	
SLD - w	17	22	**IMH**	30	0.31	1.7 : 1
			SLD - w	29	3.1	2.5 : 1
			SLD - m	43	2.2	1.3 : 1
SLD - m	17	25	**IMH**	30	0.31	2.0 : 1
			SLD - w	29	3.1	2.9 : 1
			SLD - m	43	2.2	1.6 : 1
MAFV	8.3	12	**IMH**	30	0.31	1.0 : 1
			SLD - w	29	3.1	1.4 : 1
			SLD - m	43	2.2	0.8 : 1
PICR	4.6	6.4	**IMH**	30	0.31	0.5 : 1
			SLD - w	29	3.1	0.7 : 1
			SLD - m	43	2.2	0.4 : 1
SVHYB	13	15	**IMH**	30	0.31	1.1 : 1
			SLD - w	29	3.1	1.6 : 1
			SLD - m	43	2.2	0.8 : 1

Based on the calculated proportions in Table 11.5-7 the operational blending criteria for the Lower Backfill, South MRSF and West MRSF are set as follows.

- IMH will be used as the NPAG blending material.
- Two truckloads of IMH will be blended with one truckload of PAG SLD.
- One truckload of IMH will be blended with one truckload of PAG MAFV, PICR or SVHYB.

Due to the predominance of NPAG mine rock from the SLD unit in the Upper Backfill, the blending criteria for this facility is set as follows.

- SLD will be used as the NPAG blending material.
- Three truckloads of NPAG SLD will be blended with one truckload of PAG SLD.
- Two truckloads of NPAG SLD will be blended with one truckload of PAG MAFV, PICR or SVHB.

11.5.3.6 Spatial Distribution of PAG and NPAG in Pit

A strong understanding of the spatial distribution of PAG and NPAG material classes is crucial for the effective implementation of a mine rock segregation strategy. Based on the block model approach described above, a set of plan maps were produced illustrating the relative quantities of PAG- versus NPAG-dominated areas of uneconomic mine rock within the Ajax open pit at different elevations (Figures 11.5-1 through 11.5-6). In the upper levels of the pit (bench at 750 masl) uneconomic mine rock represents the largest portion of material to be blasted, while ore becomes more and more prevalent as mining operations move towards the bottom of the pit (e.g., 570 masl; Figure 11.5-4). PAG material occurs primarily in the southern periphery of the pit, little to no PAG material is predicted north of the ore body. This is consistent with the IMH unit making up the majority of the northern pit material. A significant portion of PAG material within the pit occurs directly adjacent to the ore body, however material in proximity to the ore does not necessarily show PAG character.

11.5.3.7 Neutral Metal Leaching Characteristics

Due to its low acid generation potential, the IMH unit may be considered for construction purposes outside of MRSFs. However, during the geochemical characterization process it was identified that portions of this unit may have the potential for the release of As. The four laboratory kinetic test samples made up of IMH material can be grouped into two subcategories, one with As contents ≤ 2.5 ppm and leaching rates below 0.0005 mg/kg/wk, the other one with As contents of 5 ppm and As leaching rates of > 0.0026 mg/kg/wk, therefore roughly a factor of 5 higher. When comparing the two IMH field bin samples having a similar range in As contents (1.8 and 5.2 ppm), the higher As sample releases median concentrations that are almost 50 times higher than the sample with the lower As content (0.0001 versus 0.0046 mg/L, respectively; Figure 11.5-5). It appears that for IMH samples, the solid-phase As content has a direct effect on the leaching rate of this species. In a very general sense it may be inferred that samples with an As content ≤ 2.5 ppm releasing relatively low amounts of As into solution. It was noted that this value corresponds to the detection limit of As in the assay database which poses a practical challenge when trying to distinguish between the two groups (Figure 11.5-6). In order to use solid-phase As content as a management tool to define mine rock with a higher neutral As leaching potential, an As concentration of 1 ppm would be required as part of the routine assay procedure.

11.5.4 Management Strategies

The Project mine plan has proactively considered the avoidance and/or mitigation of ML/ARD. Due to the excess availability of neutralizing potential in Ajax mine rock and tailings, both in the form of carbonate and non-carbonate minerals (Lorax, 2015a and b), a number of mine rock handling, placement and design strategies are proposed. In addition to strategic material handling, water management strategies are also proposed to address neutral metal leaching issues by limiting the amount of water coming in contact with exposed rock surfaces and collecting mine-affected drainage in seepage collection ponds. Management strategies specific to the Ajax Project include:

- Locate mine rock storage facilities to areas east and south of the open pit to:
  - increase distance from the City of Kamloops; and
  - facilitate collection of seepage.

Figure 11.5-1
PAG NPAG Block Model 840 Bench

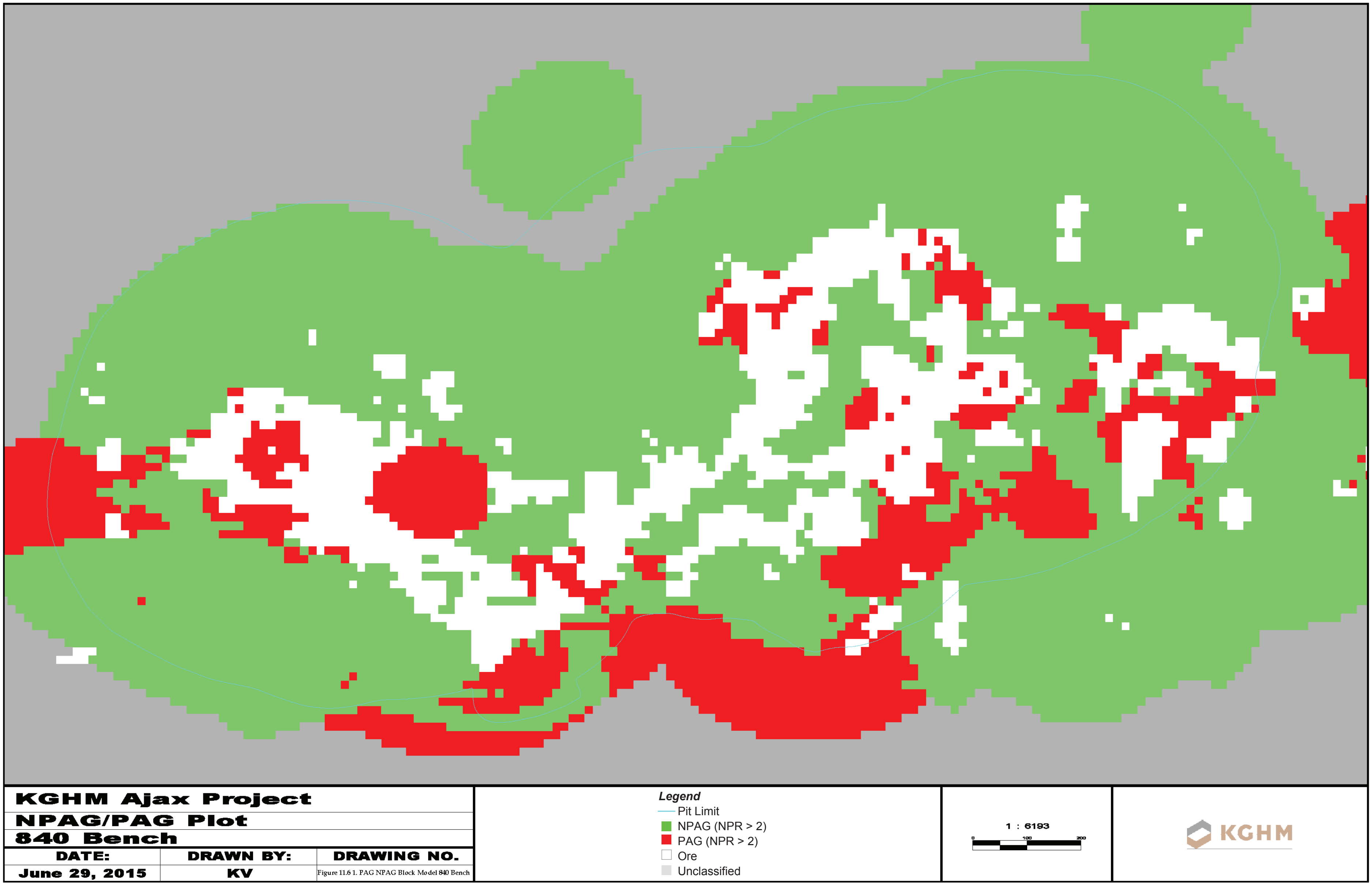
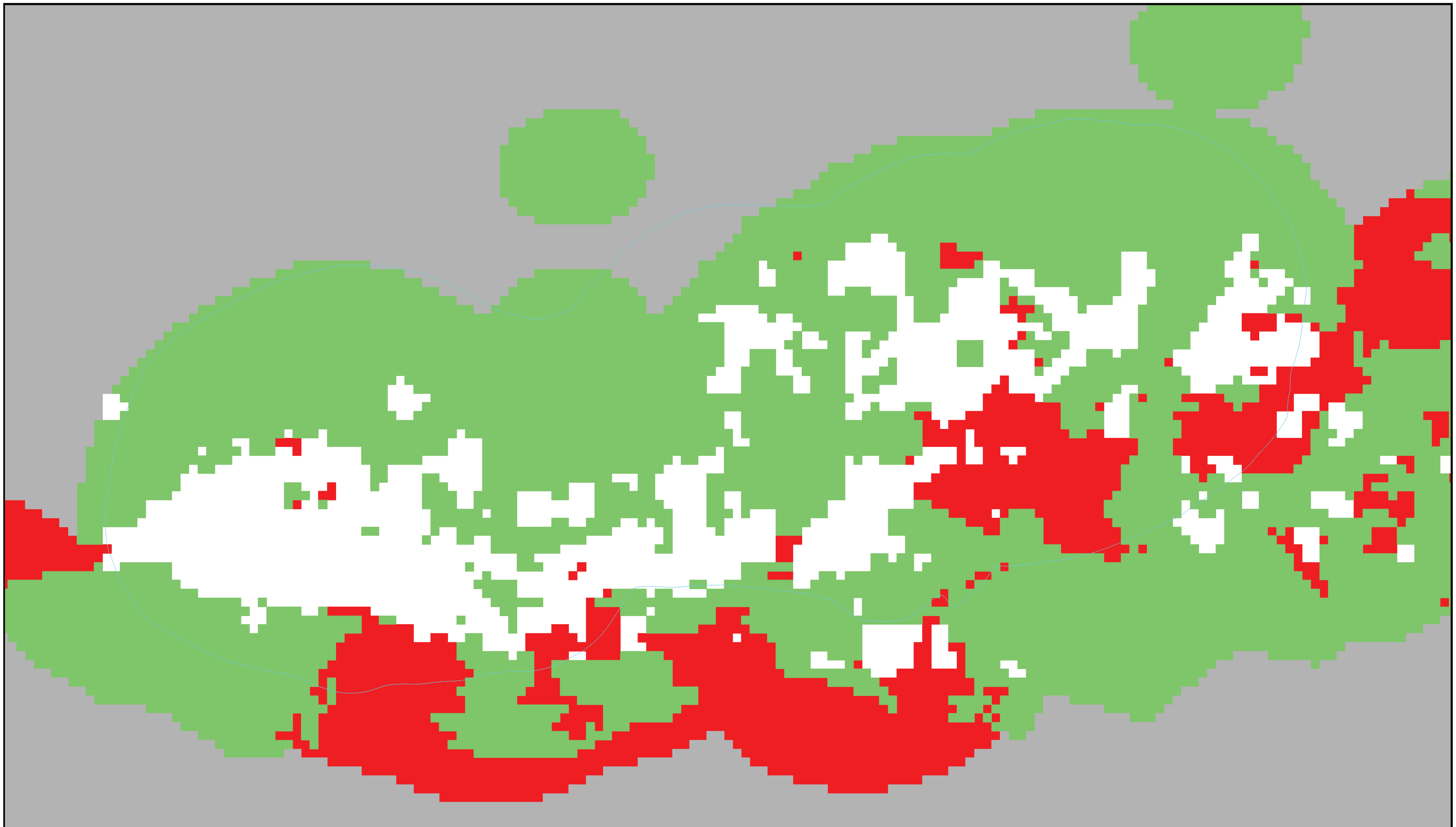


Figure 11.5-2
PAG NPAG Block Model 750 Bench



KGHM Ajax Project
NPAG/PAG Plot
750 Bench

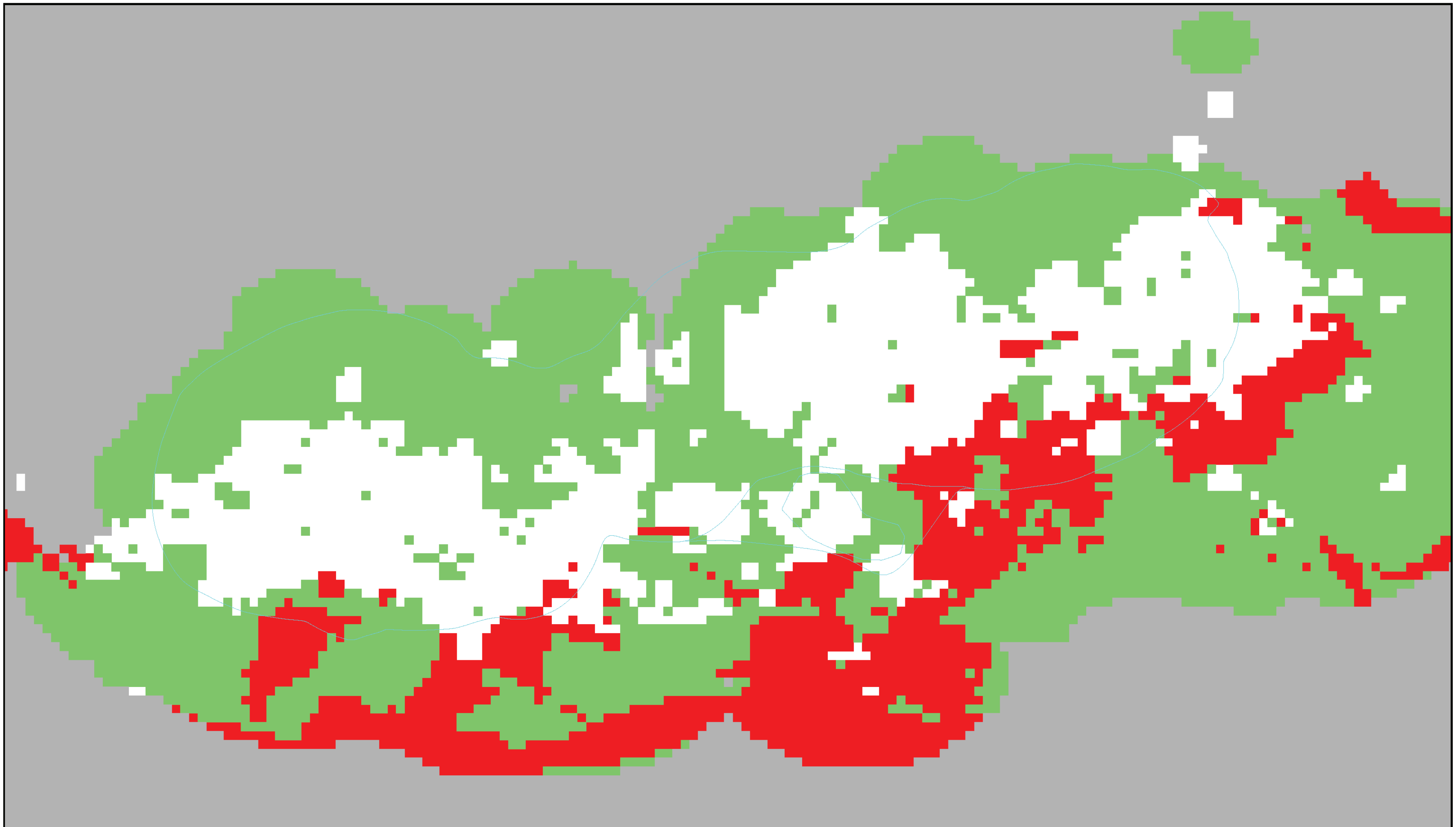
DATE:	DRAWN BY:	DRAWING NO.
June 29, 2015	KV	Figure 11.6.2. PAG NPAG Block Model 750 Bench

Legend
- Pit Limit
- NPAG (NPR > 2)
- PAG (NPR > 2)
- Ore
- Unclassified

1 : 6193
0 100 200

KGHM

Figure 11.5-3
PAG NPAG Block Model 660 Bench



KGHM Ajax Project
NPAG/PAG Plot
660 Bench

DATE:	DRAWN BY:	DRAWING NO.
June 29, 2015	KV	Figure 11.6 3. PAG NPAG Block Model 660 Bench

Legend
- Pit Limit
- NPAG (NPR > 2)
- PAG (NPR > 2)
- Ore
- Unclassified

1 : 6193

0 100 200

KGHM

Figure 11.5-4
PAG NPAG Block Model 570 Bench

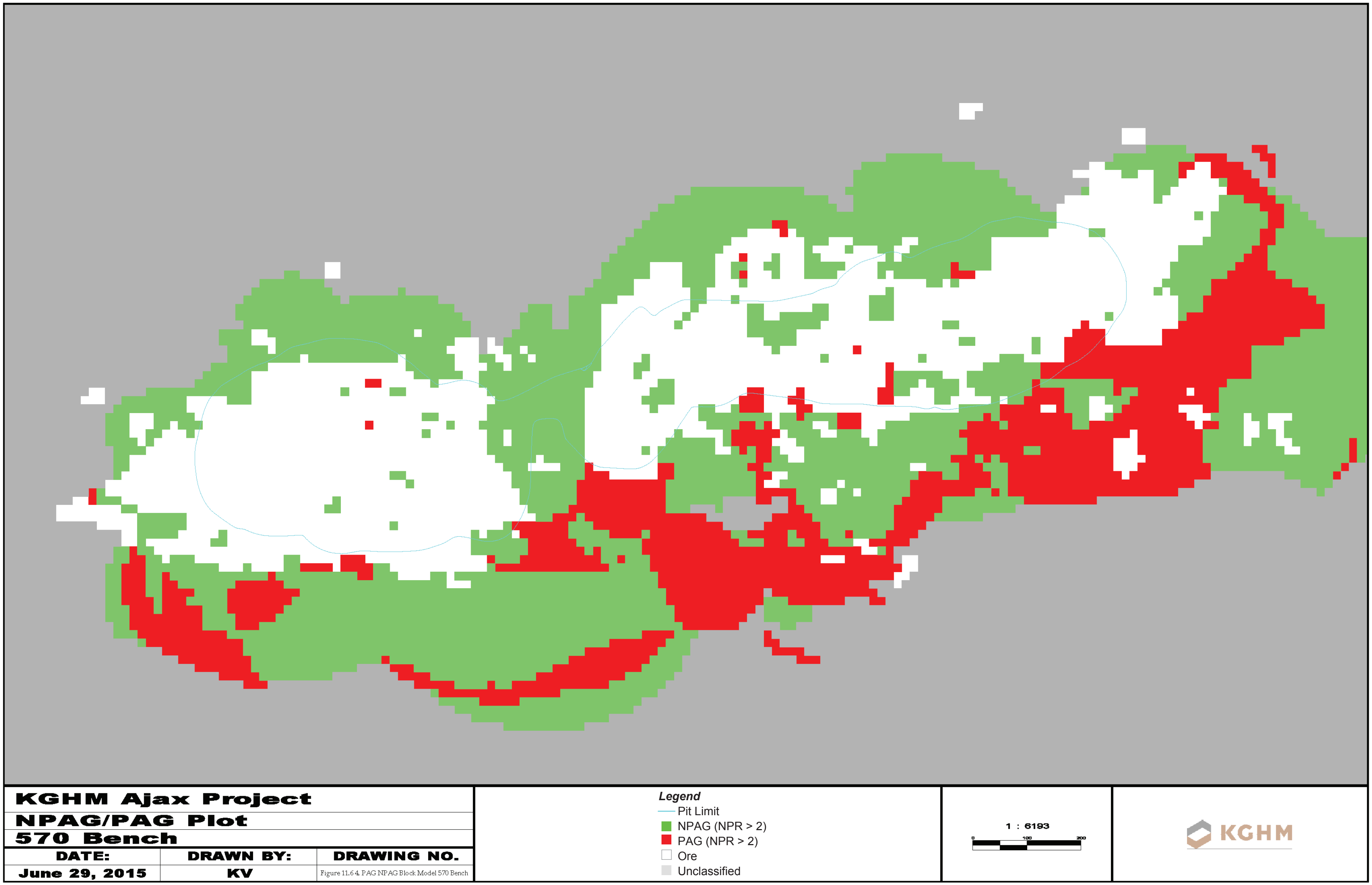


Figure 11.5-5

Solid-phase As Content versus Laboratory As Loading Rates and Field Bin Leachate Concentrations in IMH Kinetic Test Samples

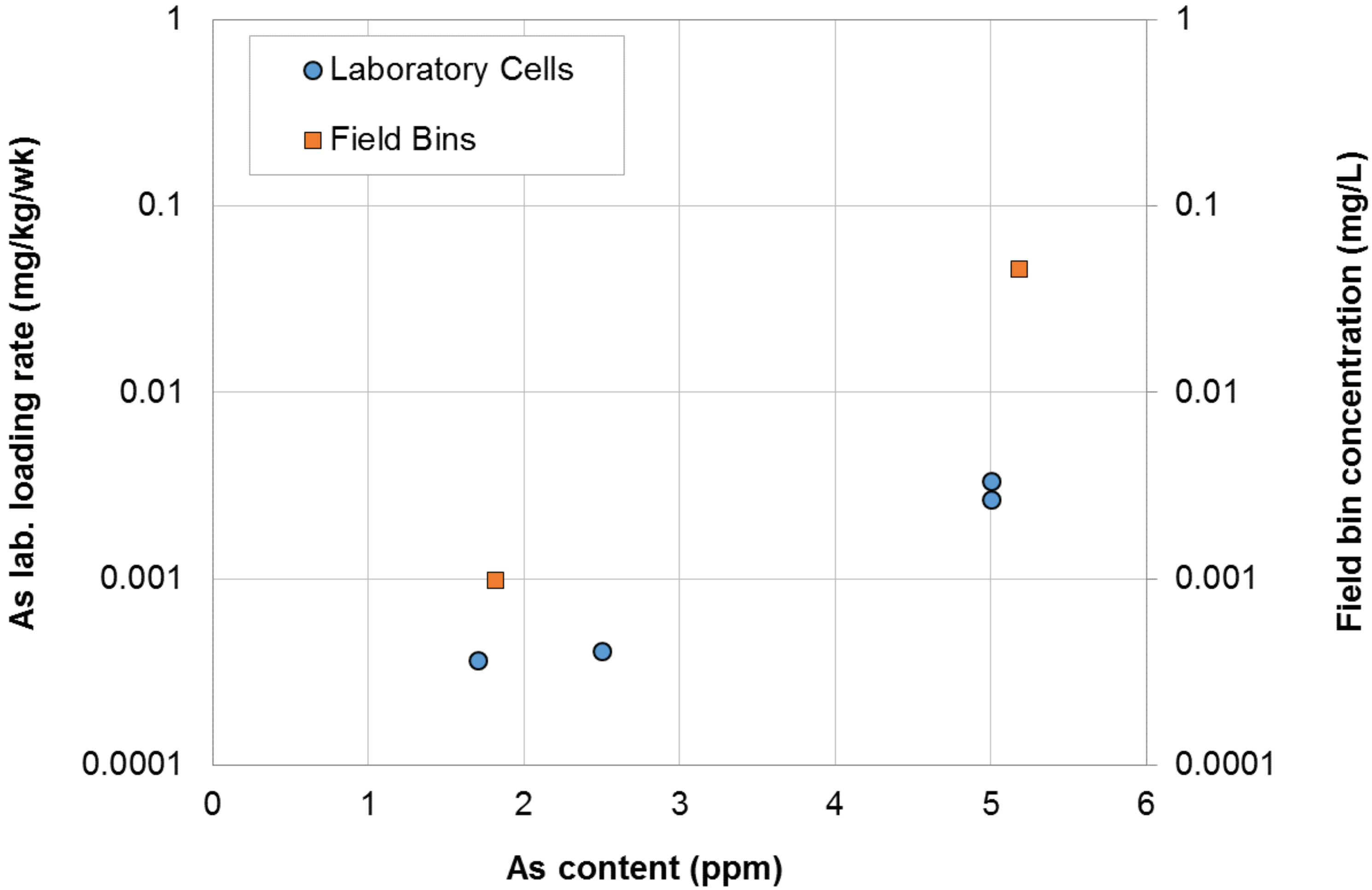
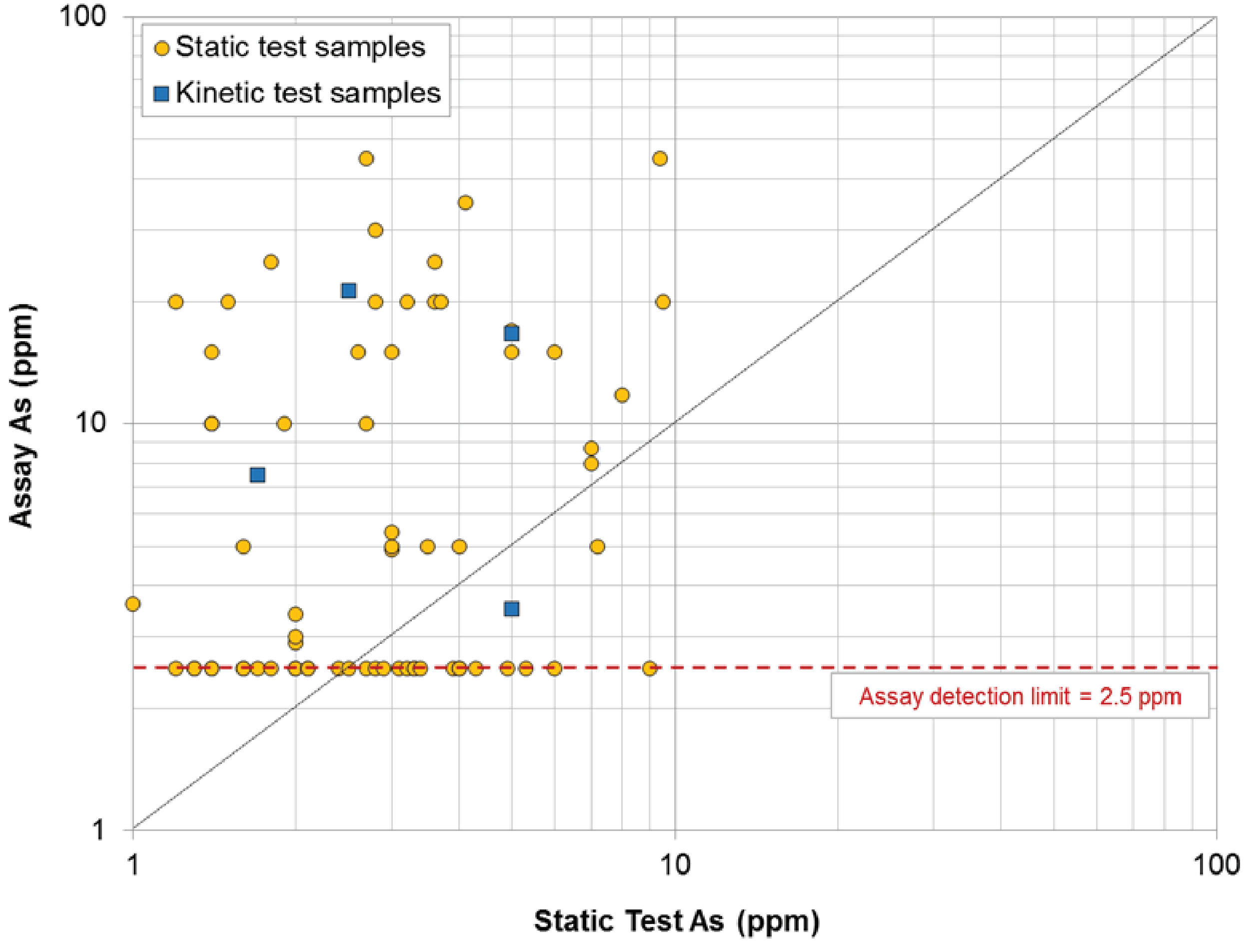


Figure 11.5-6

Comparison of Solid-phase As Contents in Assay versus Static Test Analyses for IMH Mine Rock Samples



- Segregate high-risk versus low-risk rock types in the pit;
- Blending of PAG and NPAG materials in proportions appropriate to prevent ARD onset;
- Construction of a NPAG base for the blended MRSFs;
- Limit infiltration by the implementation of a cover;
- East MRSF size minimized and constructed only of NPAG material to limit seepage over the Pedersen Creek Aquifer;
- Peterson Creek Diversion constructed to limit the quantity of contact water discharging to Peterson Creek;
- In-pit backfill contains seepage and prevents discharge to receiving water streams; and
- Use of liner systems in the TSF where tailings are in contact with embankments to limit infiltration of tailings pore water.

11.5.4.1 Mine Rock Management

During mining operations, the ARD management plan for uneconomic mine rock will be focused on in-pit identification of PAG rock and blending PAG with NPAG mine rock in the MRSFs. The following section provides technical overview on how mine rock blending will be carried out at the Ajax Project.

<u>Waste Handling and Placement Plan</u>

The estimate of PAG versus NPAG material quantities discussed above and presented in Lorax (2015b) indicated that 87% of the analyzed static test samples have a NPR >2 and are therefore classified as NPAG. This high proportion of NPAG rock allows for the implementation of a blending strategy for the MRSFs. During operations, in-pit identification of PAG material will be guided by the predicted spatial occurrence of PAG by the ARD block model as well as refinements derived by operational monitoring results as outlined Section 11.5.5.

Only three MRSFs will contain PAG material (pit backfill, South MRSF and West MRSF), where the remaining facilities will be entirely composed of NPAG rock. The MRSF schedules were generated utilizing PAG proportions defined by modified NPR values and list the relative proportions of PAG and NPAG material for each rock type on an annual basis. These annual schedules are provided in Table 11.5-8 for the pit backfill, Table 11.5-9 for the South MRSF and Table 11.5-10 for the West MRSF. The final column in each of the tables denotes the full tonnage of mine rock placed in each year.

Table 11.5-8. PAG NPAG Schedule for Pit Backfill

Pit Backfill														
Year	SLD - weak - PAG	SLD - mod - PAG	MAFV - PAG	PICR - PAG	SVHYB - PAG	Other - PAG	SLD - weak - NPAG	SLD - mod - NPAG	IMH - NPAG	MAFV - NPAG	PICR - NPAG	SVHYB - NPAG	Other - NPAG	Total (tonnes)
Upper Backfill														
18	6%	4%	2%	2%	0.1%	-	55%	23%	0.2%	2%	3%	3%	-	1,325,725
Total	**PAG = 14%**					**NPAG = 86%**								
Lower Backfill														
14	11%	3%	0.01%	0.2%	-	0.2%	9%	9%	58%	0.2%	9%	0.3%	0.7%	54,514,825
15	1%	8%	0.2%	0.3%	-	-	2%	11%	64%	0.9%	13%	0.2%	-	52,357,758
16	2%	13%	0.2%	0.2%	-	-	4%	13%	53%	6%	8%	0.1%	-	50,371,841
17	5%	4%	0.7%	0.01%	0.6%	-	20%	12%	44%	10%	0.5%	1%	-	22,759,772
18	10%	6%	0.3%	1%	-	-	48%	27%	-	1%	7%	-	-	1,995,805
Total	**5%**	**7%**	**0.2%**	**0.2%**	**0.1%**	**0.1%**	**7%**	**11%**	**56%**	**3%**	**8%**	**0.3%**	**0.2%**	**182,000,000**
	PAG = 13%					**NPAG = 87%**								

Table 11.5-9. PAG NPAG Schedule for South MRSF

South MRSF																
Year	SLD - weak - PAG	SLD - mod - PAG	SLD - strong - PAG	MAFV - PAG	PICR - PAG	SVHYB - PAG	Other - PAG	SLD - weak - NPAG	SLD - mod - NPAG	SLD - strong - NPAG	IMH - NPAG	MAFV - NPAG	PICR - NPAG	SVHYB - NPAG	Other - NPAG	Total (tonnes)
-2	-	-	-	-	-	-	11%	-	-	-	51%	-	-	-	38%	1,096,137
-1	0.9%	0.8%	-	0.0%	-	-	4%	9%	1%	-	69%	0.05%	0.3%	0.2%	14%	17,949,464
1	11%	12%	-	0.5%	0.1%	4%	13%	2%	7%	1%	2%	0.7%	0.5%	-	47%	14,593,064
2	0.4%	3%	-	0.4%	2%	1%	2%	3%	5%	0.8%	58%	0.8%	15%	0.4%	9%	17,557,539
3	3%	4%	-	1%	2%	-	0.1%	1%	24%	0.1%	47%	2%	14%	0.1%	0.4%	14,493,301
4	0.2%	1%	-	1%	2%	0.0%	0.1%	2%	4%	2%	61%	3%	22%	1%	0.4%	36,196,962
5	0.5%	0.1%	-	0.02%	0.8%	0.2%	0.56%	2%	2%	0.8%	84%	0.1%	6%	1%	2%	27,350,360
6	1.0%	0.1%	-	0.03%	0.8%	0.3%	1%	9%	1%	0.1%	72%	0.04%	8%	2%	4%	51,745,099
7	5%	1%	-	0.7%	1%	0.3%	0.003%	11%	5%	-	64%	1.1%	9%	0.5%	0.01%	72,478,101
8	3%	0.6%	-	0.7%	0.6%	0.03%	-	6%	12%	0.1%	69%	2%	5%	1%	-	43,037,083
9	1%	0.7%	-	0.5%	0.3%	0.01%	-	3%	0.2%	-	92%	0.7%	1.3%	0.1%	-	8,318,446
10	0.1%	1.1%	-	0.02%	0.2%	0.3%	1%	8%	12%	-	69%	0.03%	2%	3%	4%	41,632,348
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
13	3%	0.1%	-	-	0.1%	-	1%	8%	0.2%	-	80%	-	2%	-	5%	11,987,219
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	**2%**	**1.4%**	**-**	**0.4%**	**0.9%**	**0%**	**1%**	**7%**	**6%**	**0.3%**	**65%**	**1.0%**	**8%**	**1%**	**5%**	**358,435,123**
	PAG = 7%							**NPAG = 93%**								

Table 11.5-10. PAG NPAG Schedule for West MRSF

West (TSF) MRSF																
Year	SLD - weak - PAG	SLD - mod – PAG	SLD - strong - PAG	MAFV - PAG	PICR - PAG	SVHYB - PAG	Other - PAG	SLD - weak - NPAG	SLD - mod - NPAG	SLD - strong - NPAG	IMH - NPAG	MAFV - NPAG	PICR - NPAG	SVHYB - NPAG	Other - NPAG	Total (tonnes)
2	2%	3%	-	1%	1%	0.3%	4%	6%	8%	1%	53%	3%	4%	0.5%	14%	24,000,000
3	2%	5%	-	5%	2%	-	0.2%	1%	5%	0.3%	22%	17%	38%	1%	1%	24,000,000
4	0.1%	0.1%	-	3%	6%	0.01%	1%	0.1%	4%	0.3%	25%	10%	44%	1%	5%	16,000,000
5	0.1%	0.1%	-	0.3%	7%	1%	4%	0.02%	0.02%	-	38%	1%	33%	1%	14%	7,200,000
6	16%	1%	-	3%	1%	1%	0.3%	22%	5%	-	27%	5%	14%	2%	1%	22,000,000
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	5%	2%	-	2%	1%	-	-	14%	12%	-	54%	3%	6%	1%	-	18,000,000
9	8%	2%	-	2%	2%	-	-	2%	0.3%	-	74%	3%	7%	-	-	11,000,000
10	1%	3%	-	-	0.01%	1%	2%	16%	14%	-	51%	-	0.1%	7%	5%	12,000,000
11	10%	12%	-	0.004%	2%	1%	4%	12%	15%	-	19%	0.02%	7%	4%	14%	8,400,174
12	3%	4%	-	-	0.3%	0.04%	0.3%	11%	11%	-	67%	-	2%	0.2%	1%	60,219,418
13	49%	30%	-	-	-	-	1%	11%	6%	-	0.04%	-	-	-	4%	12,180,408
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**7%**	**5%**	**-**	**2%**	**1%**	**0.3%**	**1%**	**9%**	**8%**	**0%**	**45%**	**4%**	**12%**	**1%**	**4%**	**215,000,000**
	PAG = 16%							**NPAG = 84%**								

In the two PAG-bearing MRSFs where blending will be undertaken, the base of the MRSFs will be constructed on NPAG material. In addition, the annual schedules for these facilities and the pit backfill were screened to determine the critical time periods in which relatively high amounts of PAG versus NPAG material is deposited. This was done by calculating the proportional tonnage of NPAG and PAG mine rock for each MRSF by year and the overall proportion for each facility, which is presented in the NPAG/PAG ratio column in Table 11.5-11. Ongoing iterations of mine plan development will continue to refine the release of PAG and NPAG mine rock to achieve a NPR of 3:1. Table 11.5-11 also presents the NPR (based on modified NP) that is calculated from the weighted proportion of the blended PAG and NPAG mine rock for two scenarios:

- The best estimate case uses the median NP and AP values for each PAG and NAG sub-population of the individual mine rock units.
- The conservative case uses the 90th percentile AP for the PAG category of all mine rock units and median values for all remaining parameters required.

Table 11.5-11. PAG NPAG Schedule for Pit Backfill

Year	NPAG/PAG Proportion (t/t)	Blended NPR Best Estimate	Blended NPR Conservative
Lower Backfill			
14	6.0	7.9	4.5
15	9.1	10	5.2
16	5.4	6.9	3.3
17	8.5	8.3	5.1
18	4.9	5.2	3.2
Total	6.7	8.1	4.3
Upper Backfill			
18	19	6.6	4.5
South MRSF			
-2	8.3	9.6	4.7
-1	17	14	7.9
1	1.4	3.2	1.6
2	9.6	11	6.4
3	8.4	10.0	5.9
4	19	17	12
5	44	31	22
6	27	20	13
7	11	12	7.6
8	21	18	13
9	35	30	20
10	35	21	14
11	-	-	-
12	-	-	-
13	20	18	11
Total	14	14	8.4

Year	NPAG/PAG Proportion (t/t)	Blended NPR Best Estimate	Blended NPR Conservative
West MRSF			
2	13	9.7	5.3
3	5.9	7.2	4.6
4	9.4	9.3	6.8
5	11	9.1	5.6
6	3.3	4.9	3.1
7	-	-	-
8	9.3	10.0	6.5
9	6.2	8.9	5.4
10	20	13	7.6
11	2.8	4.2	2.1
12	13	12	6.6
13	0.26	1.3	0.64
Total	**5.6**	**6.9**	**3.9**

Bulk NPR values falling below a value of 3.0 are highlighted in Table 11.5-11.

Overall, it is apparent that, on a tonnage basis, NPAG material makes up the vast majority of the mine rock in the pit backfill, West MRSF and South MRSF despite the use of only NPAG material for the construction of other MRSFs and TSF embankments. The only occasion in which more PAG rock is scheduled to be deposited is Year 13 of the West MRSF which is also reflected by an overall NPR of 1.3. Only considering the conservative case, two more years have relatively low overall NPR values, namely Year 11 in the West MRSF and Year 1 in the South MRSF (Table 11.5-11). For these time frames refinements to the schedule will be made to ensure a greater proportion of NPAG material is available for blending.

Segregation Procedures

1. The pit operations team will use blast classification maps and high precision GPS to define the boundaries of each ore and waste class. The maps are also used to communicate the shift's plans with equipment operators and supervisors at the beginning of each shift.
2. Haul trucks are loaded by a shovel, the operator of which is responsible for knowing the material class being excavated.
3. Haul trucks will use a dispatch system to direct them to the correct facility.
4. The haul truck driver then delivers the load to the crusher or to the appropriate stockpile (if ore) or MRSF (if uneconomic mine rock).

Placement and Blending Procedures

Controlled end-dumping mine rock placement method will be implemented to ensure that the PAG mine rock is well distributed through the MRSFs and Backfill to maintain neutral pH conditions in the MRSF. Blended layers will be constructed by placing a 1 m end dumped PAG layer alternating with NPAG material in the proportions identified in Table 11.5-12. IMH will be used as NPAG blending material in the MRSFs and the Lower backfill. SLD will be used as a NPAG blending material in the Upper Backfill. The choice regarding the NPAG:PAG proportion is dependent on the type of PAG mine rock and the storage facility.

Table 11.5-12. PAG : NPAG Blending Proportions

PAG Mine Rock to Blend	NPAG : PAG	
Facility	MRSFs and Lower Backfill	Upper Backfill
PAG SLD	2 : 1	3 : 1
PAG MAFV, PICR or SLVHB	1 : 1	2 : 1

A minimum 3 m layer of non-PAG mine rock will be placed at the base of the blended dumps to ensure that seepage that may travel along the base of the MRSF does not come into contact with any PAG rock. This strategy will also provide a source of additional buffering for infiltrating water that comes into contact with the PAG layers.

The construction of blended layers is achieved by controlled end dumping of haul trucks. The spotting dozer on the MRSF will spot each load to insure correct layer thicknesses are achieved. For PAG rock a 1 m vertical thickness is placed, and then a NPAG rock layer is placed, as tabulated in Table 11.5-12. Communication protocols will be in place to ensure that the PAG or NPAG materials are directed to the appropriate PAG or NPAG placement area. To control the PAG layer thickness for blending, the spotting dozer moves between dumped truck loads. The spacing between dumped loads will vary according to the face height.

The assumed standard operating procedure for end dumping mine rock at Ajax is creating 20 m-high lifts with 300 t capacity haul trucks (truck capacity may change with advancement of Project design). With these standard conditions, one truck load of mine rock would produce a thickness of 0.5 m over average width of 8.15 m on the face of the MRSF.

11.5.4.2 TSF Embankment and Tailings Management

ML/ARD management objectives associated with the TSF include maintaining pH-neutral drainage and limiting the neutral metal loading to the receiving environment.

Preventing the development of ARD from the TSF will be achieved by constructing the TSF with NPAG materials. The TSF embankment will be constructed with NPAG mine rock from the Ajax open pit as determined by the mine rock production and placement schedules. Similarly, tailings deposited in the TSF will be a low-sulphur NPAG tailing as documented in Appendix 3-A (Lorax, 2015a).

Mitigation of the potential effects of neutral metal leaching during operations will be achieved by limiting seepage rates through the TSF embankments and foundation and the construction of seepage collection ponds that will collect and divert seepage water to process. The foundation of the TSF is underlain by low permeability glacial till, which will restrict the rate of seepage Appendix 6.6-D (BGC 2015). Seepage through the embankments will be limited by liner systems. Installation of an underdrain system beneath the embankments will collect seepage water and direct it to seepage collection ponds. A description of the operational underdrain and seepage collection system is provided in Appendix 3-D (Norwest 2015). During the Post-Closure period the seepage collection ponds will be operated as evaporation ponds.

During the Post-Closure phase the effects of neutral metal leaching will be achieved by pumping residual operational pond water to the open pit and the placement of a dry cover over the TSF to limit infiltration into the tailings. The closure design of the TSF is presented in Appendix 3-D (Norwest 2015).

11.5.4.3 Ore Management

ML/ARD management of the ore stockpiles will be achieved by maintaining pH-neutral conditions while the stockpiles are present during mine operations. The ore stockpiles are scheduled to be removed and processed during the latter stages of the mine life. Although a portion of the stockpiled ore is expected to be PAG, only a small proportion (< 2%) has the potential to become acidic within the 20 year operation period (Section 11.5.3.2). During Decommissioning and Closure, once the ore has been removed from the stockpiles, the ore stockpile pad will be removed and placed as backfill in the open pit. In the event of unexpected early closure when peak quantity of ore is stockpiled (56 Mt), 2 years would be required to process the ore. However, ongoing mine planning is reducing the peak quantity of ore that will be stockpiled at site.

11.5.5 Monitoring

ML/ARD Monitoring is designed to characterize mine waste during the implementation of the ML/ARD Management Plan. Although specific objectives and procedures of the monitoring plan vary slightly between the facilities, the primary objectives shared for all facilities include:

- provide sufficient characterization to effectively segregate mine rock and implement the operational management plan objectives; and
- provide sufficient characterization to document the geochemical characteristics of the rock in each storage facility as a result of the ML/ARD management activities.

The necessary in-pit monitoring and subsequent confirmatory monitoring is presented in the following sections.

11.5.5.1 In-Pit Monitoring

In-pit monitoring will be conducted to identify PAG mine rock to allow it to be blended into the MRSF and differentiate it from NPAG mine rock and ore.

- Ore Identification and Management:
  - Ore grade identified by block model and assays on blast hole drill cuttings. Visual confirmation by site geologist will be conducted to assess discrepancies between assays and block model.
  - In-pit ore will not be assayed for ABA.

- Segregation of PAG and NPAG mine rock:
  - Mine rock geo units will be identified visually by site geologist and from the block model.
  - IMH mine rock is 100% NPAG. IMH will be identified and segregated as NPAG mine rock based on block model and visual observation on the bench.
  - SLD, SVHB, and MAFV units contains 20% to 30 % PAG rock and the PICR unit contains 7% PAG. Blast hole drill cuttings from these units will have ABA assays.

Procedures will vary depending on the specific requirements and capabilities of the Ajax assay lab, however, the procedures and analyses listed below are planned for the Ajax pit.

In-Pit Sampling Procedures

1. Samples of cuttings from blast holes are collected for grade control and mine rock segregation purposes.
2. Mine rock samples from blast may be composited if required.
3. Cuttings samples are split into aliquots for grade control and for determination of the appropriate ABA parameter.
4. Samples sent to on-site laboratory for sample preparation and analysis ($S_{TOT,}$ C_{TOT} and S_{HCL}).
5. Test results are imported into the mine's grade control software for processing by the mine geologists. 2% of the in-pit samples will be sent to an external laboratory for QA/QC.
6. PAG / NPAG boundaries or necessary grade/mineralization types are plotted for each blast pattern, and mine geologists use the mine's grade control software to define polygons outlining contiguous zones of waste and ore types.
7. Ore grade polygons are defined for material above the mine's operational cut-off grade, with the result being that all material in a blast is classified as:
   - Direct mill ore;
   - Low or Moderate grade ore to stockpile;
   - NPAG IMH mine rock for embankment construction;
   - NPAG IMH mine rock for blending in West MRSF or South MRSF;
   - PAG SLD, SLVH, PICR or MAFV mine rock for blending in West or South MRSF;
   - NPAG SLD, SLVH, PICR or MAFV mine rock for construction of embankments or MRSFs;
8. Material classification information is uploaded to loading equipment for GPS and Dispatch
9. A map of the final ore and waste classifications is provided to the pit operations team to guide the dispatching of all rock released from the pit.

11.5.5.2 Confirmatory Monitoring

Confirmatory monitoring will be conducted for ore and mine rock that is placed in the ore stockpile, MRSFs, and reclamation stockpile. The primary objective of this monitoring is to confirm and document that the ML/ARD Management Plan was implemented as planned. In order to achieve this, the proposed sampling frequency and ABA parameters are listed in Table 11.5-13. A higher frequency of confirmatory monitoring will be conducted for facilities where blending will be conducted. Duplicate samples will be prepared from the onsite laboratory samples and will be sent to an external lab for testing.

Table 11.5-13. Confirmatory Sample Analyses and Frequency

Facility	On-site Analyses		External Analyses	
	Analyses	Frequency	Analyses	Frequency
West & South MRSFs	S_{TOT}, S_{HCL}, C_{TOT}	75,000 t	S_{TOT}, S_{HCL}, Mod NP, C_{TOT}, Aqua-Regia metal	3,750,000 t
East MRSF	S_{TOT}, S_{HCL}, C_{TOT}	100,000 t	S_{TOT}, S_{HCL}, Mod NP, C_{TOT}, Aqua-Regia metal	5,000,000 t
TSF Embankments	S_{TOT}, S_{HCL}, C_{TOT}	150,000 t	S_{TOT}, S_{HCL}, Mod NP, C_{TOT}, Aqua-Regia metal	7,500,000 t
Ore Stockpile	S_{TOT}, S_{HCL}, C_{TOT}	150,000 t	S_{TOT}, S_{HCL}, Mod NP, C_{TOT}, Aqua-Regia metal	7,500,000 t
Reclamation Stockpiles	S_{TOT}, S_{HCL}, C_{TOT}	150,000 t	S_{TOT}, S_{HCL}, Mod NP, C_{TOT}, IC, Aqua-Regia metal	7,500,000 t
Tailings	S_{TOT}, S_{HCL}, C_{TOT}	Weekly	S_{TOT}, S_{HCL}, Mod NP, C_{TOT}, Aqua-Regia metal	Monthly

Samples for mine rock, ore and reclamation overburden/soil will be collected from the storage facility during construction and tailings samples will be collected from the tailings slurry pump box. The time and location that each sample was taken will be recorded. The results of the confirmatory sampling will be reviewed as they become available and the ML/ARD Management Plan updated should the confirmatory monitoring program determine that management objectives are not being met.

11.5.5.3 Seepage and Tailings Slurry Water Quality Monitoring

Quarterly sampling of the seepage collection ponds will be conducted to determine the metal leaching rates from the MRSF and TSF Embankments. In addition, tailings slurry water samples will be collected quarterly from the tailings pump box.

11.5.5.4 On-site Laboratory

An on-site laboratory will be commissioned in order to facilitate the rapid analysis of samples collected during the implementation of the ML/ARD Monitoring Plan. The laboratory will be located centrally on the site near the ore processing facility. The laboratory will have standard ore assay and sample preparation capabilities in addition to a selected set of ML/ARD specific tests.

ML/ARD test requirements include the following parameters:

- Total sulphur;
- HCl soluble sulphur; and
- Total carbon

11.5.6 Reporting

The results of the operational monitoring will be reported to MEM in annual reports.

11.6 AIR QUALITY MONITORING AND DUST CONTROL PLAN

11.6.1 Purpose

KGHM Ajax Mining Inc. (KAM) has developed a preliminary Air Quality Monitoring and Dust Control Plan (AQMDCP or the Plan) to address potential environmental concerns during the Construction, Operation, Decommissioning and Closure, and Post Closure of the Project. The AQMDCP is a component of the Environmental Management System (EMS) and will be implemented by KAM in conjunction with processes outlined in the EMS (Section 11.1).

The AQMDCP presents a framework for managing potential adverse environmental effects based on the Application/EIS and information from regulators, Aboriginal groups, stakeholders and the public gathered in the pre-Application stage. The plan outlines best management practices (BMPs) and mitigation measures which will be used by KAM to reduce potential effects on air quality. In general, prevention of emissions is the most practical way to achieve these objectives. This plan will be updated and refined based on detailed Project design and permitting requirements. A detailed Plan will be submitted as part of the joint *Mines Act* and *Environmental Management Act* (MA/EMA) permit applications.

The criteria air contaminants (CACs) of interest in this AQMDCP include sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and particulate matter (PM). These substances are selected based on the expected Project emissions, professional judgment obtained from previous project experience, and the ambient air quality objectives (AAQO or 'applicable regulatory criteria') established by Canada and British Columbia (BC) regulatory agencies. The AMDCP also focuses on reducing dustfall from Project activities during Construction, Operation, Decommissioning and Closure and Post Closure.

The AQMDCP will work in conjunction with other components of the environmental and operational management plans, including:

- Greenhouse Gas Management (Section 6.1);
- Environmental Management System (Section 11.1);
- Solid Waste Management Plan (Section 11.9);
- Explosives Management Plan (Section 11.11);
- Wildlife/Vegetation Monitoring Plan (Section 11.21);
- Transportation Management Plan (Section 11.20);
- Conceptual Landscape Restoration and Reclamation Plan (Section 11.26); and
- Compliance Reporting (Section 11.29).

The Plan will be adaptive in its approach. KAM will rely on ongoing monitoring and stakeholder consultation programs to provide early warnings of concerns. All air quality and fugitive dust issues will be recorded and addressed in a timely and transparent manner. The information gained from these programs will support further Plan improvements and ensure that BMPs and appropriate mitigation responses are implemented.

KAM will be responsible for the execution, implementation and maintenance of the Plan during the Project Construction, Operation, Decommissioning and Closure, and Post Closure phases.

11.6.2 Performance Objectives

AAQO are non-statutory limits (i.e., not legally binding) used to guide decisions. They are established by government agencies to protect human health and the environment and are generally expressed in terms of a concentration (e.g., micrograms per cubic metre) averaged over a specific period of time. AAQO are typically used to assess air quality, develop long-term air management strategies and evaluate progress. In this AQMDCP the AAQO are used as the performance objectives.

The province of BC uses a suite of AAQO that have been developed provincially and nationally to inform decisions on the management of air contaminants. These include Provincial Air Quality Objectives (AQOs), the former Pollution Control Objectives (PCOs), National Ambient Air Quality Objectives (NAAQOs) and Canadian Ambient Air Quality Standards (CAAQS) (BC MOE 2014). These are collectively referred to as 'applicable regulatory criteria' or 'regulatory criteria'.

The Canada (Federal) and BC AAQO are summarized in Table 11.6-1, with regulatory criteria applicable to this Project highlighted in bold font. The Canada AAQO is denoted as Desirable, Acceptable and Tolerable. The BC objectives are denoted as Levels A, B and C. Note that the Canada and BC AAQO for some substances are very similar.

Table 11.6-1. Provincial and Federal Ambient Air Quality Objectives and Standards

Substance (Units)	Averaging Period	Provincial (BC) AAQO			National (Canada) NAAQO & CAAQS [c d]		
		Level A	Level B	Level C	Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Dustfall (mg/dm²/day)	24-hour	**1.7** [e]	2.9 [e]	- -	- -	- -	- -
TSP (µg/m³)	24-hour	**120**	200	260	- -	120	400
	Annual	**60**	70	75	60	70	- -
PM_{10} (µg/m³)	24-hour	- -	**50**	- -	- -	- -	- -
$PM_{2.5}$ (µg/m³)	24-hour		**25** [a]			28 (27) [b]	
	Annual		**8** [a]			10 (8.8) [c]	
SO_2 (µg/m³)	1-hour		**200** [f]		**450**	900	- -
	24-hour		- -		**150**	300	800
	Annual		- -		**30**	60	- -

Substance (Units)	Averaging Period	Provincial (BC) AAQO			National (Canada) NAAQO & CAAQS [c d]		
		Level A	Level B	Level C	Maximum Desirable	Maximum Acceptable	Maximum Tolerable
NO_2 (µg/m³)	1-hour		**188** [g]		- -	**400**	1,000
	24-hour		- -		- -	**200**	300
	Annual		**60**		60	100	- -
CO (µg/m³)	1-hour	**14,300**	28,000	35,000	15,000	35,000	- -
	8-hour	**5,500**	11,000	14,300	6,000	15,000	20,000

NOTES:
[a] The $PM_{2.5}$ 24-hour average is based on the 98th percentile value for one year.
[b] The CAAQS for 24-hour $PM_{2.5}$ is referenced to the annual 98th percentile of daily 24-hour average concentrations, averaged over three years. The first CAAQS is the standard effective in 2015; the new standard proposed for 2020 is given in brackets (Environment Canada 2013).
[c] The CAAQS for annual $PM_{2.5}$ is referenced to the 3-year mean of annual average concentrations. The first CAAQS shown is the standard effective in 2015; the new standard proposed for 2020 is given in brackets (EC 2013).
[d] National Ambient Air Quality Objectives, or NAAQO, summarized in (CCME 1999).
[e] BC MOE 1979 Pollution Control Objectives for the Mining, Smelting, and Related Industries (BC MOE 1979). As the dustfall Objective is a daily rate referenced to a 30 day sampling interval, the Objective is referenced to the monthly averaging interval, not the daily.
[f] Achievement is based on the annual 99th percentile of daily 1-hour maxima, averaged over one year. This requires the extraction of the highest predicted 1-hour value at each location for each day, followed by the calculation of the 99th percentile (the fourth highest) of those 365 values.
[g] Achievement is based on the annual 98th percentile of daily 1-hour maxima, averaged over one year. This requires the extraction of the highest predicted 1-hour value at each location for each day, followed by the calculation of the 98th percentile (the eighth highest) of those 365 values.
- - Indicates no applicable objective or standard specified for this Jurisdiction
*Values in **boldface** identify the most stringent objectives adopted to evaluate the Project.*

The Canada AAQOs are defined as follows:

- the **Maximum Desirable Level** is the long-term goal for air quality and provides a basis for anti-degradation policy for unpolluted parts of the country, and for the continuing development of control technology;
- the **Maximum Acceptable Level** is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being; and
- the **Maximum Tolerable Level** denotes time- based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population.

The BC AAQOs are defined as follows:

- **Level A** is set as the objective for new and proposed discharges and, within the limits of best practicable technology, to existing discharges by planned staged improvements for these operations;
- **Level B** is set as the intermediate objective for all existing discharges to meet within a period of time specified by the Director (BC MOE), and as an immediate objective for existing discharges which may be increasing in quantity or altered in quality as a result of process expansion or modification; and
- **Level C** is set as the immediate objective for all existing chemical and petroleum industries to reach within a minimum technically feasible period of time.

In 1979 BC established PCOs for the mining, smelting, and related industries (BC MOE 1979). Table 11.6-1 lists objectives for dustfall that are derived from this document. It specifies a range in values that have been portrayed as Level A and Level B. While the PCOs themselves have been rescinded the dustfall objectives continue to be employed.

In 1995, BC established an Interim Level B 24-hour Objective for PM_{10} of 50 $\mu g/m^3$. In 2009, BC adopted AAQO for respirable particulate matter ($PM_{2.5}$) set at 25 $\mu g/m^3$ for a 24-hour averaging period (as a 98^{th} percentile value over one year) and 8 $\mu g/m^3$ for the annual averaging period (BC MOE 2014). BC also listed a planning goal of 6 $\mu g/m^3$ for the annual averaging period. The status of this goal is uncertain given recent changes in $PM_{2.5}$ measurement methodologies, and the uncertainty surrounding historical $PM_{2.5}$ measurements.

The CAAQS for 2015 and 2020 were adopted by the Canadian Council of Ministers of the Environment (EC 2013). The new CAAQS replace the Canada-wide Standards for PM and O_3. A review of the 2020 CAAQS is expected in 2015.

It is important to note that the original Canada-wide Standards were not intended to be used as a standard for predicted concentrations at facility fencelines (CASA 2003). They are intended to be employed as a means of determining potential health effects in a large census metropolitan area (population greater than 100,000). As such, the stations to which the Canada-wide-Standards were applied were intended to be representative of the community as a whole. These stations are carefully selected to be free of interference from nearby sources such as highways or industrial facilities (CCME 2000).

It is expected that this same principle applies to the CAAQS. This caveat applies to all objectives and standards to some extent. At a location where predicted concentrations exceed an objective or standard, there needs be a receptor (e.g., resident population, sensitive ecosystem) capable of being affected by that substance for an adverse effect to occur.

The British Columbia and Canada AAQOs and CAAQS for CACs relate to ambient air quality. Ambient air is outside of the occupational work place. Separate air quality guidelines and standards exist for the occupational workplace locations and these concerns are addressed by other regulatory processes in British Columbia. Occupational Health and Safety Regulations (WorkSafeBC 2015) and the Health, Safety and Reclamation Code for Mines in British Columbia (BC MEMPR 2008, enforced through WorkSafeBC and the Chief Inspector of Mines, respectively) require the proponent to provide a safe working environment for employees. Canadian Standards Association (CSA) design standards and the *Mines Act* (Province of British Columbia 2015) permitting process ensure the engineering design of the Project protects both the employees and the public. As human health and safety are governed by legislation and KAM is required to comply with the laws of BC, there is no need to include this in the Application.

11.6.3 Environmental Protection Measures

The following section describes the environmental protection measures to avoid, control and mitigate air emissions from Project activities during construction, operations, closure, and post-closure. The emphasis is on controlling air emissions at the source through Project design and application of BMPs to minimize air emissions.

11.6.3.1 Design Criteria

A number of Project design criteria have been established as mitigation measures to reduce CAC and fugitive dust emissions:

- conveyor from crusher to plant will be covered with an arch cover to reduce dust generation;
- construct a cover over the coarse ore and fine ore stockpiles;
- install dust collectors (baghouses) for the coarse ore reclaim area, cone crusher area, high pressure grinding roller (HPGR) area);
- partially enclose the primary crusher;
- minimize the height from which materials are dropped;
- use covered concentrate transport trucks;
- design roads to minimize haul distances;
- use large trucks for ore and mine rock transport to minimize the number of trips required between the source and destination;
- construct roads with coarse gravel and aggregate material;
- where practical, orient the exposed stockpiles to minimize wind exposure;
- minimize the height of stockpiles where compatible with operational requirements;
- the concentrate transport trucks will be well sealed to reduce deposition of concentrate along the transportation route;
- comply with the *Sulphur in Diesel Fuel Regulation* (EC 2002);
- comply with the *Open Burning Smoke Control Regulation* (Government of BC 2003); and
- select mine equipment in compliance with BC's Best Achievable Technology policy (BC MOE 2012)

11.6.3.2 Construction

Following are the air quality management and mitigation measures that will reduce CAC and fugitive dust emissions during Construction:

- watering haul road surfaces as appropriate to maintain the optimum 4% moisture ratio for suppression of fugitive dust;
- roadways will be properly graded, compacted and maintained to reduce the silt content for the surface material;
- construct roads with coarse gravel and aggregate materials;
- grade snow into the surface of unpaved roads during winter to suppress dust emissions;
- operate vehicles within the posted maximum speed limits to minimize fugitive dust and diesel emissions;
- if necessary, implement wheel-cleaning for vehicles leaving site to prevent dust “track-out” onto the surfaces of public roads;
- where applicable, use of water or a dust suppression agent on exposed surfaces prone to wind erosion (e.g., surfaces of mine rock storage facilities, TSF dams, Overburden Stockpile, Reclamation Stockpile, Topsoil Stockpile, etc.);
- minimize the areas of exposed soil and rock;
- where practical and economically achievable, re-vegetate disturbed areas including temporary soil and overburden stockpiles and road cuts;
- where possible, use multi-passenger vehicles to transport crews to and from job sites;
- select BAT (technology that can achieve the best emissions standards and that has been shown to be economically feasible through commercial application) for the construction equipment (BC MOE 2012);
- maintain vehicles in good operating condition to meet emission standards (especially catalytic converters and particulate filters for diesel engines);
- reduce vehicle idling and minimize rapid starts and stops;
- avoid blasting when wind speeds and wind direction will potentially cause a safety concern;
- provide training and instruction for equipment operators related to the air emission controls and general mining mitigation measures to reduce air emissions;
- maintain records for the employee training related to control of air emissions and air quality mitigation measures; and
- adherence to all permits, authorizations and approvals related to air quality.

11.6.3.3 Operation

Following are the air quality management and mitigation measures that will reduce CAC and fugitive dust emissions during Operation:

- watering haul road surfaces as appropriate to maintain the optimum 4% moisture ratio for suppression of fugitive dust;
- roadways will be properly graded, compacted and maintained to reduce the silt content for the surface material;
- construct roads with coarse gravel and aggregate materials;
- grade snow into the top surface of unpaved roads during winter to suppress dust emissions;
- operate vehicles within the posted maximum speed limits to minimize fugitive dust and diesel emissions;
- if necessary implement wheel-cleaning for vehicles leaving site to prevent dust "track-out" onto the surfaces of public roads;
- where applicable, use of water or a dust suppression agent on exposed surfaces prone to wind erosion (e.g., surfaces of mine rock storage facilities, TSF dams and beach, Overburden Stockpile, Reclamation Stockpile, Topsoil Stockpile, etc.);
- minimize the areas of exposed soil and rock;
- where practical and economically achievable, re-vegetate disturbed areas including temporary soil and overburden stockpiles and road cuts;
- where possible, use multi-passenger vehicles to transport crews to and from job sites;
- select BAT (technology that can achieve the best emissions standards and that has been shown to be economically feasible through commercial application) for mine fleet equipment (BC MOE 2012);
- maintain vehicles in good operating condition to meet emission standards (especially catalytic converters and particulate filters for diesel engines);
- reduce vehicle idling and minimize rapid starts and stops;
- avoid blasting when wind speeds and wind direction will potentially cause a safety concern;
- provide training and instruction for equipment operators related to the air emission controls and general mining mitigation measures to reduce air emissions;
- maintain records for the employee training related to control of air emissions and air quality mitigation measures;
- re-vegetate disturbed areas progressively during post-closure as per the Closure and Reclamation Plan (Section 3.17); and
- adhere to all permits, authorizations and approvals related to air quality.

11.6.3.4 Decommissioning and Closure

Following are the air quality management and mitigation measures that will reduce CAC and fugitive dust emissions during Decommissioning and Closure:

- provide training and instruction for equipment operators related to the air emission controls and general mine closure mitigation measures to reduce air emissions;
- maintain records for the employee training related to control of air emissions and air quality mitigation measures;
- Adopt Environment Canada's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (EC 2005);
- where practical, develop the mine rock storage facilities in a manner to reduce wind erosion;
- re-vegetate disturbed areas progressively according to the Closure and Reclamation Plan (Section 3.17); and
- adhere to all permits, authorizations and approvals related to air quality.

11.6.3.5 Post-Closure

During Post-Closure, air emissions will be controlled through the use of best achievable technology (BAT) and BMPs. KAM will manage air emissions through proper vehicle maintenance, reducing vehicle idling, minimizing rapid starts and stops, operating vehicles within the posted maximum speed limits, maintaining the re-vegetated surfaces to prevent wind erosion, using multi-passenger vehicles to transport crews and proper maintenance of the Project roads. In addition, air emissions will be minimized by adhering to all permits, authorizations and approvals related to air quality.

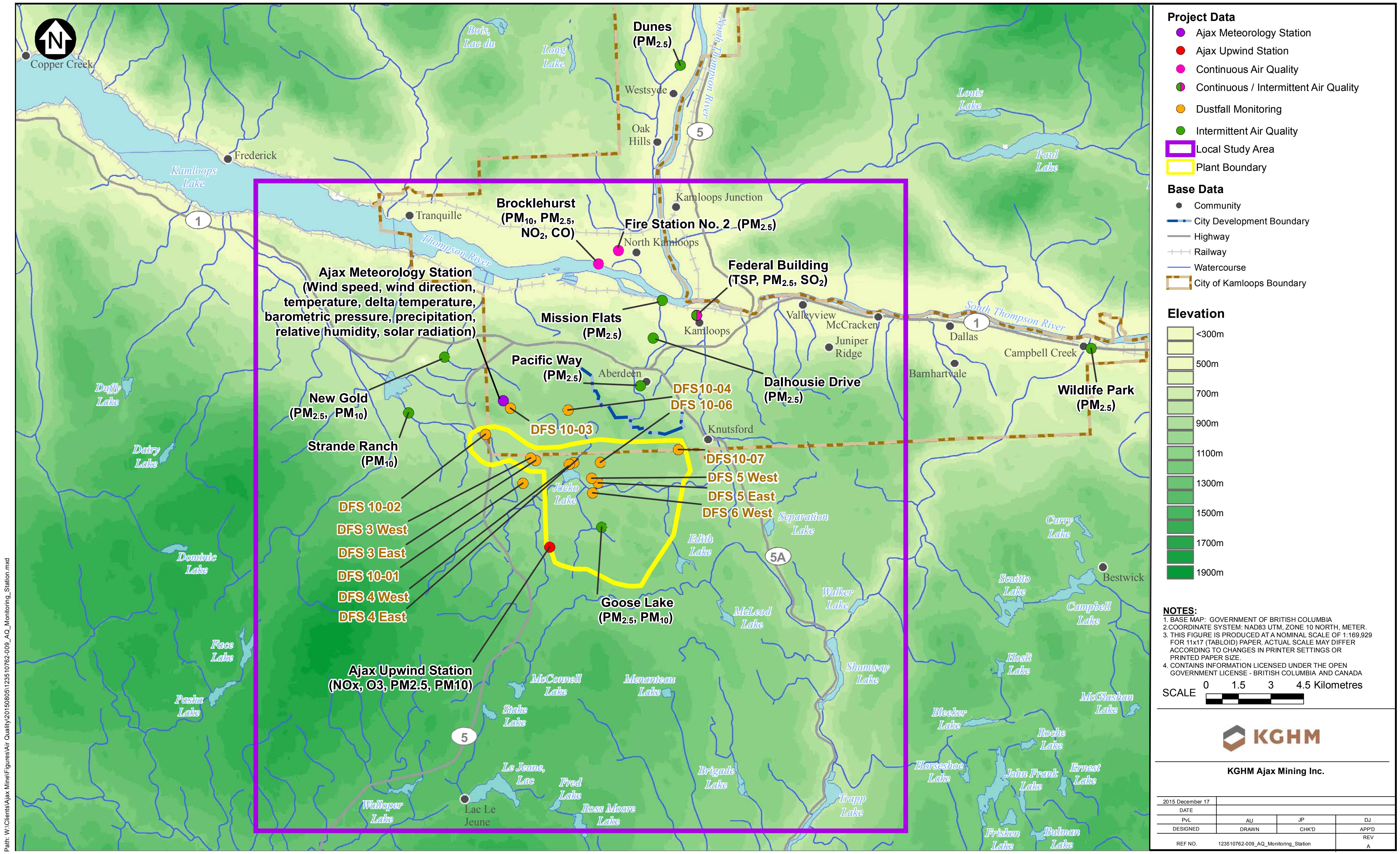
11.6.4 Monitoring

During Project permitting (e.g., *Mines Act* and EMA waste discharge permits and authorizations), in collaboration with BC MOE and BC MEM, KAM will determine the detailed requirements for the source testing, ambient air quality, dustfall and meteorology monitoring programs that will involve consideration of the largest sources of air emissions and the location of various receptors within the air quality regional study area. Where possible, the program will utilize the baseline monitoring station locations to allow for a determination of whether or not there has been a change in the baseline conditions due to the various Project activities.

Monitoring requirements will reflect the conditions set in the *BC EMA* Air Discharge Permit and may include continuous ambient monitoring, stationary source testing and dustfall monitoring requirements. KAM will also continue to collect site-specific meteorological data at the automated AJAXMET station.

Ambient air quality and meteorology monitoring began at the Ajax Upwind Station (shown in Figure 11.6-1) in August 2014. The station is located on Lac Le Jeune Road approximately 7.5 km southwest of Aberdeen. The purpose of the station is to provide baseline data for effects assessment analysis as well as upwind monitoring data during Construction and Operation. Ultimately the system will form part of an air quality monitoring network for the Project that will include one upwind station and two downwind stations. The meteorological components were installed in August 2014. A precipitation gauge upgrade was installed in December 2014 with a full suite of air quality monitoring instrumentation.

Figure 11.6-1
Location of Background Air Quality Monitoring Stations



The meteorology components measure wind speed, wind direction, temperature, delta temperature, barometric pressure, precipitation (including snowfall), relative humidity, and solar radiation. The air quality components measure NO_x, O_3, $PM_{2.5}$, and PM_{10}. All instrumentation uses continuous monitoring technology. Data is processed into 15 minute averages and uploaded to an online network for easy access and data management purposes. Data is automatically filtered to identify outliers and equipment malfunctions so that any problems can be rectified immediately. Weekly inspections of instrumentation occur by KAM staff and quarterly calibrations and inspections are carried out by third party consultants.

The dustfall monitoring locations will be selected in accordance with the ASTM Standard D1739-98 (ASTM 2010). This standard stipulates that the stations are to be located in open areas that are free of structures higher than 1 m within a 20 m radius from the collection container.

The stationary source emissions testing and ambient air quality monitoring will be done in accordance with the BC Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples (BC MOE 2013).

KAM will implement and manage the source testing, ambient air quality, dustfall and meteorology monitoring programs to confirm that crews are implementing the various management and mitigation measures. Further details related to the monitoring roles and responsibilities are summarized in the Environmental Management System, Section 11.1.

11.6.4.1 Work Planning and Schedule

The source testing, ambient air quality and meteorology monitoring activities will occur according to the schedule determined in the *BC EMA* Air Discharge Permit.

11.6.5 Reporting

The reporting of the results from the Project source testing, ambient air quality, dustfall and meteorology monitoring will occur according to the schedule determined in the *BC EMA* Air Discharge Permit.

The National Pollutant Release Inventory (NPRI) is a Federal program run by EC that collects information on releases of specific pollutants to the atmospheric, aquatic, and the terrestrial environment. The requirement to report releases depends on the nature of the activity, the pollutants being released, and the quantity of pollutants released. KAM will report emissions to NPRI if the releases of CACs are greater than the reporting threshold.

KAM will assess the effectiveness of the air quality management and mitigation measures during Construction, Operation, Decommissioning and Closure and Post Closure. KAM will assess whether or not the predicted air quality effects were accurate. The ambient air quality monitoring data will be reviewed annually to determine if any trends are evident (Table 11.6-2). The key performance indicators that will trigger the need for corrective actions or additional mitigations could include; ambient air quality monitoring concentrations with an upward trend that are approaching the applicable AAQO, and air quality issues or concerns raised by on-site staff, regulators or the public.

In addition, the key performance indicators summarized in the *BC EMA* Air Discharge Permit will be monitored and if any of the maximum allow emission limits (or ambient air quality ground-level concentrations) are surpassed an immediate plan for corrective action will be developed. Where necessary improvements will be implemented through adaptive management to minimize air emissions and maintain ambient air quality below the applicable regulatory criteria. Changes to the air quality mitigations and management measures may be necessary to respond to technological advances and regulatory changes.

Table 11.6-2. Air Quality and Dust Control Reporting Summary

		Report Submitted to	
Report Type	Report Frequency	Provincial Regulatory Agency	Federal Regulatory Agency
Stationary source emissions testing	As specified by the BC EMA Air Discharge Permit	BC MOE, BC MEM	Not required
Meteorology monitoring	As specified by the BC EMA Air Discharge Permit	BC MOE, BC MEM	Not required
Ambient air quality monitoring results (CACs and dustfall)	As specified by the BC EMA Air Discharge Permit	BC MOE, BC MEM	Not required
National Pollutant Release Inventory	Annual	BC MOE	EC

11.6.5.1 Complaint Resolution

Air quality complaints will be recorded and evaluated to determine if dust management procedures or other project activities require modification. KAM will respond respectfully to all complaints and implement all feasible and reasonable measures to address the issue. A complaint management process will be developed to respond and document the particulars of the complaint. Complaint details will be recorded and will include feedback provided to complainant, resolution of complaint, contact information of KAM individual addressing the complaint and time taken for responses and/or resolution.

11.7 WATER MANAGEMENT AND HYDROMETRIC MONITORING PLAN

11.7.1 Introduction

11.7.1.1 Purpose

The purpose of the Ajax Project (Project) Water Management Plan (WMP) is to guide Project water management throughout mine life such that:

- infrastructure can be appropriately designed and maintained to convey or withstand predicted flows;
- sufficient water is available to support existing water licenses on Peterson Creek (Lower) and consumptive uses of water for mining related purposes; and
- discharges to the aquatic receiving environment occur in a manner that meets environmental protection objectives from a flow and water quality perspective.

The WMP is integrated with a water balance developed for mine infrastructure that will be located within the Peterson Creek catchment (Figure 11.7-1). The WMP incorporates principles of adaptive management by providing a framework for ongoing review and improvement of water management practices. It is intended to be used in conjunction with other management plans pertinent to the protection of the aquatic receiving environment, including the Surface Water Quality Management and Monitoring Plan, the Groundwater Quality Management and Monitoring Plan, the Erosion and Sediment Control Plan, the Fisheries and Aquatic Life Monitoring Plan, the Solid Waste Management Plan, the Conceptual Landscape Restoration and Reclamation Plan, the Closure Plan. The WMP focuses primarily on water flows, although water management at the Project has been planned such that water flows and quality are fully integrated with each other and with facility design and operation (see the Surface Water Quality Management and Monitoring Plan). The specifics of water quality mitigation planning and management, including geochemistry aspects and erosion prevention and sediment control, are addressed in the above referenced management plans.

11.7.1.2 Applicable Legislation and Standards

The following legislation is pertinent to the WMP:

- BC *Environmental Management Act* (SBC 2003) - regulates the discharge of liquid effluent into the environment;
- BC *Mines Act* (RSBC 1996a) - provides guidance and approvals for all activities on the Project, including exploration, development, production, closure, and reclamation;
- BC *Mines Act* (RSBC 1996a) and the Health, Safety, and Reclamation Code for Mines in British Columbia (BC MEMPR 2008) - requires the proponent to provide:
  - designs and details for water management structures, water storage, and water treatment facilities;
  - the source, use, and water balance for any water required in the operation;

  - a plan for erosion control and sediment retention; and
  - a reclamation plan;

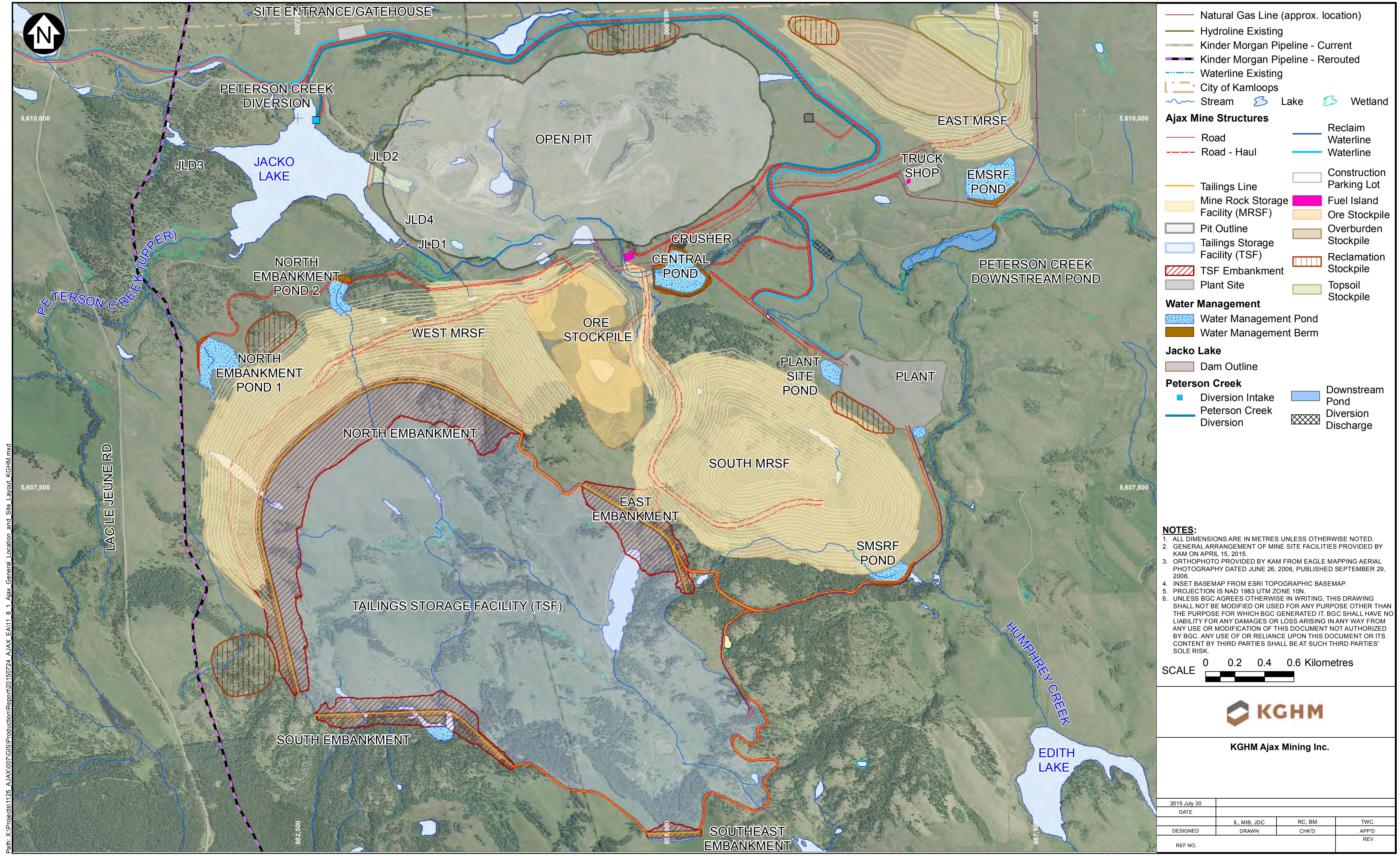
- *Fisheries Act* (RSC 1985a) - information requirements set under the Fish Habitat Protection and Pollution Prevention provisions of the *Fisheries Act* (RSC 1985a) include descriptions of measures that will be taken to avoid or minimize any effects on the aquatic environment, shoreline, or riparian areas during Project Construction and Operation. The *Fisheries Act* (RSC 1985a) also regulates the discharge of harmful substances into fish habitat and imposes reporting requirements in case such a discharge occurs;
- Metal Mining Effluent Regulations (MMER 2002) - environmental monitoring and surveillance programs of effluent discharges are requirements of the Metal Mining Effluent Regulations (SOR/2002-222) pursuant to the *Fisheries Act*;
- Canada *Water Act* (RSC 1985b) - provides the framework for joint federal-provincial management of Canada's water resources. Approvals and licences under provincial water acts are required to authorize the construction of works for the purposes of diverting, storing, or using water, or causing changes in and about a stream for any purpose;
- BC *Water Act* (RSBC 1996b) - administers the allocation and management of surface waters in British Columbia. It is the primary legislation for regulating surface water diversion, storage, and use, and managing water quality;
- *Navigation Protection Act* (RSC 1985c) - regulates works that interfere with navigation built in, on, over, under, through or across navigable waters in Canada. Navigable waters are defined as all bodies of water that can be navigated by any type of floating vessel for transportation, recreation, or commerce;
- BC *Forest and Range Practices Act* (SBC 2002) - although this legislation does not apply to roads approved under the *Mines Act*, KAM has been requested to follow the spirit of this legislation, which includes codes provided in the Forest Service Road Use Regulation (BC Reg. 70/2004) that focus extensively on erosion prevention. The Forest Practices Code of British Columbia Forest Road Engineering Guidebook (BC MOF 2002) is a key information source used to identify water management measures for road construction work. This legislation will apply to the access road when the applicable permit is issued.

11.7.1.3 Performance Objectives

The Project is located in a semi-arid climate characterized by low annual precipitation (on the order of 336 mm) and high annual potential evapotranspiration (579 mm) (Knight Piésold 2015). In this semi-arid climate where the mine is expected to operate in a water deficit, water management is an important component of the mine plan during all phases of mine life (Construction, Operation, Decommissioning and Closure, Post Closure). Therefore, the WMP provides guidance for achieving the following objectives:

- managing water to for ongoing compliance from a flow perspective with regulatory commitments, guidelines, and objectives;
- implementing water management measures in a timely and effective manner;

Figure 11.7-1
Ajax General Location and Site Layout



- integrating water management activities with other management and monitoring programs;
- minimizing potential adverse effects on the downstream aquatic receiving environment from a flow perspective;
- maintaining an adequate supply of water for mine operations and downstream water licenses on Peterson Creek (Lower);
- collecting surface water flow data at key locations through the life of mine to inform revision and optimization of the site water balance and to contribute to ongoing adaptive management of the Project; and
- minimizing the use of make-up water through water recycling whenever possible.

11.7.2 Site Characterization

The following section provides a general site characterisation of the Project. The Project lies in a unique physical setting with specific long-term weather patterns and hydrology. The Project is located in an area that includes the presence of man-made regulation in the form of dams and low-level outlets, as well as a number of existing water licenses that impose control on the flows.

11.7.2.1 Physical Setting

Regional

The Thomson Plateau represents a late Tertiary erosional surface that has since been dissected by three major rivers including the Thompson River, Similkameen River, and the Okanagan River as well as their smaller tributaries. The Thompson River flows westward from the City of Kamloops through Kamloops Lake and continues westward to Ashcroft and subsequently southwest into the Fraser River near Lytton. Kamloops Lake is considered a widened and deepened stretch of the Thompson River defined by steep embankments. The lake has a maximum length of 29 km and maximum width of 1.6 km. The surface area of Kamloops Lake is 52 km^2 draining an area of 39,050 km^2. The average depth of the lake is approximately 70 m. The Thompson River drains an area of 56,000 km^2 from Greenstone Mountain to Kamloops Lake, carrying runoff from the Columbia and Monashee mountains.

The Thompson River has two main tributaries which converge in the City of Kamloops and include the South Thompson and the North Thompson Rivers. The Project site is located within the South Thompson River watershed. The South Thompson River originates at the outlet of Little Shuswap Lake flowing through the wide valley to the City of Kamloops draining an area of approximately 18,000 km^2. The South Thompson River watershed also drains several tributaries and sustains lakes that interact with the proposed area of the Project site.

Local

The Project lies completely within the Peterson Creek watershed, a sub watershed of the South Thompson River watershed. The local topography of the Project is characterised by moderate relief with local elevation ranging from 800 m to 1,500 masl. The area is depicted by rolling grasslands with timber at higher elevations. Forested areas consist of mainly Douglas fir (*Pseudotsuga menziesii*), Lodgepole pine (*Pinus contorta*), and Ponderosa pine (*Pinus ponderosa*). At lower elevations, vegetation typically consists of bunchgrass, sagebrush, and prickly pear cacti (Keystone 2008).

Peterson Creek originates at the Chuwels Mountain and flows north through a wide valley to Jacko Lake. This portion of the creek is referred to as Peterson Creek (Upper). Jacko Lake drains an area of approximately 37 km^2, about half of which is located above an elevation of 1200 masl. Historical records indicate that Jacko Lake has been managed since the early 1900s, when the outlet to Peterson Creek was raised to impound water for irrigation. This earthfill dam has since been raised on several occasions for this purpose and is currently about 3 m high, impounding a volume of about 4.2 Mm^3 (Frontier 2014).

At higher water levels, flow discharge through a spillway located adjacent to the dam. Below elevation 892.0 masl, the spillway invert, flows are released through a low-level outlet to support downstream water licenses. The outlet consists of a 17 m long concrete culvert with a sluice gate at its inlet (BCMOE 1980). The pipe discharges immediately downstream of the dam and flows into a small concrete weir structure located approximately 30 m downstream of the dam, which overflows into the natural Peterson Creek channel. Jacko Lake is an important water body for recreational fisheries and has been stocked with rainbow trout.

The portion of the creek downstream of Jacko Lake is referred to as Peterson Creek (Lower). Downstream of Jacko Lake, the creek flows east through Knutsford and north again through downtown Kamloops ending at the confluence with the South Thompson River. Within the downtown core of Kamloops, the majority of Peterson Creek (Lower) is contained within culverts and channeled through concrete waterways to its confluence with the South Thompson River (City of Kamloops 2001). Peterson Creek (Upper and Lower) has a mainstem length of approximately 40 km and drains a watershed area of approximately 130 km^2.

Significant tributaries of Peterson Creek (Lower), from west to east, include Keynes Creek, Humphrey Creek, and Davidson Brook. Keynes Creek discharges into Peterson Creek (Lower) from the south immediately downstream of Jacko Lake. Keynes Creek drains an area of 11.4 km^2 and is characterised by low flows as a result of upstream water licences and evaporative loses from a number of natural and dammed lakes (BGC 2015b). The proposed TSF for the Project is located in this tributary watershed.

Humphrey Creek is located to the immediate east of Keynes Creek, and also flows from south to north. Humphrey Creek originates from Edith Lake, flowing north over a distance of approximately 2.5 km to the confluence of Peterson Creek (Lower) draining an area of approximately 5.8 km^2. Edith Lake is similar to Jacko Lake in that it is stocked with fish and has a dam, which was originally constructed to support downstream water licenses on Peterson Creek (Lower). The lake is a popular destination for recreational fishing, particularly during the winter for ice fishing. Moving further to the east, Davidson Brook discharges into Peterson Creek (Lower) in the vicinity of Knutsford. This tributary flows from south to north and has a watershed area of approximately 6.2 km^2.

Drainages on the north side of Peterson Creek (Lower) are best described as disrupted, with numerous shallow ponds, some of which are ephemeral containing alkaline water and bordered with saline soils and mineral deposits.

Water storage and irrigation licenses have been present throughout the region since at least 1877 for Jacko Lake and Peterson Creek. Water licenses are described in more detail in Section 11.7.2.4 and Appendix 6.4-C (BGC 2015b).

11.7.2.2 Climate

The climate of the Ajax mine site is typical of the dry BC Interior with generally low total precipitation, high evaporation, and correspondingly low streamflow rates. Lying within the rain shadow of the Coast Mountains, this area has a semi-arid steppe climate characterized by generally cool dry winters and hot, dry summers, with low humidity. Convective storms are frequent in the summer months, and as a result precipitation is generally highest in June and July (Knight Piésold, 2013).

Meteorological data have been collected at the site since August 2010 and include records of temperature, relative humidity, precipitation, and wind speed and direction. Mean annual precipitation for the site has been evaluated by Knight Piésold (2013, 2015) who analyzed active and inactive regional climate stations throughout the area, several of which have two decades or more of data. Based on this analysis, Knight Piésold (2015) estimated average annual precipitation for the site at 336 mm, distributed as summarized in Table 11.7-1. This annual precipitation applies to an elevation of 950 masl. Approximately 30% of the annual precipitation is estimated to occur as snow.

Table 11.7-1. Average Monthly Climate Data for Ajax (Knight Piésold, 2014b)

Month	Average Temperature (°C)	Average Rainfall (mm)	Snow Water Equivalent (mm)	Average Precipitation (mm)	PET (mm)
January	-4.5	2.3	21.1	23.4	0
February	-2.4	2.9	11.6	14.5	1
March	1.5	4.2	7.7	11.9	12
April	6.5	16.3	2.8	19.2	40
May	11.1	32.8	0.0	32.8	77
June	14.7	43.4	0.0	43.4	103
July	18.7	42.4	0.0	42.4	130
August	17.8	32.0	0.0	32.0	114
September	12.9	35.8	0.0	35.8	71
October	5.6	13.2	2.3	15.5	28
November	-0.1	5.6	22.4	28.0	3
December	-4.9	3.7	33.3	37.0	0
Average/Total	**6.4**	**235**	**101**	**336**	**579**

Annual potential evapotranspiration (PET) has been estimated by Knight Piésold (2015) at 579 mm; monthly values are shown on Table 11.7-1. In addition, sublimation between November and February has been estimated at 28 mm (Knight Piésold, 2015). Wet (i.e., above average) and dry (i.e., below average) annual precipitation for various return periods is summarized in Table 11.7-2.

Table 11.7-2. Wet and Dry Year Annual Precipitation at Ajax (Knight Piésold, 2015)

Return Period (years)	Precipitation (mm)	
	Dry	Wet
10	259	413
20	238	434
50	213	459
100	197	475
200	182	490

The synthetic long-term temperature values estimated for the Project site are summarized in Table 11.7-1. The mean annual temperature for the Project site is estimated to be 6.4 ºC. The warmest months are July and August, with mean monthly temperatures of 18.7 ºC and 17.8 ºC, respectively. The coldest months are January and December, with mean monthly average temperatures of -4.5 ºC and -4.9 ºC, respectively. The annual mean temperature varies from year to year, with a standard deviation of 0.6 ºC.

A minor historical increase in temperature in the order of 0.3ºC per decade has been observed in the region of the Project site (Knight Piésold 2015). This trend has not been incorporated into the long-term temperature values presented in Table 11.7-1.

11.7.2.3 Hydrology

This section provides a brief overview of the regional and local hydrology. Additional details of the site hydrology are provided in Appendix 6.4-A, 6.4-B and 6.4-C. Appendix 6.4-A (Knight Piésold 2013) provides a hydrometeorological characterization of the Project, Appendix 6.4-B (BGC 2015a) provides results of the 2014 streamflow monitoring program at site, while Appendix 6.4-C (BGC 2015b) provides details of the site-wide water balance model (WBM) developed for the Project.

Hydrometric Stations

A baseline hydrometeorological report was produced by Knight Piésold in 2013 that incorporates local and regional hydrology assessments to provide estimated long-term water quantity values (Appendix 6.4-A). The objective of that report was to provide a hydrometeorological characterization of the Project area for the purposes of water balance modelling, engineering design, water rights applications and environmental assessments. Results of the 2014 surface water monitoring program, completed by BGC Engineering (2015a), in the Project area are presented in Appendix 6.4-B.

Hydrometric gauging stations were established in 2008 at five (5) different locations within the Project area to assess local flow conditions. One of these stations (TSFINF), located in the adjacent Cherry Creek watershed, was made inactive following the 2012 monitoring season as Project layout changes made it obsolete. An additional station was subsequently installed in early 2014 at the mouth of Keynes Creek, a south-flowing tributary that discharges into Peterson Creek (Lower) immediately downstream of Jacko Lake. Hydrometric stations were typically operated between March and October from 2008 through 2012 and in 2014. Hydrometric station information is summarized in Table 11.7-3 and a map showing the station locations and watersheds is provided in Figure 11.7-2.

Figure 11.7-2
Active Hydrometric Stations

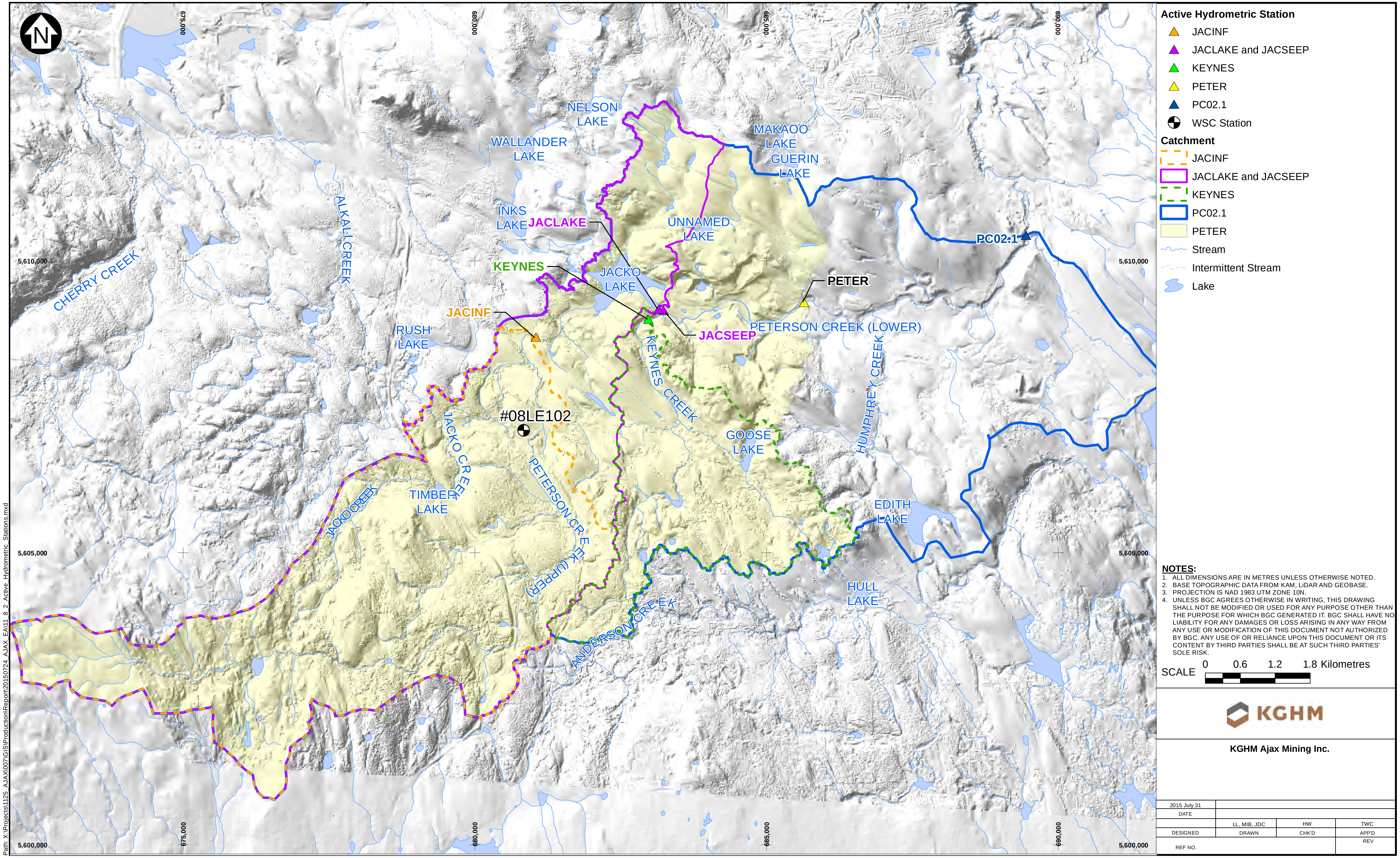


Table 11.7-3. Hydrometric Stations in Project Area

Station ID	Latitude	Longitude	Watershed Area (km^2)	Station Elevation (masl)	Period of Record	Status
JACINF	50.602	-120.441	31	912	April 2008 – present	Active
JACLAKE	50.606	-120.412	41	891	April 2008 – present	Active
JACSEEP	50.605	-120.410	41	883	April 2008 – present	Active
PETER	50.606	-120.376	60	880	April 2008 – present	Active
KEYNES	50.604	-120.414	11	915	March 2014 – present	Active
PC02.1	50.615	-120.322	85	795	June 2015 - present	Active
TSFINF	50.643	-120.535	53	721	April 2008 – October 2012	Inactive

A brief description of each of the active Project area hydrometric stations is provided below.

Jacko Lake Inflow (JACINF): The JACINF hydrometric station monitors the primary inflows into Jacko Lake from Peterson Creek (Upper). The catchment area to this station is 31 km^2. The station is located in a reach just upstream of a culvert crossing of the Lac Le Jeune Road where the channel is approximately 3.5 m wide. The banks are well-vegetated and the channel bed is comprised primarily of sand with large woody debris scattered throughout. Streamflow recorded at this station represents disturbed conditions due to upstream surface water licenses for irrigation (Section 2.4).

Jacko Lake (JACLAKE): This station monitors the water level in Jacko Lake and any flow over the spillway when occurring. The station is located in the southeast arm of Jacko Lake about 30 m from the entrance to the overflow spillway channel. The bank of the lake is grassy and there is woody debris around the station. The catchment area to this station is 41 km^2. The spillway channel is approximately 3 m wide with a gradient of 3%. It is not uncommon for the spillway channel to be dry, as it was during field inspections from July through October 2014.

Jacko Lake Seepage (JACSEEP): During low flow periods in the summer, the water levels in Jacko Lake are controlled by a low-flow outlet. Flows from this outlet, which is operated by a provincially-appointed bailiff when the overflow spillway is dry, are monitored at the JACSEEP hydrometric station. The station is located downstream of the outlet pipe in a concrete outflow channel with a v-notch weir. The catchment area to JACSEEP is the same as that of JACLAKE, 41 km^2, as both stations monitor outflow from Jacko Lake. Peak discharge for this station does not follow the same hydrologic trends as the other stations in the Project area as it generally only operates in July and August when the low level outlet is opened to satisfy downstream water license requirements.

Peterson Creek Lower (PETER): The PETER station is located 3 km downstream of the Jacko Lake outlet and it has a catchment area of 60 km^2. The channel is 2.5 m wide at the station and the banks are overgrown with small shrubs. The stream bed is comprised of sand with small gravels and cobbles in the centre of the channel.

Keynes Creek (KEYNES): This hydrometric station monitors flows from a small (11 km^2 catchment) tributary of Peterson Creek that discharges to the creek between the Jacko Lake outlet and the

PETER station. At the station, the channel is very small (70 cm wide) and flows through a wooded area with thick organic material on the bed. The channel was observed to be dry through most of the 2014 summer from mid-June through October and flow measurements were challenging under such low-flow conditions. The highest measured flow at this station in 2014 was 2 L/s. A lack of surface runoff at this station can be attributed to upstream licensed water use.

PC02.1 (Peterson Creek Lower): Station PC02.1 is located the furthest downstream on Peterson Creek and it receives contributing flows from all other Project gauging stations. This station was installed in June 2015 with the intent of monitoring baseflows in Peterson Creek (Lower) during periods when Jacko Lake is not spilling or flows are not being released from the low level outlet. During periods of low flow, there is typically no surface flow at PETER, due to flow through the subsurface aquifer. However, station PC02.1 is located within a zone of groundwater discharge and it is expected that baseflows can be monitored here.

The Water Survey of Canada (WSC) also maintains and operates hydrometric stations throughout the region. Six regional hydrometric stations within a 60 km radius of the Project area were evaluated as part of the baseline assessment (Appendix 6.3-A). Details of these stations are provided in Table 11.7-4, while station locations are shown on Figure 11.7-3.

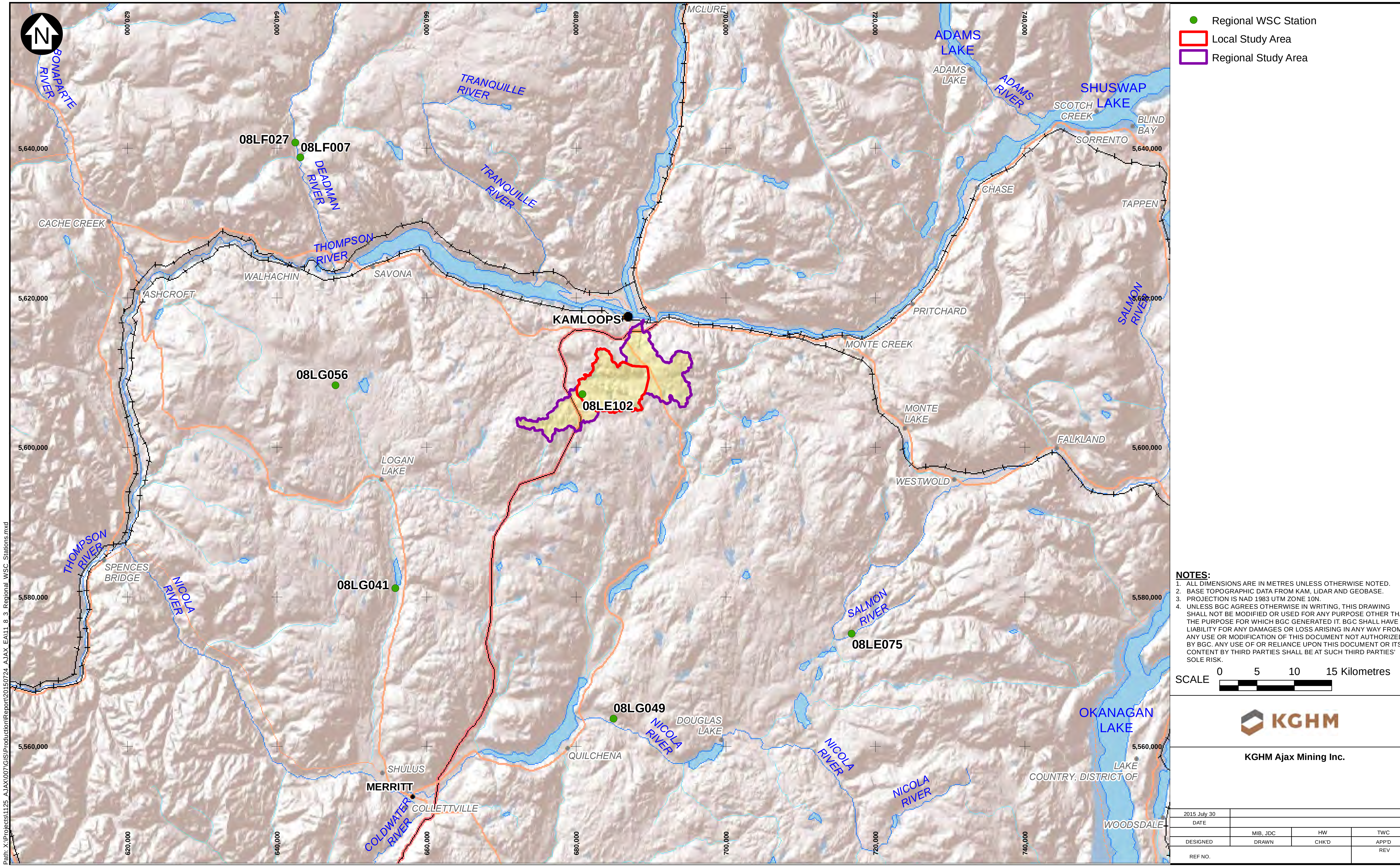
The WSC also operated a station on *Peterson Creek above Jacko Creek* (08LE102) from 1981 to 1986. Flow was measured seasonally at this station, typically from April 1 to September 30. The reported drainage area for this station is 21.2 km^2 and is located upstream of JACINF and irrigation activities. Average annual runoff at this station was 35 mm for the 1981 to 1986 period.

<u>Runoff Patterns and Quantity</u>

Consistent with regional hydrologic patterns typical of the BC Interior Region, peak streamflows in Peterson Creek generally occur in the spring (between April and June) in response to snowmelt and low flows occur during the remainder of the year. Figure 11.7-4 illustrates the regional streamflow pattern plotting average unit runoff hydrographs for the regional WSC stations. On Peterson Creek (Upper), there is typically no surface runoff observed at JACINF by late summer.

For the purpose of gaining an understanding of long-term flow patterns in Peterson Creek, a long-term synthetic flow series was generated for the JACINF gauge (Appendix 6.4-A). To generate the synthetic dataset, the JACINF daily streamflow data was correlated with concurrent data from the regional WSC hydrometric stations summarized in Table 11.7-4. That analysis indicated that data from station 08LF027 (*Deadman River at Criss Creek*) provided the strongest and most consistent relation. Ranked regression analysis (also known as frequency paired analysis) was then used to generate a synthetic long-term streamflow record for JACINF using monthly derived relations between the long-term streamflow data from 08LF027 (1962 to 2001) and the short-term streamflow data at JACINF (2008 to 2011). The resultant synthetic dataset covers the period 1962 to 2011. Mean annual flow for this period is 0.025 m^3/s, which represents an annual runoff of 26 mm based on a drainage area of 31 km^2. The monthly distribution of runoff is illustrated in Figure 11.7-5.

Figure 11.7-3
Regional WSC Stations



NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. BASE TOPOGRAPHIC DATA FROM KAM, LiDAR AND GEOBASE.
3. PROJECTION IS NAD 1983 UTM ZONE 10N.
4. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE 0 5 10 15 Kilometres

KGHM Ajax Mining Inc.

2015 July 30			
DATE			
	MIB, JDC	HW	TWC
DESIGNED	DRAWN	CHK'D	APP'D
REF NO.			REV

Table 11.7-4. Regional Hydrometric Stations (after Knight Piésold, 2013)

ID	Station Name	Period of Record	Lat	Long	Distance from Site (km)	Drainage Area (km^2)	Median Elevation (masl)	Mean Annual Runoff (mm)
08LE075	Salmon River Above Salmon Lake	1965 - 2002	50.288	-119.956	57	143	1350	165
08LF007	Criss Creek near Savona	1912 - present	50.883	-120.965	41	479	1190	110
08LF027	Deadman River at Criss Creek	1913 – present	50.901	-120.974	42	878	1190	41
08LG041	Guichon Creek at Outlet of Merrit Lake	1933 – present	50.362	-120.809	38	871	1369	26
08LG049	Nicola River above Nicola Lake	1915 – present	50.197	-120.408	52	1,500	1230	87
08LG056	Guichon Creek Above Tunkwa Lake Diversion	1967 - present	50.608	-120.911	27	78	1340	56

Figure 11.7-4
Regional Unit Runoff Hydrograph

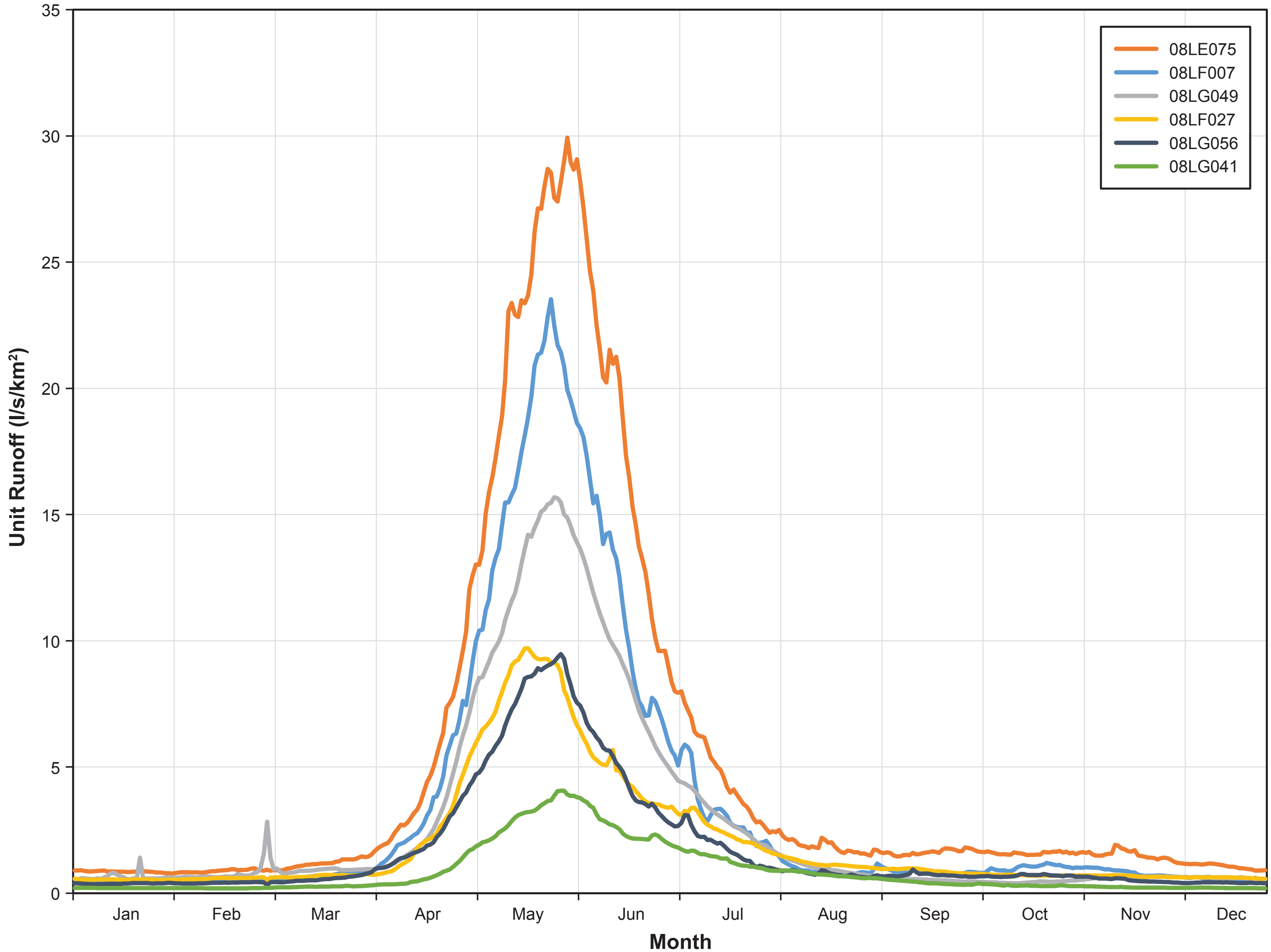
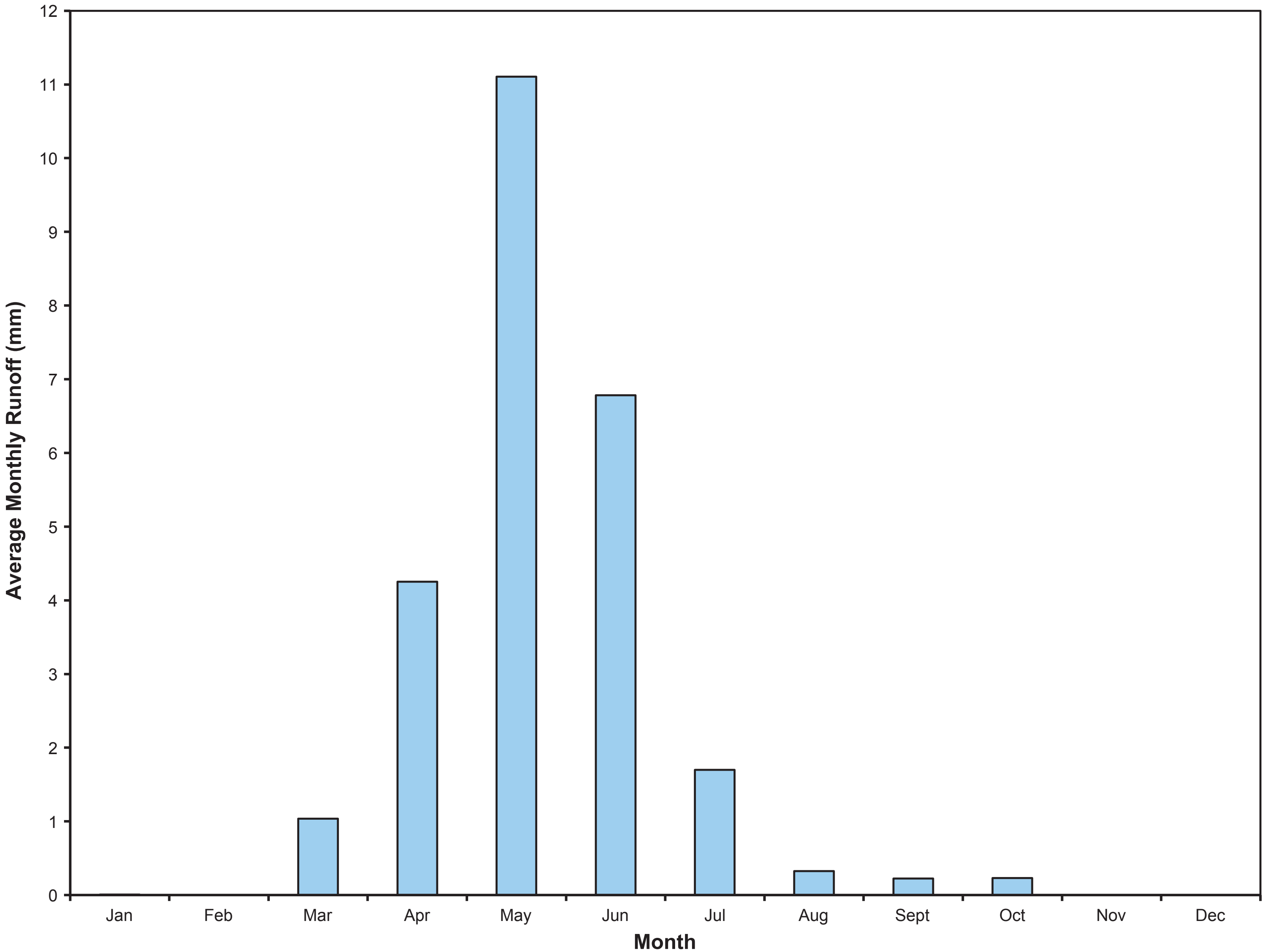


Figure 11.7-5

Average Monthly Runoff for Peterson Creek (Upper) at JACINF (1963-2011)



11.7.2.4 Water Licenses

There are a number of existing water licenses on Jacko Lake, Edith Lake, Peterson Creek and its tributaries. A summary of these licenses is provided here-in. Additional details are provided in Appendix 6.4-C (BGC 2015b).

<u>Peterson Creek</u>

Historical records indicate that Jacko Lake has been managed since the early 1900s, when the outlet to Peterson Creek was raised to impound water for irrigation. Water licenses entitling users to the water in Jacko Lake and Peterson Creek date back to at least 1877 and the elevation of Jacko Lake has been raised on several occasions for this purpose.

While Jacko Lake was originally modified for irrigation purposes, it is now an important water body for recreational fisheries and has been stocked for this purpose. There are a number of water storage licenses on Jacko Lake to support downstream irrigation, as well as a conservation license held by FLNRO for fish habitat. These licenses are summarized in Table 11.7-5. Each of the storage licenses on Jacko Lake have either a supplementary storage and diversion license on Edith Lake (see Table 11.7-6) or a diversion license on Anderson Creek.

Table 11.7-5. Jacko Lake and Peterson Creek Water Licenses

Name	# Licenses	Purpose	Volume	Unit	Licensee
Peterson Creek above Jacko Lake					
Timber Lake	2	Storage-Non Power	103,612	m^3	Michell
Peterson Creek	3	Irrigation	427,829	m^3	various
Jacko Creek	1	Irrigation	103,612	m^3	Michell
Licensed annual irrigation volume			**530,441**	**m^3**	
Jacko Lake					
Peterson Creek	8	Storage-Non Power	492,283	m^3	various
Peterson Creek	1	Conservation Storage	432,335	m^3	FLNRO, Fish & Wildlife
Total licensed storage volume			**924,618**	**m^3**	
Peterson Creek below Jacko Lake					
Peterson Creek	3	Irrigation - baseflow	189,537	m^3/yr	various
Peterson Creek	6	Irrigation – storage supported	431,226	m^3/yr	various
Licensed annual irrigation volume			**620,763**	**m^3**	

Table 11.7-6. Edith Lake Water Licenses

Name	# Licenses	Purpose	Volume	Unit	Licensee
Humphrey Creek	5	Conservation Storage	1,017,377	m^3	FLNRO, Fish & Wildlife
Humphrey Creek	5	Storage-Non Power	314,290	m^3	various
Total licensed storage volume			**1,331,667**	**m^3**	

There are also a number of water licenses on Peterson Creek (Upper) above Jacko Lake (Table 11.7-5).

Humphrey Creek/Edith Lake

Humphrey Creek is a 580 ha tributary of Peterson Creek (Lower). Reservoir storage in the Peterson Creek watershed is supplemented by Edith Lake, which is located in the upper reaches of Humphrey Creek. Some of the licensees on Jacko Lake have complementary licenses on Edith Lake that would be available to supplement flows in Peterson Creek (Lower) during very dry years. Edith Lake is similar to Jacko Lake in that it is stocked with fish and has a dam. According to FLNRO records, the dam is an earthfill structure with:

- crest elevation = 1023.2 masl;
- dam height = 3.3 m; and
- crest length = 60 m.

Edith Lake has a local watershed area of 185 ha compared to a lake area of about 25 ha. The resulting ratio of 7.5 indicates that the lake has a severe water deficit, as evaporative losses from the lake surface far exceed inflows (BGC 2015b). However, there is a channel diversion that connects Anderson Creek (the watershed to the immediate south) to Edith Lake. The diversion into Edith Lake is supposed to capture all flow that arrives at the diversion point between October 1 and March 31 every year (BC Rivers Consulting 2011). Also all freshet flows in excess of that needed for licenses downstream on Anderson Creek should be diverted into Edith Lake. According to BC Rivers Consulting (2011), there was reportedly zero diversion into Edith Lake for at least a decade prior to 2011, although excess freshet runoff was diverted into the lake- in 2011, 2014 and 2015. Water licenses on Edith Lake are summarized below. All of the Edith Lake licenses (Table 11.7-6) are supported by diversion licenses on Anderson Creek.

Water License Management

Because of the many water licenses on Peterson Creek, procedures are in place to fairly distribute the available water in any year to all licensees in order of priority. This allocation of water is administered by a province-appointed water bailiff. There are four categories of licensed water in Peterson Creek and these licenses have the following priority (BC Rivers Consulting 2011):

- baseflow licenses downstream of Jacko Lake;
- irrigation and related storage licenses downstream of and in Jacko Lake;
- baseflow licenses upstream of Jacko Lake; and
- the conservation storage license in Jacko Lake.

Because of the many licenses on Peterson Creek, the water bailiff is tasked with opening and closing the sluice gate that controls outflows from Jacko Lake when water levels are below the elevation of the spillway outlet (Plate 11.7-1). The invert of the sluice gate is 2.6 m lower than the spillway invert (BC Rivers Consulting 2011).

BC Rivers Consulting (2011) was retained by the Province to develop storage release rules for Jacko Lake. A summary of these storage rules is provided in Table 11.7-7.

Plate 11.7-1. Jacko Lake outflow control structure.

Table 11.7-7. Jacko Lake Storage Release Rules (from Table 4 of BC Rivers Consulting, 2011)

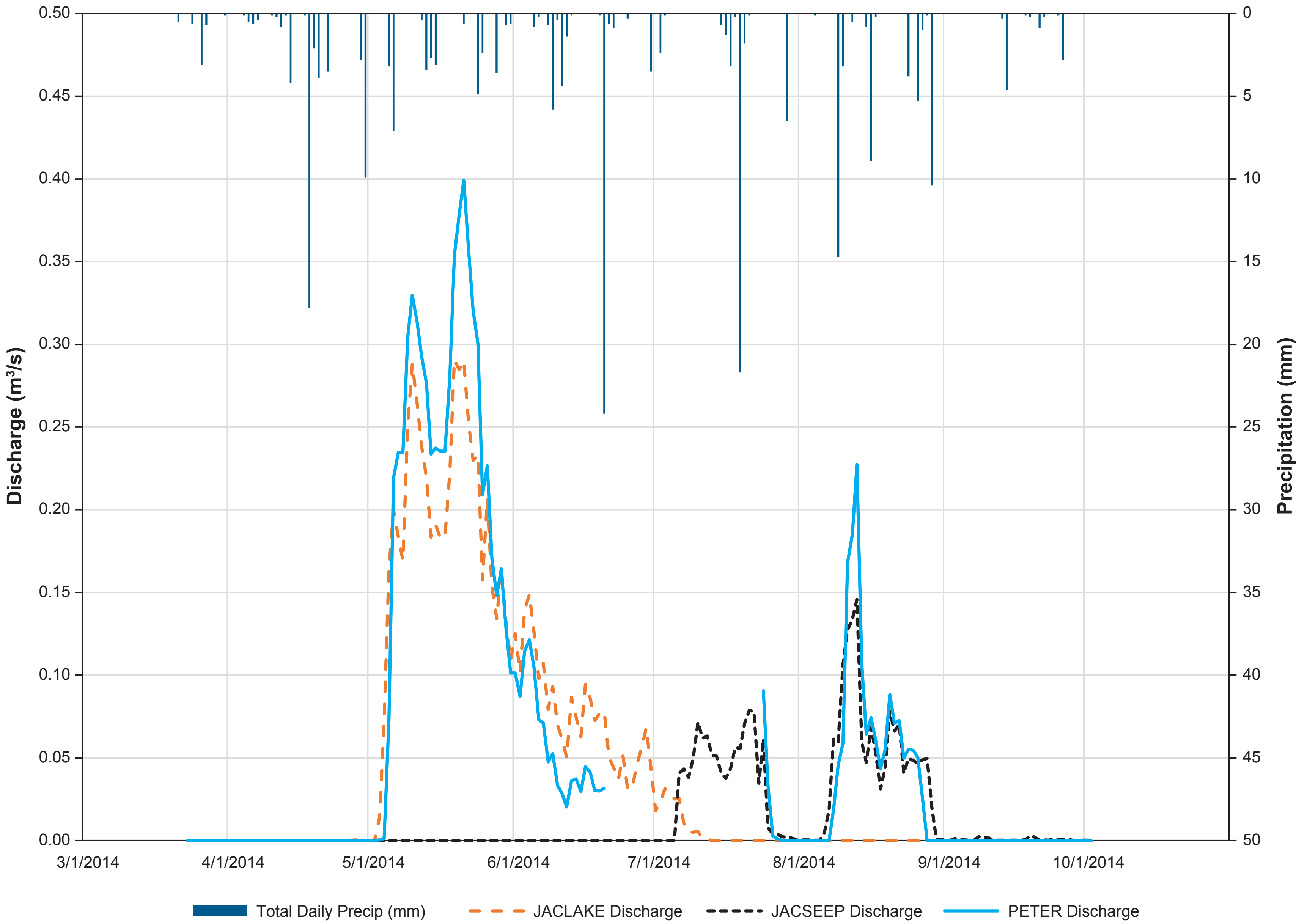
No release from Jacko Lake storage below a lake level of 1.36 m above the sluice invert (1.24 m below the spillway invert elevation)*.
Jacko Lake gate remains closed from October 1 to March 31.
First priority release from Jacko Lake each spring is for the three baseflow licenses downstream of Jacko Lake • Maximum daily flow rate is 38 L/s; max duration is 70 consecutive days from start of irrigation • Baseflow flow release cannot exceed the daily Jacko Lake inflow rate. • Any licenses not being exercised will reduce the maximum daily flow rate accordingly.
Second priority release from Jacko Lake is for all the storage-supported licenses downstream of Jacko Lake • Maximum daily flow rate is 70 L/s; duration is 100 days from start of irrigation • Any licenses not being exercised will reduce the maximum daily flow rate accordingly. • Maximum duration of 100 days of storage release is reduced by the duration of spilling minus 2 days • Any supplemental release from Edith lake will reduce the maximum daily release from Jacko Lake in kind
Third priority use of Peterson Creek flow is for baseflow licenses upstream of Jacko Lake • Maximum daily flow rate is 71 L/s; maximum duration is 70 days from start of irrigation • Any licenses not being exercised will reduce the maximum daily flow rate accordingly. • These licenses can only be exercised when first and second priority licensed demand has been met. Only exception to this is written authorization from Allocation Section Head to divert flow.
Fourth priority conservation storage license in Jacko Lake is automatically met if all the above rules are followed.

** This stipulation recognizes the fact that all the additional water stored in Jacko Lake since the dam crest and spillway were raised 1 m in 1989 is licensed to FLNRO and that lake evaporation from July through September averages 0.15 m or more. This evaporation loss is shared equally between the FLNRO storage volume and the irrigation storage volume.*

The impact of the flow regulation on Jacko Lake is illustrated by 2014 flow hydrographs for the lake spillway (JACLAKE), the low level outlet (JACSEEP), and PETER (Figure 11.7-6). From the beginning of May to early July, water levels were high enough such that the lake spillway was employed. This was followed by a pair of two to three week periods where flows were released via the low level outlet to accommodate the storage-supported licenses downstream of Jacko Lake.

Figure 11.7-6

2014 Hydrographs for JACLAKE, JACSEEP and PETER



These existing water licenses on Peterson Creek and Jacko Lake will continue to be supported through all phases of the Project.

11.7.3 Environmental Protection Measures

11.7.3.1 Mine Overview

Ajax Mine and its infrastructure are located in the Peterson Creek watershed (Figure 11.7-1). The mine plan envisages a conventional open pit operation with multiple phases to access high, medium and low grade material such that the mill has a consistent average available feed. The longest span of the pit will be approximately 2.5 km in an east-west direction and approximately 1.25 km in a north-south direction. The ore will be processed on site at a nominal rate of 65,000 tonnes per day (t/d) and the resulting tailings pumped to the TSF in a conventional slurry. The TSF is located in the Keynes Creek watershed, a tributary of Peterson Creek (Lower).

As development progresses mine rock will be removed with the material stockpiled in a number of facilities: the SMRSF located southeast of the Open Pit, the EMRSF located to the east of the Open Pit, and the WMRSF located downslope of the TSF North embankment. The remaining waste rock will be used for construction of the TSF embankments and for in-pit backfill. Overland runoff and seepage from the base of the MRSFs, if any, will be collected and directed to process. Topsoil and overburden from the footprint of the Open Pit, TSF and MRSFs will be stockpiled in a number of facilities.

Ore will be stockpiled into three piles during mining: a low grade ore stockpile (LGS), a medium grade ore stockpile (MGS), and a high grade ore stockpile (HGS). All three stockpiles are located west of the Plant Site and upslope of Peterson Creek (Lower).

The TSF will occupy an ultimate footprint of about 600 ha (Norwest, 2015b). It is located to the south of the Open Pit within the Keynes Creek drainage. Surface runoff from the TSF will be collected into a pond, from which reclaim will be drawn from and pumped to the process plant. Kamloops Lake is the source of fresh water make-up throughout the year, as required up to a maximum extraction rate of 1,505 m^3/h.

11.7.3.2 Water Management Overview

The mine layout during Operation is shown in Figure 11.7-1. Water will be required for use as make-up water for the process plant, potable water, explosives mixing, fire protection, the truck shop, dust control, etc. Water will be obtained from a variety of fresh, contact, and recycled water sources. All water collected, recycled, or used on the project will require containment or storage in man-made structures.

Fresh and contact water will be available in varying quantities from the following sources:

- fresh water via a pipeline from the Kamloops Lake pump station;
- process water from the tailings thickener overflow;
- process water from the Plant Site concentrate thickener;

- reclaim from the TSF pond;
- contact water from the Open Pit (groundwater inflows and runoff within the pit footprint);
- contact water collected down gradient of the WMRSF, EMRSF, and SMRSF; and
- contact water from the Plant Site.

Fresh (non-contact) water will be required for reagent preparation, gland seals, potable, process make-up requirements, dust control, the truck shop, explosives mixing, and firefighting. Fresh water will be pumped from Kamloops Lake and stored in a fresh/fire water tank. From this tank, fresh water will be distributed to different applications.

Recycled water (contact water) will be used to partially make up the water consumed in the process (e.g., evaporative losses on the tailings beach and void losses within the tailings deposits). However, because the mine will operate with a water deficit, contact water will not meet the full make-up water requirement. The deficit will be made up through fresh water supply from Kamloops Lake. Contact water will be directed to and held in one of the following:

- Central Pond located in the valley bottom of Peterson Creek (Lower);
- Plant Site Pond;
- mill process water tank;
- TSF supernatant pond; and
- dams and ponds located down gradient of the MRSFs.

Key aspects of water management include the following:

- During Operation, all affected site water will be captured in the site process water ponds or water collection ponds for containment and subsequent use in the process plant.
  - Runoff from the EMRSF, SMRSF and WMRSF will report to water collection ponds, which will be pumped to the Central Pond or Plant Site Pond.
  - Open Pit water will be transferred to the Central Pond during Construction and throughout the mine life.
  - Reclaim from the TSF pond will be pumped to the process plant.
- Process water from the tailings thickener overflow and concentrate thickener will be pumped directly to the mill process,
- The site is in a water deficit. This deficit will be made up through fresh water supply from Kamloops Lake.
- The supernatant pond remaining in the TSF at the end of Operation will be pumped to the Open Pit during Decommissioning and Closure.
- The Post Closure WMP assumes passive infilling of the Open Pit with surface runoff and groundwater inflows. The filling rate of the pit lake is considered later in this report.

The potential to recycle treated effluent from the City of Kamloops for use as process water is also being investigated. This option would reduce the requirement for fresh water supply; however, it is considered as a future opportunity at this time and has not been incorporated as part of the Project and the effects assessment at this time.

11.7.3.3 Overview of Water Management Design

This section provides an overview of the water management design for a number of the facilities/structures at site. Facilities discussed include the Peterson Creek Diversion, the fresh water supply from Kamloops Lake, the TSF, the various water management ponds around site, and construction of offsetting fish habitat in Inks Lake.

<u>Peterson Creek Diversion</u>

Management of Jacko Lake is required because the Open Pit will impinge on the northeast arm of the lake and the Kinder Morgan pipeline, which will require relocation to the west. Four (4) engineered dams, less than 5 m high and crest length ranging from 30 m to 175 m, are required within Jacko Lake to prevent potential flooding of the Open Pit and for removal of the Kinder Morgan pipeline which runs beneath the northeast arm of the lake. Therefore, the water management plan (WMP) for Jacko Lake and Peterson Creek (Lower) includes:

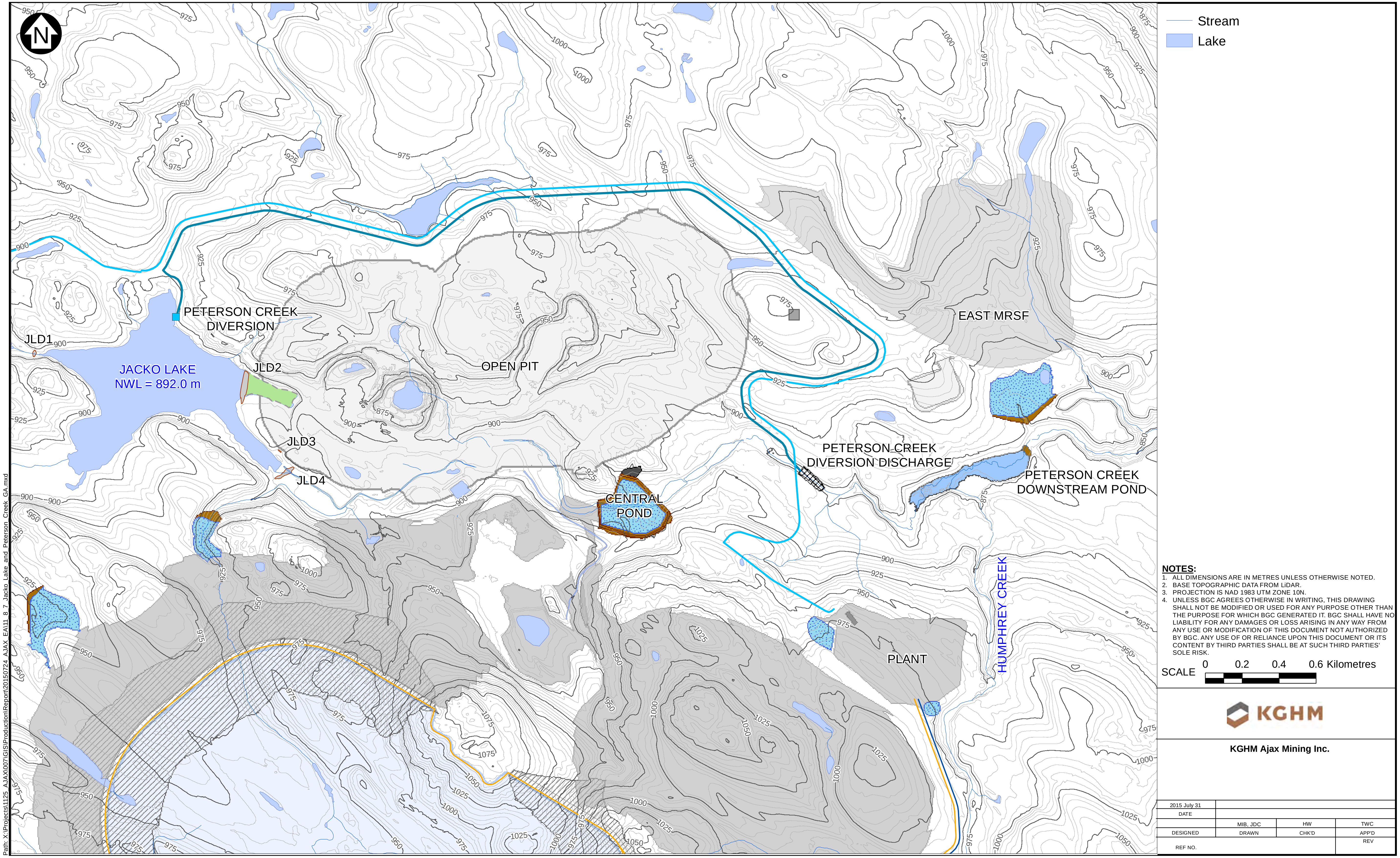
- construction of four new dams on Jacko Lake;
- removal of the existing dam and low-level outlet on Jacko Lake;
- construction of the Peterson Creek Diversion System (PCDS), which will allow for inflows into Jacko Lake to be pumped around the mine site and re-introduced to Peterson Creek (Lower) immediately downstream of the Central Pond;
- temporary abandonment of the Peterson Creek (Lower) channel between the outlet of Jacko Lake and the eastern extent of the Open Pit for Operation (this channel would be re-established during Closure and Decommissioning);
- construction of a new pond, the Central Pond, within Peterson Creek (Lower) adjacent to the Open Pit; and
- construction of a new pond, the Peterson Creek Downstream Pond (PCDP), within Peterson Creek (Lower) downstream of the confluence with Humphrey Creek.

Figure 11.7-7 shows the general arrangement of the above facilities, all of which will be constructed during the Construction period. The following key objectives will be addressed by these facilities during Operation:

- upgrade existing Jacko Lake facilities and provide design flood storage;
- divert inflows to Jacko Lake around the Open Pit with downstream discharge into Peterson Creek (Lower); and
- supply water to downstream water license holders.

Figure 11.7-7
Jacko Lake and Peterson Creek General Arrangement

BGC



The design and operational features of these structures are described in more detail below. Additional details are provided in Norwest (2015a).

Jacko Lake Dams

Currently, flow from Jacko Lake is managed through a spillway on the southeast arm of the lake. To manage downstream flows and meet environmental and water license requirements, a number of options were considered for managing the Inflow Design Flood (IDF), which is defined as the runoff associated with a 24-hour Probable Maximum Precipitation (PMP). KAM has elected to fully contain the IDF in Jacko Lake and install a pumping system to divert flow to the PCDP. The pond can be managed to regulate flows for downstream requirements. To retain the IDF, four (4) small dams are required on the east and west side of Jacko Lake. These structures will be required early in the Construction phase of the Project, during Operation and will remain in place Post Closure. Upon closure, Peterson Creek will be re-established.

Engineered dams will be constructed to a crest elevation of 894.5 masl on the western, northeastern and southeastern arms of Jacko Lake. Four dams will be constructed: the West Dam (JLD3), the Northeast Dam (JLD2), the Southeast Saddle Dam (JLD4), and the Southeast Dam (JLD1). West Dam is located on a catchment divide between the Jacko Lake and Inks Lake watersheds and has a maximum height of 2.5 m. Northeast Dam and the southeastern dams (JLD2 and JLD1) are located on the east side of Jacko Lake closest to the Open Pit and range up to 5 m in height. The dams will be constructed from engineered fill sourced from local borrow and will incorporate drainage features to control seepage through the dams. All dams will be constructed to a crest elevation of 894.5 masl, with minimum crest widths of 5 m and design slopes of 3H:1V (upstream and downstream).

During the spring freshet, the normal water level of Jacko Lake will be maintained at an elevation of 892.0[1] masl using the PCDS. The purpose of the dams is to manage stormwater that causes the lake to rise above the normal water level of 892.0 masl during large rainfall/runoff events. The Inflow Design Flood (IDF) volume has been estimated at 580,000 m^3 based on the runoff associated with the 24-hour PMP (Norwest 2015a). Design freeboard for the dams above the normal lake water elevation is 2.5 m based on the following:

- IDF storage = 1.1 m;
- wave runup = 0.3 m; and
- additional storage = 1.1 m.

Therefore the dams have been designed to manage stormwater greater than the estimated IDF as an extra measure of conservatism (providing a safety factor of at least 1.5 times the IDF). In addition, there is also an allowance for an emergency spillway to divert water into the Open Pit; design for the spillway is pending further site investigation work. Key metrics for each of the dams are presented below in Table 11.7-8.

[1] The spillway invert elevation for the existing Jacko Lake Dam is at elevation 892.0 masl.

Table 11.7-8. Jacko Lake Dam Configuration Summary

Item	JLD3 (West Dam)	JLD2 (Northeast Dam)	JLD4 (Southeast Saddle Dam)	JLD1 (Southeast Dam)
Crest length (m)	35	200	30	120
Base elevation (masl)	892.0	899.7	893.8	889.5
Ultimate crest elevation (masl)	894.5	894.5	894.5	894.5
Maximum dam height (m)	2.5	5.0	0.7	5.0
Dam Fill Volume (m^3)	1,100	17,000	400	6,000

The Northeast Dam (JLD2) will cut off a portion of the Jacko Lake northern arm to facilitate removal of the existing Kinder Morgan Pipeline and mining of the adjacent Open Pit. The Southeast Dam (JLD1) will be constructed approximately 25 m downstream of the existing Jacko Lake Dam, which will require removal as part of this construction.

Peterson Creek Diversion System

The Peterson Creek Diversion System (PCDS) comprises an intake structure and pump house, a pipeline along the north of the Ajax site, with discharge into Peterson Creek (Lower) at an outlet structure located at the Goose Lake access road crossing. Flow from the diversion system will discharge into a new pond, the PCDP, downstream of the outlet structure. The intake will be located at the northeast end of the lake, as it allows for a relatively simple intake structure with fish protection screens in combination with larger centrifugal pumps on the shore. The screen inverts will be located at an elevation of 889.1 masl. Should effects from circulation changes be noted in the southeast arm of the lake, a recirculating pump/pipeline will be installed, if required. Lake water will be pumped into a 400 mm diameter HDPE pipeline and routed around the north end of the Open Pit. The pipeline outlet will discharge into a 5 m long section of 0.3 m to 0.5 m diameter angular rock, which extends 0.5 m above the top of the pipeline and 1 m below the pipeline base. The angular rock is intended to provide for energy dissipation. The angular rock extends for several more meters before reaching the confluence with Peterson Creek (Lower).

It is expected that the PCDS will mostly be required during the spring freshet in order to maintain the normal water level of 892.0 masl and during the summer to maintain existing downstream water licenses. Flows currently discharge from the lake through a spillway with an invert elevation of 892.0 masl. This normal water level will be maintained to the extent possible during Construction and Operation by pumping water around the north side of the Open Pit. The pumping system is currently designed to handle 288 m^3/h. During the summer, at water levels below elevation 892.0 masl, water would be pumped out at the direction of the province-appointed water bailiff to meet the requirements of downstream water licenses. Operational rules governing the release of this licensed water are summarized in Section 11.7.3.3.

Peterson Creek Downstream Pond

Surplus water from Jacko Lake will be diverted to the new downstream pond (PCDP) on Peterson Creek, which will be operated similar to the Jacko Lake spillway and low-level outlet to regulate supply to downstream users. The PCDP will remain after mine closure and water releases will be managed to provide the needs of downstream users in accordance with existing operational rules.

The PCDP comprises a dam and a lined water storage pond (Figure 11.7-8). Water from the PCDS outlet structure will be discharged upstream and flow into the pond. The dam is located approximately 350 m downstream of the confluence with Humphrey Creek, near an existing access road crossing. Design of the pond provides for water storage up to the normal water level of 865.5 m, which equates to a storage capacity of 68,000 m^3. The dam will be a broad-crested weir structure with an overflow spillway that passes excess pond inflows downstream into Peterson Creek. The sill of the weir and the spillway is designed to pass an IDF flow of 153 m^3/s, based on the 24-hour PMP. Flood routing indicates that the maximum water level during the IDF is 867.4 m. A low level decant system will be installed to provide flow control for the British Columbia Water Steward.

The pond extends approximately 700 m upstream of the dam, and has a maximum width of about 150 m. Surface area of the pond is approximately 6 ha at the normal water level of 865.5 m. The pond basin will be fully lined with a low permeability barrier to minimize seepage losses into the underlying foundation. The broad-crested weir is 70 m wide and up to 5.6 m high at the abutments. Weir crest elevation at the abutments is 868.3 masl, with a sill elevation of 865.5 masl and width of 38 m (equal to the normal water level of the pond).

The spillway will be an armoured trapezoidal channel with 3H:1V side slopes and a base width of 38 m. The chute will be tied into the existing Peterson Creek channel, with appropriate energy dissipation and erosion/scour protection works to be determined during the detailed design phase. An access road immediately downstream of the spillway chute will also be moved or redesigned to pass appropriate flood flows.

The low level decant system comprises an intake valve on the upstream side of the broad-crested weir, a buried pipeline, and an outlet structure downstream of the spillway chute. Intake elevation of the low level decant system will be 863.0 masl and will comprise a gate valve in order to control discharge to the downstream side. Access to the gate valve will be from a walkway adjacent to Goose Lake road. Flow will be conveyed along a pipeline trenched into the foundation and discharged to a smaller flow measurement weir structure downstream of the spillway chute. The flow measurement weir will comprise a v-notch steel plate or similar to enable flow rate monitoring.

Key metrics for the PCDP are summarized in Table 11.7-9. Flow releases from the PCDP will be operated similarly to Jacko Lake. During the spring freshet, it is expected that pond levels will be at the spillway invert elevation of 865.5 masl with no need for active management of the structure. During the summer, when Jacko Lake water levels fall below elevation 892.0 masl, water will be pumped out of the lake to meet downstream water license requirements. Flows pumped out of Jacko Lake during this period will either discharge through the PCDP spillway or the low-level outlet will need to be operated to regulate supply to downstream users.

Table 11.7-9. Peterson Creek Downstream Pond Configuration Summary

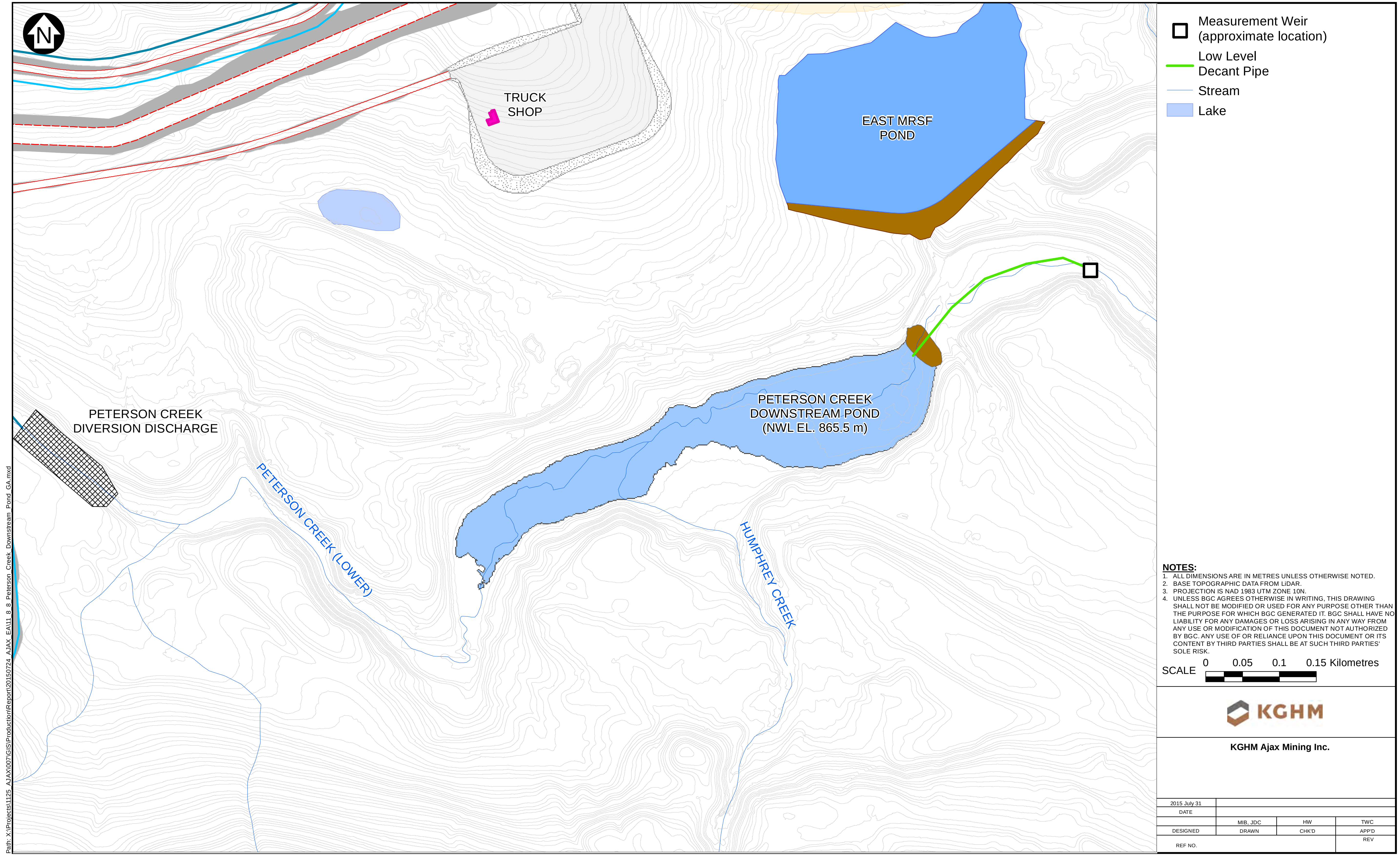
Design Component	Design Characteristic	Value
Dam (broad-crested weir)	Maximum crest elevation (masl)	868.3
	Total crest length (m)	70
	Crest width (m)	5 to 22
	Maximum dam height (m)	5.6
	Upstream/downstream slope	3H:1V
Pond	Normal water level (NWL) (masl)	865.5
	Maximum water level (masl)	867.4
	Minimum water level (masl)	863.0
	Minimum basin elevation (masl)	862.0
	Maximum water depth (m)	3.5 m (includes 1 m sediment capacity)
Spillway Chute	Spillway invert elevation (masl)	865.5
	Spillway base width (m)	38
	Spillway crest width (m)	44.6
	Spillway chute gradient (%)	8.5
Low Level Outlet	Pipe intake elevation (masl)	863.0
	Pipe gradient	0% (0.35% hydraulic gradient)
	Pipe length (m)	285
	Outlet elevation (masl)	862.0

11.7.3.4 Fresh Water Supply Pipeline

An intake system and existing steel pipeline (600 mm) is currently operated by New Gold Inc. to supply water to the New Afton Mine, located to the northwest of the Project. The pipeline was oversized at the time of construction to allow for future expansion. A portion of this pipeline will be used to deliver water to the Project and approximately 16 km of new pipeline will be required to deliver water from the New Afton Mine site to the Project. The new pipeline will largely follow alongside the haul road route. Upgrades to the intake, pumping and booster stations will be required to provide water to both New Afton Mine and the Project. Infrastructure upgrades include: a lake intake pipe; a wet-well and pumping station building; two booster stations; and approximately 16 km of welded steel and HDPE piping.

The intake structure, piping and pumping stations will be designed to provide 1,805 m^3/h, of which up to 300 m^3/h will be allocated to the New Afton Mine.

The New Afton Mine occupies the site of the historic Afton Mine infrastructure. New Afton began underground mining immediately beneath the historic Afton Mine open pit in June 2012. This mine is able to produce up to 13,000 tonnes per day of raw ore though the processing plant. Currently the mine is licenced to draw an annual volume of 1.218 Mm^3 (139 m^3/h) from Kamloops Lake for water supply to the processing plant. An application to withdraw an additional 1.324 Mm^3 (151 m^3/h) is currently in review.


N
TRUCK SHOP
EAST MRSF POND
PETERSON CREEK DIVERSION DISCHARGE
PETERSON CREEK (LOWER)
PETERSON CREEK DOWNSTREAM POND (NWL EL. 865.5 m)
HUMPHREY CREEK
Measurement Weir (approximate location)
Low Level Decant Pipe
Stream
Lake
NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. BASE TOPOGRAPHIC DATA FROM LiDAR.
3. PROJECTION IS NAD 1983 UTM ZONE 10N.
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Fresh water for both Projects will be pumped from two intakes, one operated by New Gold (existing) and the other operated by KAM for the Ajax Project and will be combined into the existing New Afton water pipeline from Kamloops lake to the New Afton storage pond and Ajax booster station. Water flow from each intake will be combined using a t-connection and thrust block at the existing intake pump house.

The fresh water pipeline will supply water to the explosives facility, primary crusher, truck shop, plant site and other buildings and facilities as required. A portion of the water delivered will be treated for potable use during all project phases and stored in a potable water storage tank prior to delivery to various service points.

11.7.3.5 Tailings Storage Facility

Overview

The TSF has been designed to permanently store approximately 275 Mm^3 of tailings at closure (Norwest 2015b). Thickened tailings generated from the mining process is managed within the TSF during Operation and is permanently contained within the TSF at Closure (Figure 11.7-9). All site runoff and process-affected water is recycled within the TSF as part of the reclaim system during Operation, including TSF supernatant pond water and recovered seepage water. Supernatant pond water will be pumped from a barge to a reclaim tank and then gravity-fed to the process plant. Recovered seepage water will be pumped to the TSF or to the Central Pond and returned to the process plant to be used in in the mill. Prior to mill commissioning, a trenched channel will be excavated within the basin to provide a surface water connection between Goose Lake and the TSF supernatant pond for the barge recycle system. This channel will operate primarily during the initial production years, as over time the tailings will slowly infill the trench. This barge trench will be approximately 7 m deep, 12 m wide at the base with 2H:1V sideslopes.

Seepage will be managed through the use of drainage ditches and a series of water management ponds downstream of the TSF, along with the placement of an upstream seepage control zone. This seepage control zone will be constructed from low permeability glaicial till material from nearby borrow sources or geosynthetic material of the local borrow material does not meet design construction specifications (Norwest, 2015b). Seepage cutoff is planned beneath the dam foundation along the upstream toe or as close as possible to the dam centreline. The seepage cutoff will tie into in-situ lower permeability materials in the foundation. Rock drains will be constructed to convey any seepage flow from the downstream toe to seepage collection ponds, and relieve any hydrostatic pressures within the embankment and downstream mine rock buttress.

Construction of the TSF and downstream embankments is expected to occur in stages starting in Year -2, with a starter dyke elevation of 971 masl and a maximum elevation of 1,056 masl by the end of Operation. The TSF will be constructed using the downstream method of construction that includes four (4) zoned earth-rockfill dams referred to as the North Embankment, East Embankment, South Embankment, and Southeast Embankment. The TSF embankments will be constructed throughout the LOM and will be coordinated with the mine rock production schedule. Embankments will be progressively raised during Operation and will be constructed of run of mine non-potentially acid generating (NPAG) mine rock. The SMRSF and WMRSF are located at the downstream end of the TSF to provide additional stability for the embankments. Tailings will be discharged using discharge spigots from the embankment crest and natural ground for beach development and tailings management.

Tailings Distribution

Tailings will be pumped from the floatation circuit to the TSF and discharged from the embankment crests. The tailings delivery pipeline will be an overland HDPE line within a bermed corridor located along the pipeline access road from the process plant to the TSF and along the North, East and Southeast embankments. Inline isolation valves installed at intervals along the delivery pipelines will allow the tailings discharge locations to be rotated as appropriate for controlled beach development and proper subaerial deposition to allow for the greatest tailings consolidation. Pumping will be required for all stages of mine operations to overcome hydraulic head, offset frictional and other losses around the tailings distribution system.

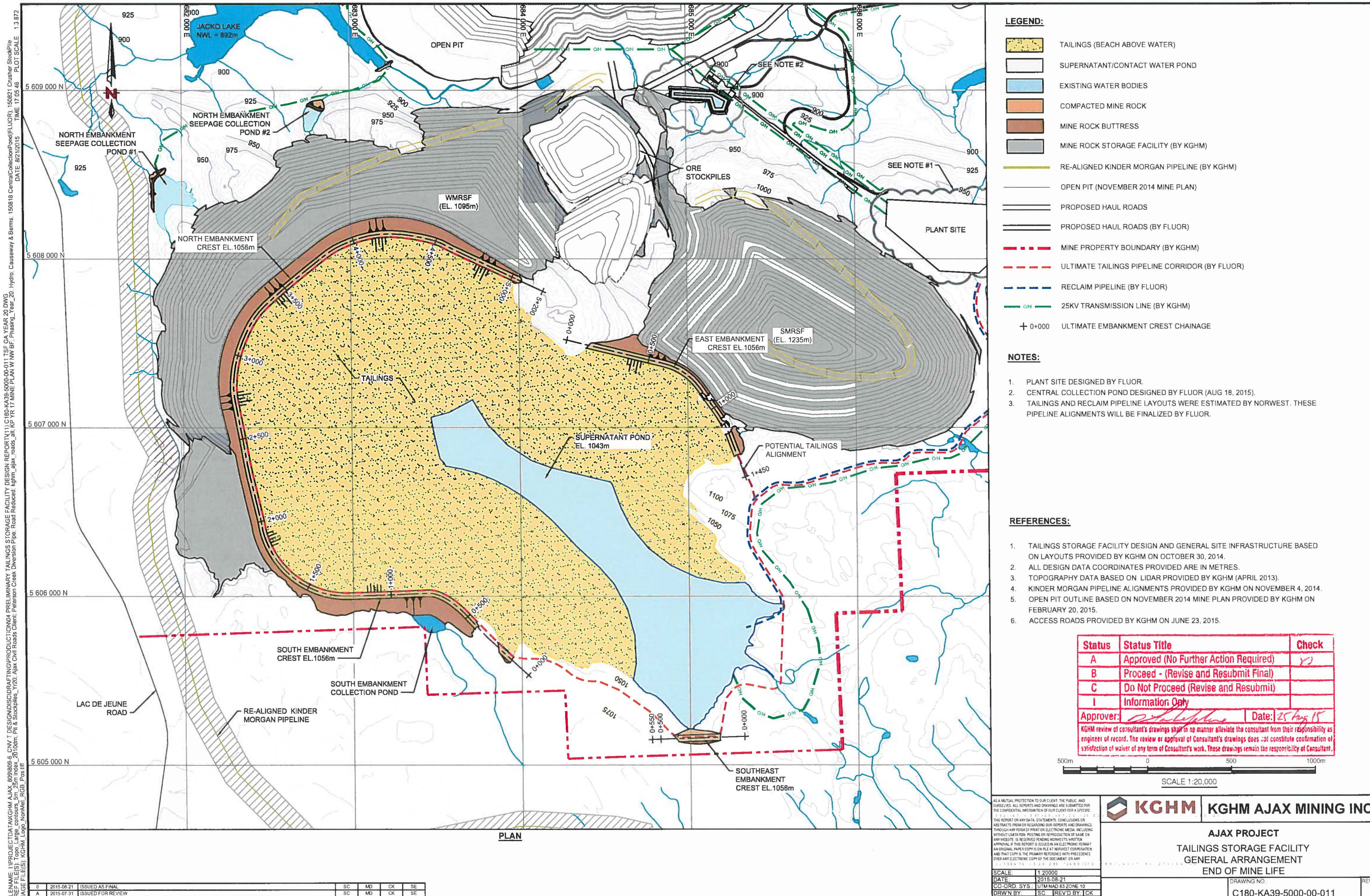
A single pipeline conveys the tailings from the pump station to the topographic divide between the TSF and the process plant. At the divide, the single tailings pipeline bisects into a Northern tailings pipeline and a Southern tailings pipeline. The North and South tailings conveyance pipelines convey the tailings stream along the top crest of the TSF embankments. Tailings will be discharged from the embankments that will result in a supernatant pond developing in the southeast corner of the facility. Discharge spigots are used to discharge the tailings from the conveyance pipeline running along the embankment crest. This method of deposition is expected to result in beaches with approximately 1 to 2% slopes. Note the southern tailings pipeline only comes online when the South and Southeast embankments are developed in Year 7.

Tailings Storage Facility Reclaim

The TSF reclaim system is designed to transfer water from the TSF to the Plant Site for use in process. The reclaim system consists of three primary components: a floating barge, a storage tank, and the conveyance pipeline. The barge will be fitted with a de-icing system to prevent freezing of the barge unit in the TSF pond during winter months.

Reclaim water will be pumped from the TSF barge located in the southeastern area of the TSF. A dedicated HDPE pipeline, located within a bermed corridor along the access road, will convey the reclaimed water to a storage tank located on the topographic divide between the TSF and the process plant. The storage tank will provide water storage capacity to enable the plant operations to continue to operate for a short-period of time if there are interruptions to the pump operation on the floating barge unit. Level switches in the tank will control the operation of the floating barge pump sets to ensure that the tank is always maintained full. Conveyance of reclaim water from the storage tank to the process plant is via an HDPE gravity pipeline. The gravity pipeline will feed directly into the cyclone feed pumpbox at the Plant Site.

Figure 11.7-9
TSF General Arrangement



Design Characteristics

The flood storage criteria for the TSF is to contain the IDF, which is defined as: 72-hour PMP + 100-year return period snowpack – average annual snowpack. The total IDF is estimated at 447 mm. This IDF is based on an 'EXTREME' dam safety classification, in accordance with the Canadian Dam Association (CDA, 2013) guidelines. The TSF design also provides sufficient freeboard to accommodate the IDF above a maximum supernatant pond level at each construction stage, along with a minimum additional 2 m allowance for wave run-up protection. General design characteristics for the TSF are summarized in Table 11.7-10.

Table 11.7-10. Tailings Storage Facility Design Summary (adapted from Norwest, 2015b)

Design Component	Design Characteristic	Value
Tailings Properties	Solids (%)	60
	Ultimate dry density (t/m^3)	1.5
	Specific gravity (tailings solid)	2.85
TSF	Maximum elevation (masl)	1,056
	Total solids contained (Mm^3)	275
	IDF (mm)	447
	Storm storage (Mm^3)	2.4
	Dam crest width (m)	39
	Freeboard (m)	2
TSF Embankments	Maximum elevation (masl)	1,056
	Starter dyke elevation (masl)	971
	Total fill requirement (Mm^3)	101
	Startup water storage requirement (Mm^3)	2.1

11.7.3.6 Water Management Ponds

Contact water for the site will be generated from the various MRSF's, the Open Pit and the TSF. A majority of this contact water is expected to be collected at a number of water management ponds around the site (Figure 11.7-1), including:

- North Embankment Pond 1 and 2 – collect runoff from TSF seepage and a portion of the WMRSF;
- South and Southeast Embankment Ponds – collect runoff from TSF seepage, the respective embankments, and undisturbed areas located up gradient, (these ponds may be determined to be unnecessary with advancement of design);
- SMRSF Pond – collects seepage and surface runoff from the southeast portion of the SMRSF;
- EMRSF Pond – collects seepage and surface runoff from the EMRSF;
- Plant Site Pond – collects surface runoff from the Plant Site; and

- Central Pond – all of the above ponds (with the exception of the Plant Site Pond and SMRSF Pond) are pumped to the Central Pond, which also receives runoff from a portion of the WMRSF and SMRSF. Groundwater inflows and surface runoff to the Open Pit is also collected and pumped to the Central Pond.

The water management ponds have been sized to provide storage for seasonal runoff conditions and have storm water storage capacity for the 200-year return period, 24-hour rainfall event (68.5 mm). Events exceeding this design storm will be discharged to the environment through engineered spillways. The ponds will be constructed of earthfill/rockfill materials, and may include low permeability basin liners, natural or synthetic, as required by site conditions.

The water management ponds are described below. KAM and their engineering consultants are currently working on permit-level designs for all of the water management ponds. The design and final design of these ponds is expected to evolve over the course of the Environmental Assessment (EA) and permitting process, as additional investigations are conducted.

<u>Central Pond</u>

The Central Pond is located south and adjacent to the Open Pit in the valley bottom of Peterson Creek (Lower). Inputs to the pond include:

- direct precipitation on the pond and catchment runoff;
- Open Pit dewatering and depressurization;
- seepage/runoff from the ore stockpiles;
- seepage/runoff from the primary crusher area and mill area;
- seepage/runoff from the SMRSF;
- seepage/runoff from the WMRSF;
- seepage/runoff from the EMRSF Pond;
- seepage/runoff from the SMRSF Pond; and
- seepage/runoff from North Embankment Pond 1.

Containment on the north and south sides of the Central Pond will be provided by natural ground, while the conveyor ramp and a haul road will provide containment to the east and west, respectively. The pond will have a base elevation of 890 masl and a maximum water level of 896 masl (the haul road to the west has a crest elevation of 897 masl). Rock underdrains will run in a west-east direction under the lined facility (80 mil HDPE smooth geomembrane), which will daylight in French drains on the creek bottom at the east toe of the conveyor ramp. Outflows from the foundation drains will be monitored for water quality at sumps.

Water collecting in the Central Pond will be managed by a pumping system designed to direct flow to the mill for use in process. The pump house will be located on the east side of the pond below the crest of the conveyor ramp.

East MRSF Pond

The EMRSF Pond is located down gradient of the EMRSF (Figure 11.7-10). Inputs to the pond include:

- direct precipitation on the pond and catchment runoff;
- seepage/runoff from the EMRSF; and
- runoff from the truck shop area.

As the pond is situated partially on the Peterson Creek Aquifer, the pond will be lined with a synthetic liner (80 mil HDPE smooth geomembrane). The pond will have an under liner drainage system to a water testing well for the purpose of leak detection. As the pond is located on a slope, a dam will need to be constructed to retain the water. This dam will be designed to contain the runoff associated with a 200-year return period, 24-hour rainfall event and will include a spillway sized for the 200-year peak instantaneous flow (Q_{i200}).

Based on the topography, it is not feasible to have a drainage channel from the EMRSF Pond to the Central Pond. As a result, the pond will be managed by pumping flow to the Central Pond. A pump house would be located on the dam crest. Preliminary design of the dam indicates a dam crest elevation of 885.0 masl with the spillway invert at elevation 884.0 masl. At this spillway elevation, the pond has an approximate storage capacity of 180,000 m^3, while the dam height is about 12 m.

As noted on Figure 11.7-10, the EMRSF is actually situated within two tributary watersheds of Peterson Creek (Lower). A majority of the mine rock and the pond will be situated in the west tributary. To collect runoff from the east tributary, a diversion channel will be constructed from the east tributary with the outlet discharging into the EMRSF Pond. This channel will be lined with riprap for erosion protection and will have sufficient capacity for the Q_{i200}. With the proposed diversion channel in place, an area of approximately 314 ha will discharge to the pond (176 ha from the west tributary and 138 ha from the east tributary).

South MRSF Pond

The SMRSF straddles three watershed boundaries, as illustrated in Figure 11.7-11:

- Surface runoff and seepage from the west portion will report either to the Central Pond or the Open Pit.
- Groundwater modelling by BGC (2015c) indicates that seepage from the east portion of the SMRSF for best estimate hydrogeologic conditions will report to the Open Pit. Near surface flows would be intercepted by the Plant Site area or conveyor and report to the Plant Site Pond or Central Pond.
- Surface runoff from the south portion of the facility will report to the SMRSF Pond, while a majority of seepage is predicted to also report to the pond. A smaller proportion of seepage will eventually report to Humphrey Creek, the potential impacts of which are assessed by the site-wide water balance model (WBM) and associated water quality model.

The SMRSF Pond will be located between the southeast toe of the SMRSF and the TSF pipeline service road. A watershed area of approximately 110 ha will report to this pond. Preliminary design drawings illustrate that the pond will be excavated about 3 m below the ground surface to elevation 974.0 masl so that the ponded water does not come into contact with the mine rock. This design prevents the mine rock from being exposed to wetting and drying cycles and from a slope stability perspective allows for drained conditions at the base of the SMRSF. The pipeline service road has a crest elevation of 983 masl, which is 6 m above the maximum pond water level of 977 masl. This pond level is associated with runoff from the 200-year, 24-hour rainfall event. The pond will be lined with an 80 mil HDPE smooth geomembrane, which will extend up the embankment of the pipeline access road in the event that the maximum water level of 977 m is exceeded.

Flows captured in the water management pond will be pumped to the Plant Site Pond. A pump house is currently proposed for the north end of the pond. No spillway is proposed for the pond given the significant additional storage capacity provided by the access road embankment.

Embankment Collection Ponds

Each TSF embankment has a corresponding seepage/surface runoff collection pond, except for the East Embankment for which seepage from the TSF and seepage/runoff from the SMRSF is directed to the Plant Site. These ponds also collect seepage and runoff from the corresponding MRSFs and catchment runoff. Seepage and runoff from the TSF North Embankment is collected at North Embankment Ponds 1 and 2. Both ponds:

- have sufficient storage to contain the 200-year, 24-hour rainfall event;
- may include low permeability basin liners, natural or synthetic, as required by site conditions; and
- will be designed with emergency spillways to discharge to the environment for events that exceed the capacity of the ponds (Norwest, 2015b).

North Embankment Pond 1 is located downstream of the North Embankment along the natural valley drainage to the northwest of the downstream toe. Runoff from an estimated 2.7 km^2 catchment that extends southwards to the end of the South Embankment will drain to the pond. The containment berm will be an approximately 11 m high dyke with a crest length of 280 m. The pond is sized for the area required for sediment removal during construction of the starter embankment. The elevation at which the required area can be met gives a storage volume of 119,000 m^3, which greatly exceeds the 200-year, 24-hour runoff volume of 50,000 m^3 (Norwest, 2015b). A pump house would be located on the dam crest and flows would be pumped through a 150 mm diameter HDPE pipe to North Embankment Pond 2.

North Embankment Pond 2 is located along Keynes Creek above its confluence with Peterson Creek (Lower). The containment berm will be an approximately 21 m high dyke with a crest length of 107 m. As with Pond 1, the pond is sized for the area required for sediment removal during construction. The elevation at which the required area can be met yields a storage volume of 129,900 m^3, which greatly exceeds the 200-year, 24-hour runoff volume of 10,000 m^3. Groundwater modelling (BGC 2015c) indicates that TSF seepage and seepage from the facility will report to the Open Pit. This assumption will be re-visited at the next stage of design.

Figure 11.7-10
East MRSF General Arrangement

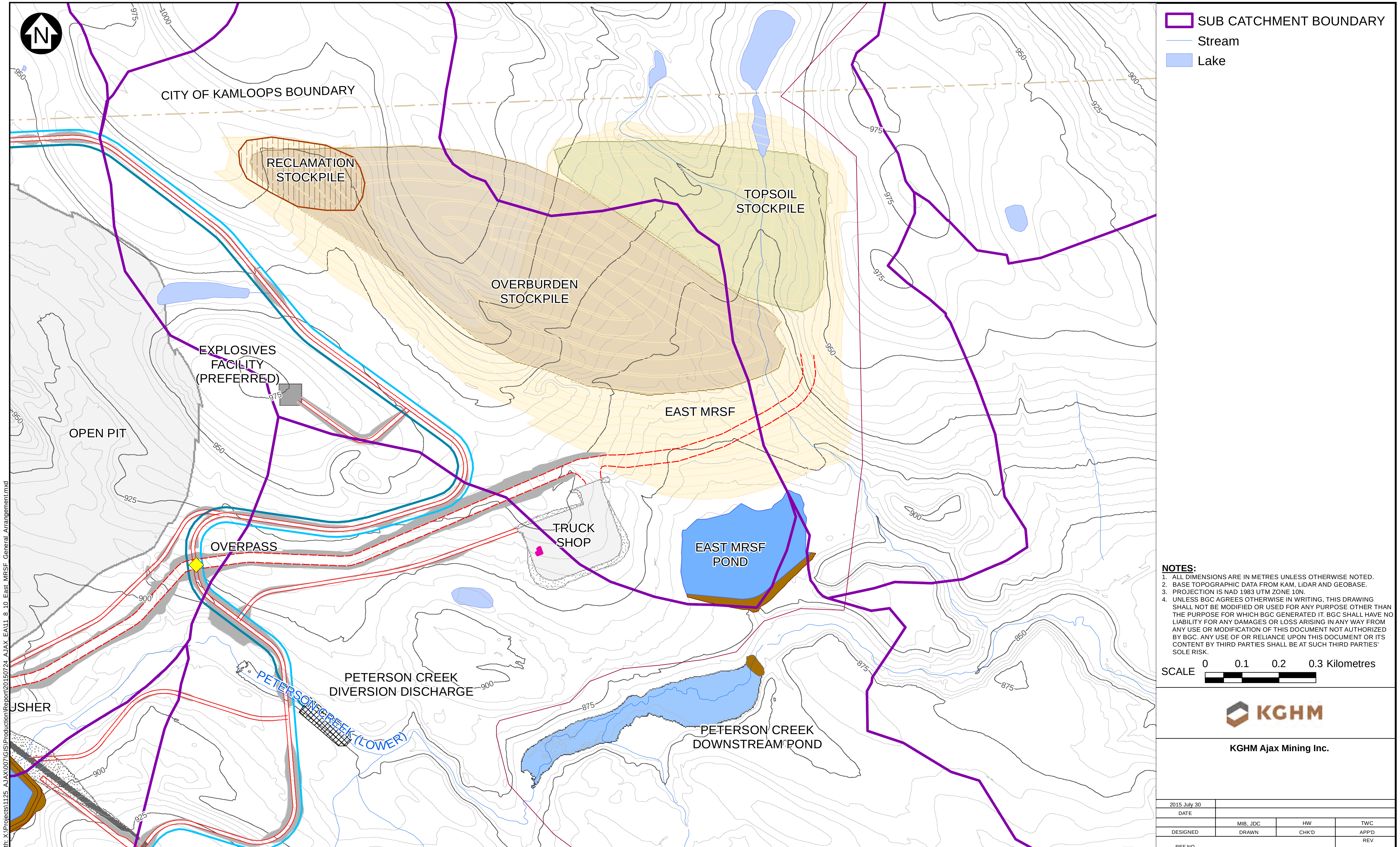
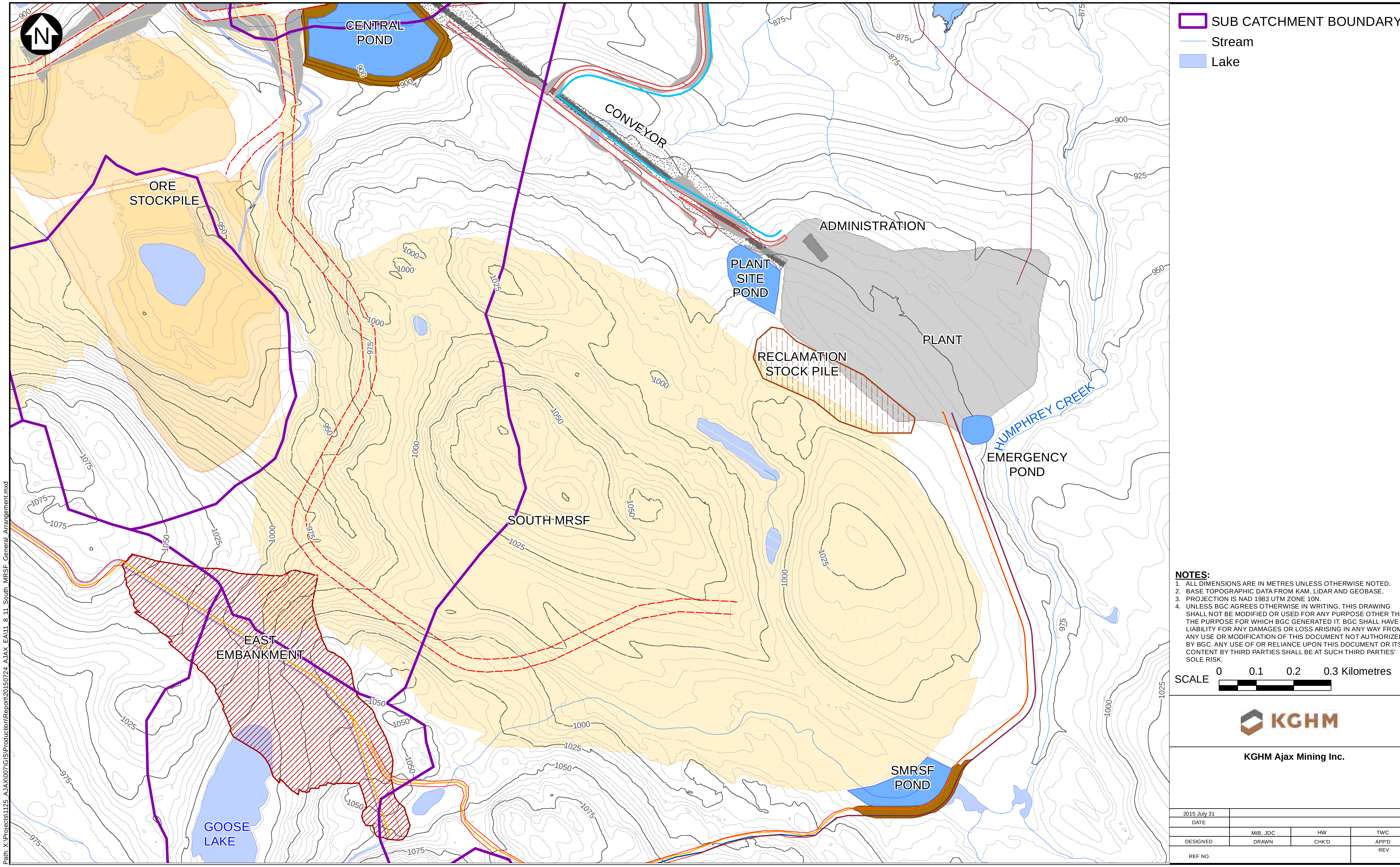


Figure 11.7-11
South MRSF General Arrangement



Seepage and embankment runoff from the South and Southeast embankments will be collected at their respective water management ponds. These ponds are constructed during Operation as the TSF footprint expands. Water collected in these ponds will be pumped back to the TSF directly, if required.

Contact water collection ditches will be constructed at the toe of the North Embankment and South Embankment to collect runoff from the embankments and divert it to the water management ponds (Figure 11.7-9). The permanent ditches will be constructed along the edge of the ultimate footprint and sized to convey the 200-year peak instantaneous flow to the water management ponds. Sizing of the ditches will be completed during the next phase of design.

Plant Site Pond

The Plant Site Pond is located adjacent to the Plant Site. Inputs to the pond include:

- direct precipitation on the pond; and
- runoff from the Plant Site.

Water collected in this pond will be pumped to process directly.

11.7.3.7 Inks Lake

Development of the Open Pit and Peterson Creek Diversion Project would result in the permanent loss of fish habitat and associated productive capacity, as described in Section 6.7. Therefore, offsetting options are required. The offsetting measures to address potential serious harm to fish in Jacko Lake and Peterson Creek will be implemented, as described in the Ajax Project Conceptual Offsetting Plan (Appendix 6.7-D).

The proposed Offsetting Plan will modify Inks Lake to create a deeper fresh water lake, which is suitable for fish habitat. Inks Lake, located to the west of Jacko Lake, is unable to support fish without enhancement due to its shallow depth, lack of inflow, and unsuitable water quality. By increasing the depth and volume of Inks Lake and supplying appropriate water, it has the potential to support fish and create a fishery through the annual stocking of rainbow trout. The potential fish habitat gains that could be accomplished by establishing a fishery on Inks Lake have the potential to greatly exceed the fish habitat offsetting requirements for the Ajax Project.

Under the Fish Habitat Offsetting Plan, the existing lake water will be drained and the lake bottom excavated to increase the volume and maximum depth of the lake. Fresh water to fill Inks Lake will be pumped using a spur from the proposed fresh water pipeline from Kamloops Lake. Once the lake has been refilled, the lake shoreline will be planted with native vegetation to establish a functional 30 m wide riparian zone. The lake will be stocked on an annual basis with rainbow trout from a local hatchery (similar to Jacko Lake), as no suitable stream exists in the area to allow for fish spawning and natural recruitment.

The design consists of the south basin of Inks Lake filled to a water surface elevation of 852 masl and within 1.3 m freeboard of Lac Le Jeune Road. The lake surface area at 852 masl is 6.1 ha. Existing lake sediments will be removed and underlying overburden materials in the south basin will be excavated to a maximum depth of 12 m. The lake bottom will be excavated to achieve a 10-12 m depth over 30% of the lake area. The preliminary excavation volume is estimated to be 180,000 m^3 and the estimated lake volume at 852 masl following excavation is 450,000 m^3. A spillway channel with an invert elevation of 852 masl will be constructed at the southwest end of the lake.

The fresh water inflow for Inks Lake will be provided through a bifurcation from the pipeline between Kamloops Lake and the process plant. The pipeline will discharge to the northeast corner of Inks Lake. The preliminary required inflow to maintain lake levels and water quality is 25 m^3/h from April to October (213 days) (Appendix 6.7-D). The lake outlet will be constructed by excavating a channel at the southwest side of the lake. The channel invert will be at elevation 852 masl and be gently sloped to allow the lake outlet to flow under the mine access road through a culvert and into a tributary of Alkali Creek. The outlet channel and culvert will be designed to pass the 100-year peak flow to the Inks Lake catchment.

11.7.4 Construction Water Management Plan

11.7.4.1 Overview

This section provides a water management strategy for the Construction phase of the Project. Site construction is scheduled to occur over an approximately 21 month period. The critical period for management of contact water commences when pre-stripping activities are initiated in the mineralized zone. These excavations will produce mine rock, ore and exposed bedrock in the mineralized zone; all of which have the potential to generate contact water. This contact water will be captured at various facilities around the site and stored in the Central Pond for use in process at start-up.

Water management objectives during Construction include:

- construction of the fresh water supply pipeline from Kamloops Lake;
- construction and operation of the Peterson Creek diversion;
- collection and storage of all contact water generated during construction; and
- ensuring an adequate supply of water for the mill at start-up.

Construction water management for site access and ancillary mine infrastructure will be focused on storm water control using best management practices (BMPs) (e.g., silt fences, hay bales, sedimentation basins). These aspects of construction water management are not discussed further in this WMP.

11.7.4.2 Construction Schedule for Water Management Infrastructure

Construction activities and initial Operation phases of the Project will involve land disturbances associated with tree clearing, road construction and infrastructure development, including the construction of water management structures such as pumping systems and diversion channels. Site tree clearing, grubbing, topsoil removal, overburden stripping and stockpiling is scheduled to begin in September of Year -2. Construction is intended to proceed in three phases staged at six month intervals specifically 0 to 6 months (Phase 1), 6 to 12 months (Phase 2) and 12 to 18 months (Phase 3) and will include the following activities:

- Phase 1 construction includes development of access and haul roads, seepage dams, water management ponds, TSF initial starter embankment, reclamation stockpiles, ore stockpile, Plant Site and crusher, truck shop, and Peterson Creek diversion outlet footprints;
- Phase 2 construction continues with pre-stripping of the pits, explosives magazine and batch plant, Central Pond, the WMRSF and SMRSF foundation works, the TSF starter area and starter embankment, the PCDS, and diversion ditches associated with the MRSFs.
- Phase 3 concludes with EMRSF foundation preparation and access. The TSF South Embankment is not scheduled for construction until Year 7 of the Project.

Table 11.7-11 summarizes general construction activities and approximate timing for each phase of construction. All activities are weather dependent, such as installation of geofabric and liners.

Table 11.7-11. Summary of Construction Activities

Phase (Approx. Timing)	Site or Structure	Activity
Phase 1 (September Year -2 to February Year -1)	Mine site access road and temporary haul roads	• Disturbance (clearing, grubbing and topsoil removal) and earthworks (surface capping and grading)
	Plant Site	• Disturbance (clearing, grubbing and topsoil removal) for the Plant Site, crusher area and truck shop
	Mine/ Rock quarry	• Disturbance (clearing, grubbing and topsoil removal) • Pre-stripping and rock removal • Drilling, blasting, crushing and ore stockpiling • Grading and sloping
	TSF Initial Starter Embankments (North and East Embankments)	• Disturbance (clearing, grubbing and topsoil removal) • Surface preparation, geofabric installation and HDPE installation
	TSF Basin	• Disturbance (clearing, grubbing and topsoil removal) • Basin preparation continues to Phase 2
	Seepage Dams	• Disturbance (clearing, grubbing and topsoil removal) • Installing geofabric, drain pipes and rock drains • Includes North Embankment Dams 1 and 2; North Embankment Seepage Underdrains 1 to 4; East Embankment Seepage Underdrains
	EMRSF and SMRSF Ponds	• Disturbance (clearing, grubbing and topsoil removal) • Constructing collection dam and installing liner
	Peterson Creek Diversion System	• Disturbance (clearing, grubbing and topsoil removal) and earthworks initiated • Pump station and water intake pipe installation • Construction complete in Phase 2
	Fresh water System	• Installation of Kamloops Lake intake, booster station, Ajax booster station and fresh water pipeline

Phase (Approx. Timing)	Site or Structure	Activity
Phase 2 (March to August Year -1)	SMRSF	• Topsoil removal and foundation preparation
	WMRSF	• Topsoil removal and foundation preparation
	Central Pond	• Disturbance (clearing, grubbing and topsoil removal) • Constructing dam and installing liner
	Plant Site/ Mine	• Pre-stripping for the pits, explosives magazine, batch plant and central collection pond • Plant Site Pond and Tailings Emergency Spill Pond disturbance and earthworks
	Diversion Channels	• Disturbance (clearing, grubbing and topsoil removal) • Installing geofabric, bedding layer and riprap armouring
Phase 3 (September Year -1 to February Year 1)	EMRSF	• Topsoil removal and foundation preparation • Access road construction

11.7.4.3 Construction Water Requirements

Clean water is required for the following construction activities:

- potable water;
- dust management;
- explosives mixing;
- initial earthworks construction;
- concrete batch plant;
- aggregate production (screening and crushing); and
- filling of the TSF for start-up.

Domestic and potable water use during Construction is estimated at 125 L/person/day. With a construction workforce of 1,800 people, the average water use is estimated at 9 m^3/h (225 m^3/day) with corresponding potable water treatment capacity. A sewage treatment plant (STP) with a capacity of 225 m^3/day will also be constructed. Effluent from the STP will be discharged to the Central Pond during Construction. The potable water will be sourced from Kamloops Lake.

For industrial uses, it is estimated that approximately 21 m^3/h on average will be required for dust management and a further 75 m^3/h for concrete, earthworks and aggregate production. This water will be sourced from the existing open pits and Kamloops Lake (see Section 11.7.4.4). For light vehicle and mine maintenance shops, water will be treated and recycled within the shop and any excess will be directed to Central Pond

11.7.4.4 Water Management Strategy

The base case for the Construction water balance includes the following components:

- passive pit slope depressurization (i.e., horizontal drains) and a pit dewatering system to convey Open Pit runoff to the Central Pond;
- decommissioning of the existing Jacko Lake Dam and construction of the four new saddle dams;
- construction and commissioning of the PCDS and PCDP;
- water management ponds to collect runoff from the North Embankment Ponds, WMRSF, SMRSF, and EMRSF and pump it to the Central Pond; and
- construction of the TSF starter dam and providing a water volume of 2.1 Mm^3 for the mill at start-up.

Some of these components of construction water management are discussed in more detail below. A schematic of the water management strategy at the end of Construction is provided in Figure 11.7-12.

<u>Open Pit Dewatering</u>

Existing pits at site include the Ajax East, West East and West West Pits. The East Pit is a bench cut and thus contains no water, while a majority of the West West Pit has been backfilled with waste rock. The West East Pit occupies an area of approximately 10 ha, measuring about 300 m long by 300 m wide and has a depth of about 60 m to the existing water level (~ 845 masl to 850 masl). This pit was also partially backfilled following the cessation of mining in the early 1990s.

The West Pit shells were allowed to flood following the cessation of mining and the current volume of water in the pits has been roughly estimated at 525,000 m^3: about 75,000 m^3 in the West West Pit and 450,000 m^3 in the West East Pit. These estimates are based on the surface area of the existing pit lakes and a water depth of 26 m. A bathymetric survey of the two pit lakes and pit shells, that indicate pit depth and contours and backfilled thickness, would be required to refine this volume estimate.

This existing pit water will be treated, as required, and used for construction water management activities including dust control, concrete batch plant requirements, aggregate production (screening and crushing), water required for initial earthworks construction, and water required for temporary facilities such as the temporary truck maintenance facility and workshop. Once construction of the fresh water supply pipeline is complete, fresh water requirements for the Project will be drawn from Kamloops Lake. If the existing pit water is not suitable for treatment and use during construction, it would be pumped to the TSF, where it would form a component of the required volume for mill start-up.

<u>Decommissioning of Existing Jacko Lake Dam</u>

The existing dam is listed as the Jacko Lake Dam in the British Columbia Ministry of Environment dam registry (Dam File#: D120211-00). It is an earth fill dam with the following characteristics:

- maximum height = 3 m;
- crest length = 62.5 m;

- average crest width = 6 m;
- crest elevation = 892.3 masl; and
- dam slopes = 2H:1V.

There is a low level discharge pipe through the dam near its eastern abutment which discharges immediately downstream of the dam. The discharge pipe flows into a small concrete weir structure approximately 30 m downstream of the dam which overflows into the natural Peterson Creek channel. The inlet to the emergency overflow spillway is adjacent to the southern abutment. The emergency spillway is lined with riprap and discharges into Peterson Creek downstream of the concrete weir.

Removal of the existing Jacko Lake Dam could be carried out either in the “wet” or “dry” (Norwest, 2015a). For either option, the Southeast Dam (JLD1) and the PCDS would be constructed prior to dam removal. Both options would require that a single or double line of floating silt curtains be installed upstream of the existing dam to prevent the turbid water from the excavation operations impacting the main body of Jacko Lake. Floating silt curtains would be installed across the width of the southeast arm of Jacko Lake and anchored on either bank.

The “wet” removal would involve allowing water to discharge from Jacko Lake into the area contained between the new downstream dam and the existing structure. Water would be allowed to discharge until the water level on both sides of the dam was equalized. Assuming removal was scheduled for the summer, it is expected the lake level would be between an elevation of 891 masl and 892 masl. A lower lake level would facilitate removal activities but is not required.

“Dry” removal would require the installation of a temporary dam (i.e., cofferdam) upstream of the existing Jacko Lake Dam. Relatively shallow depths in the southeast arm (1 to 2 m) make the use of removable water filled temporary dykes feasible. These structures are intended to function as short-term water barriers to allow for construction activities within shallow waterways and water bodies such as Jacko Lake. Following initial installation of the temporary dam approximately 10 m upstream of the Jacko Lake Dam, the water between the dam and the temporary structure would be discharged or pumped out and dam removal operations could be carried out.

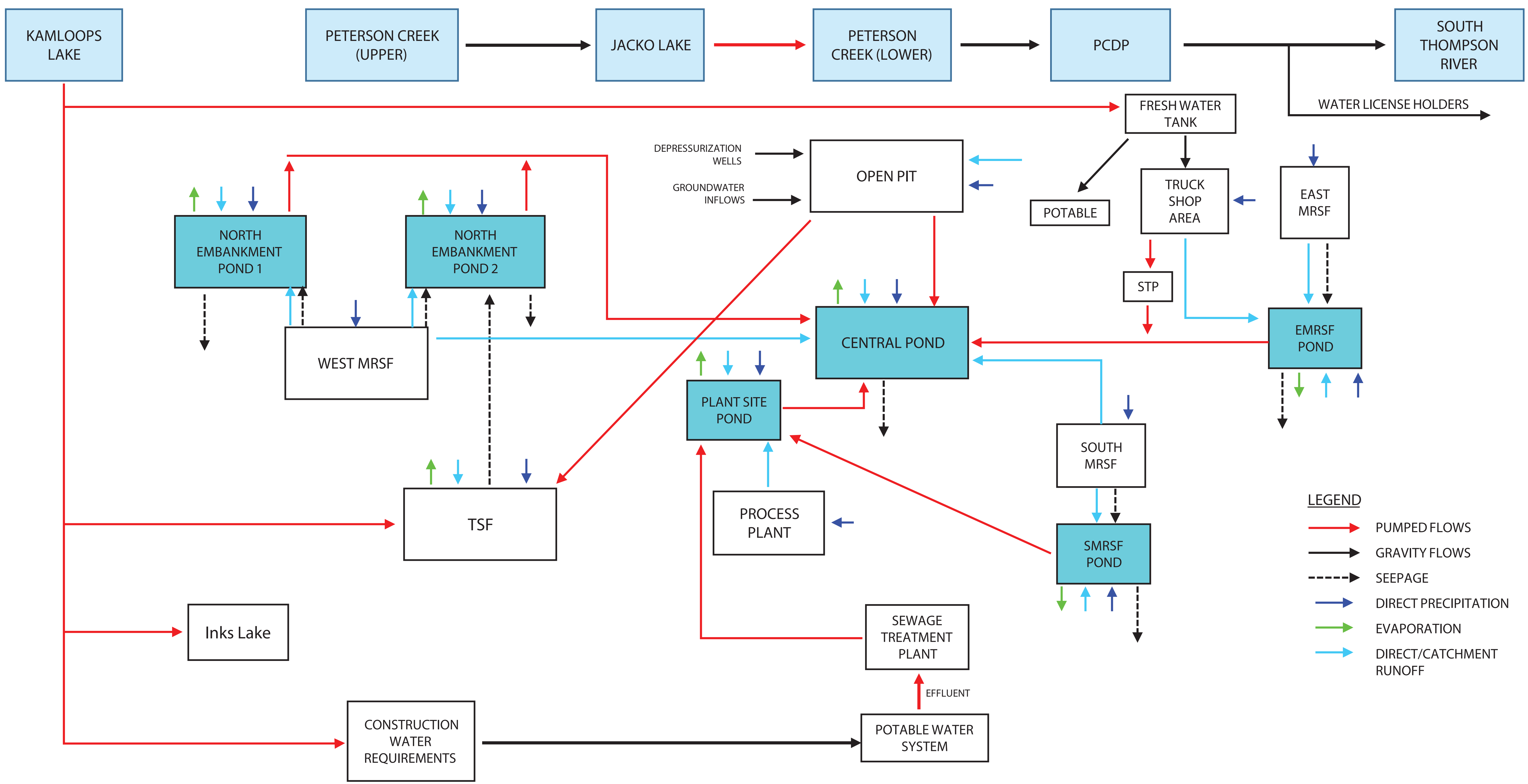
Dam excavation operations would be similar for both options, but the dry removal option would allow operations to be carried out more efficiently due to enhanced access and visibility. Additional information related to the proposed excavation and removal sequence is presented in Norwest (2015a).

<u>Peterson Creek Downstream Pond</u>

The construction plan for the PCDP includes the following steps:

- <u>Temporary Diversion of the Creek</u>: Prior to construction, a temporary sump and diversion pipe system will be installed to divert flow around the construction area. Construction will be scheduled during low flow periods.

Figure 11.7-12
Water Management Strategy Flow Diagram – Construction



- Foundation and Abutment Preparation: The dam foundation will be prepared by clearing and/or excavating unsuitable material down to a competent base. All unsuitable materials whether wet, frozen, rock or otherwise, will be removed or excavated. The dam will be keyed into the abutments a minimum of 2 m into competent intact native material. Additional seepage cutoff requirements will be reviewed during permitting design.
- Basin Preparation: The basin will be prepared by clearing and/or excavating unsuitable material down to a competent base. All unsuitable materials whether wet, frozen, rock or otherwise, will be removed or excavated.
- Dam Construction: Earth fill materials for the dam will be sourced from local glacial till material or pre-stripping of the Open Pit. The thin layer of topsoil and organics over the planned pond area will be stripped and stockpiled prior to construction.
- Spillway Chute: It is currently envisaged that the spillway will be constructed with concrete cloth, engineered fill, riprap and non-woven geotextile.
- Low Level Decant System: Concrete and piping will be used to construct the decant system. The decant system will comprise a screened vertical intake at elevation 863.0 masl attached to a steel pipe that drains to a discharge point approximately 290 m downstream at an outlet elevation of approximately 862.0 masl.

Tailings Storage Facility

The starter North Embankment will be constructed to elevation 971 masl in the 2 years prior to Operation. This embankment will provide capacity for approximately two years of tailings storage and will retain the start-up water pond, which is estimated at approximately 2.1 Mm^3. This volume represents a 3 month mill supply for the thickened tailings option and will be primarily sourced from Kamloops Lake. The ultimate North Embankment is approximately 3,700 m long, has a footprint of 154 ha, and a maximum embankment height of 131 m. This embankment provides tailings containment on the north end of the basin above Jacko Lake and the Open Pit.

Prior to construction of the North Embankment, rock drains will be constructed to convey any seepage flow from the downstream toe to the water management ponds, and relieve any hydrostatic pressures within the embankment and downstream mine rock buttress (Norwest, 2015b). The rock drains are designed with capacity to manage approximately 10 times the estimated steady state seepage flow rate through the dam. The lowest point in the natural watercourse will be used as the center line of each of the drain alignments. The rock drains will be constructed by excavating a channel in the natural topography which will be lined with a base geotextile and filled with drain rock. The drain rock will be covered with a cover geotextile and a minimum of 1 m of select competent, non-reactive mine rock for protection from truck dumped mine rock. The first lift of truck dumped mine rock above the completed drains should be no thicker than 5 m. In order to prevent the intrusion of fines into the rock drain, fabric geotextiles and a granular filter zone will be employed. This design will reduce the risk of the rock drain becoming impeded or blocked and incapable of conveying the design flow.

Inks Lake

Construction of the Inks Lake offsetting habitat consists of five main stages: dewatering, excavation and spoil disposal, riparian bench construction, inlet armouring / outlet channel construction and riparian planting. An additional stage of installing a liner on the lake bottom to prevent seepage losses is not expected.

The first stage in the construction plan consists of dewatering Inks Lake. Water from the lake basin will be pumped to the Project site for construction uses using a temporary pipeline or collected for use on the mine site. Alternatively water will be pumped to Wallender Lake, which is a nearby seasonally dry salt lake basin. The lake bottom sediments will be assessed for potential contamination and for their suitability for use as engineered fill. Any contaminated soils, or any soils that are not suitable for construction purposes, will be excavated and placed in the north basin of Inks Lake. Soils which can be used for reclamation will be excavated and stored in a temporary location.

Once the lake bottom sediments have been stripped, the underlying glacial till material will be excavated and either placed in the north basin or used locally to develop a low lying bench around the lake perimeter to support riparian vegetation. If necessary any bedrock outcrops will be removed to the required elevation using drilling and blasting techniques. Alternatively bedrock will be left in place as a subsurface lake feature provided the minimum depth criteria can be met in other areas of the basin. If seepage is considered an issue, the lake bottom will be lined with compacted glacial till which is assumed to be sourced from the excavated spoils from Inks Lake stockpiled in the north basin or a borrow location approximately 2 km away. Riprap will be placed at the lake inlet and outlet to mitigate erosion and if necessary in select areas around the perimeter of the lake for upland stability. The outlet channel will be constructed between the lake and a tributary to Alkali Creek. Lastly riparian planting will be completed after the lake filling has been completed as a final stage so that edge vegetation that requires seasonal inundation survives.

Dewatering of Inks Lake and materials excavation will be conducted in the first year of Construction. The water supply infrastructure will be completed to allow filling of Inks Lake (~ 450,000 m^3) during the winter between Year -2 and -1. Annual stocking of the lake with rainbow trout will be initiated in the spring of the third year following the onset of construction.

11.7.5 Operation Water Management Plan

11.7.5.1 Overview

The mine layout during Operation is provided in Figure 11.7-13. All water collected, recycled, and used on the Project will require containment or storage in constructed structures. Fresh and contact water will be available in varying quantities from the following sources:

- fresh water via a pipeline from the Kamloops Lake pump station;
- process water from the tailings thickener overflow;
- process water from the concentrate thickener;
- reclaim from the TSF pond;

- contact water from the Open Pit (groundwater inflows and runoff within the pit footprint); and
- contact water collected down gradient of the various MRSFs and Plant Site.

This section starts with a summary of water requirements for the process plant. The remaining sections provide a water management strategy (WMS) for the various facilities at the mine site during Operation.

11.7.5.2 Water Requirements

A majority of water use by the Project will occur within the process plant.

Process Plant

An average mill throughput of 65,000 t/d is planned for the mine over a period of 23 years. The ore will be processed at the mill with the resultant thickened tailings pumped to the TSF. The mill process is being designed by Fluor (2015). Water use at the process plant is summarized in Table 11.7-12.

Table 11.7-12. Process Plant Water Requirements

Process Plant Inflows	
Ore initial water content	4.5% (by weight) 123 m^3/h
Total process requirement	1,809 m^3/h
Process Plant Outflows	
Tailings slurry % solids (by weight)	60%
Tailings slurry water	1,806 m^3/h
Ore concentrate	3 m^3/h

Within the process, fresh (non-contact) water will be required for reagent preparation, gland seals and wash water. Recycled water (contact water) will be used to partially make up the water consumed in process (e.g., evaporative losses on the tailings beach and void losses within the tailings deposits). However, because this site is in water deficit, contact water is not expected to make up the entire volume consumed in process. The remaining deficit will be made up through fresh water supply from Kamloops Lake.

An emergency tailings discharge pond is located on the east side of the Plant Site. This pond will have sufficient volume to contain: the volume of the thickener vessel, the thickener feed lines, and the tailings line plus a 10% safety factor.

Fresh Water Requirements

Per Fluor (2015), apart from make-up water for process, additional fresh water is required for:

- drilling (1.5 m^3/h);

- explosives mixing (0.4 m^3/h);
- dust control (peak demand of 204 m^3/h);
- the truck shop (12.5 m^3/h); and
- potable water (3.6 m^3/h).

Potable water (for personal consumption, showers, washrooms, laundry facilities and janitorial servcies) will be used at two separate locations: the truck shop and the Plant Site. Before use, all potable water will be treated at an on-site treatment plant. Potable water losses are estimated at 0.7 m^3/h with the remainder being sent to one of two STPs. Effluent from the STP at the truck shop will be pumped to the Central Pond in the EMRSF Pond pipeline. Effluent from the Plant Site STP will be pumped to the Plant Site Pond (Figure 11.7-13). Sewage sludge generated from the STPs will be transported offsite for disposal at a licensed facility.

Inks Lake

Inks Lake will have a fresh water requirement of 23 m^3/h from Kamloops Lake between April and October to maintain water quality throughout the Operation period.

Design Water Use

The make-up demand from Kamloops Lake has been designed for a maximum flow of 1505 m^3/h. This demand is based on 92% availability of the mill, reduced reclaim rates during the initial years of mine production as the supernatant pond and beaches develop, and a peak demand of 204 m^3/h for water trucks (i.e., dust control) in the summer. Actual average water use over the LOM is expected to be significantly lower and also vary seasonally. Based on a tailings settled dry density of 1.45 t/m^3 at the end of Operation, the average make-up water requirement from Kamloops Lake is estimated at 901 m^3/h (see Appendix 6.4-C).

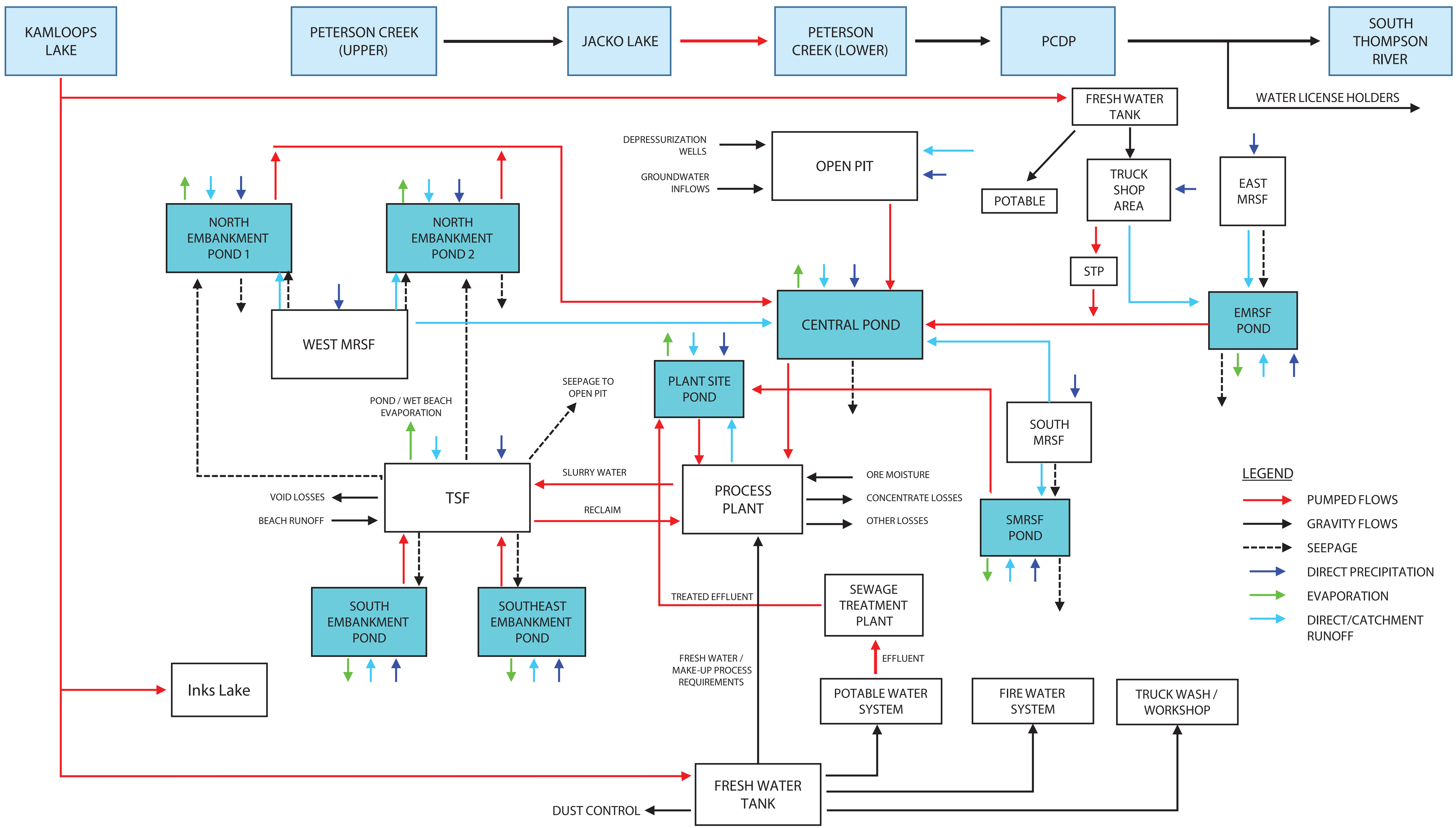
11.7.5.3 Water Management Strategy

The WMP for the Project during Operation is outlined below and illustrated on Figure 11.7-13. Water management activities include the following:

- Maintenance and operation of the Peterson Creek diversion (PCDS and PCDP).
- Runoff to the Plant Site Pond will be pumped directly to the process water tank.
- Contact water from the Open Pit, MRSF's, embankments and ore stockpiles will be collected at the various water management ponds around the mine site and used in process.
- A majority of the process water requirements will be met by TSF reclaim.
- The fresh water supply pipeline from Kamloops Lake will provide make-up water for process, as well as the other potable and industrial uses.

Additional water management activities are discussed below.

Figure 11.7-13
Water Management Strategy Flow Diagram – Operation



Mine Rock Storage Facilities

Water management activities related to the MRSFs include:

- Runoff to North Embankment Pond 1 and Pond 2 and EMRSF Pond will be routed to the Central Pond. Runoff to the SMRSF Pond will be routed to the Plant Site Pond. Water levels in these ponds will be kept to the minimum operating level at all times to provide sufficient storage for the design event (200-year, 24-hour rainfall).
- Water used in the truck shop will be collected and reused in the shop to the extent possible, with excess runoff reporting to the EMRSF pond.

Water pumped to and captured in the Central Pond will be directed to process.

Tailings Storage Facility

Staged expansion of the TSF embankments will be on-going throughout the Operation phase to maintain TSF storage and freeboard requirements. All runoff from undisturbed areas within the TSF catchment will be directed to and collected in the TSF pond. Tailings supernatant water will be reclaimed and pumped back to the mill via the water reclaim pipeline. Fresh water will be pumped from Kamloops Lake to the process plant to provide make-up water for the process. The fresh water volume required for process will be adjusted depending on the availability of reclaim water from the TSF.

Embankment seepage and runoff collected in the South and Southeast Embankment ponds will be pumped back to the TSF during Operation. Construction of the South and Southeast Embankments is not scheduled until Year 7 and Year 11 of Operation, respectively.

Seepage from the TSF is expected to vary between about 40 m^3/h and 210 m^3/h over the LOM (BGC 2015c). About 60% of that seepage is predicted to evaporate without discharge to a water course with a majority of the remaining seepage predicted to report to the Open Pit. Additional small quantities (<1%) are predicted to report to the embankment ponds.

Open Pit

A conventional truck and shovel fleet will be used to mine the Open Pit. Mining will proceed on 15 m wide benches. Horizontal drains are proposed as the primary means to depressurize potential bench scale wedge and planar failures. The longest span of the pit is approximately 2.5 km in the east-west direction and approximately 1.4 km in the north-south direction. The highest crest elevation of the ultimate pit is 987 masl and the pit bottom elevation is approximately 410 masl prior to mine rock backfill.

Precipitation, seepage from pitwalls, and horizontal drains will introduce water into the pit. Some of this water will be absorbed by the broken rock and hauled with the rock out of the pit. Ditches will be used to route the remaining water to sumps where the solids can settle out, and the water can be pumped to the Central Pond. A large collection system of ditches, pipes, sumps, pumps, and booster pumps will contain this water. The pit dewatering system is designed to handle a two-year return period rain storm. Rain events in excess of this will cause the lower areas of the pit to flood.

Predicted groundwater inflow to the open pit will contribute an average of 55 m^3/h over the LOM (BGC 2015c).

The pit drainage and dewatering system will perform the following tasks:

- help to maintain pit wall stability via horizontal depressurization holes;
- drain water and prevent water pressures from building up behind the pit walls;
- control surface water and runoff that enters the pit;
- capture precipitation and drain it away from road running surfaces and active mining areas; and
- remove surface water that is collected in sumps.

The water that flows into the pit bottom will be routed to small temporary sumps created as part of normal mining practices. The sumps will allow for some settling of solids before lower-head submersible pumps pick up the collected water and discharge it into the gravity ditches or the permanent pump-stations. When the excavation proceeds, precipitation runoff and horizontal drain flow will be collected in ditches constructed along all haul roads and on selected benches of the pit excavation and lined as required.

Sumps and pumps at appropriate locations and elevations will remove the water. The primary pumps will take water from those sumps in the rock and lift the water about 150 m. Booster pumps will be added as required by the increasing depth of the excavation. Each booster pump lifts the water by about 150 m. Three booster pumps in series will be required to drain the deepest excavation. The primary and booster pumps will be independent, self-contained units relocated quickly by mine operations as required by changing conditions. Power will be run to pumps at 600V.

Horizontal drains are proposed as the primary means to depressurize potential bench scale wedge and planar failures, requiring that the slopes be depressurized to a distance of between 50 and 75 m behind the bench face. To prevent water pressure from building up immediately behind pit walls, 140 mm diameter horizontal drain holes will be installed every 100 m, on every second double bench stack. These holes will be an average of 150 m long. The holes will be drilled into the bench at an upward inclined angle to promote drainage.

Inks Lake

Once Inks Lake is refilled, the water quality conditions should be acceptable to support rainbow trout; this suitability will be confirmed by monitoring. The pumped inflow rate of 23 m^3/h from Kamloops Lake between April and October is expected to maintain water quality in Inks Lake throughout the Operation phase. Inks Lake will be stocked annually in the spring with Fraser Valley, Pennask, or other local hatchery strains of rainbow trout.

11.7.6 Decommissioning and Closure Water Management Plan

11.7.6.1 Overview

The primary objective of the reclamation and closure initiatives will be to transform the mine site into an integrated component of the surrounding ecosystem. Water management activities during this phase include:

- Culverts and water crossings will be removed and natural drainages restored.
- Re-establishing Peterson Creek to the natural Peterson Creek route. The PCDS will be maintained and operated during the re-establishment of Peterson Creek to maintain downstream flows from Jacko Lake. The PCDP will be retained at Closure with no structural changes intended.
- Modifications will be made to the Southeast Dam (JLD1) to reduce a portion of the dam from the operational crest elevation to 892.0 masl forming a broad-crested overflow weir. Excess flows over the 892.0 masl normal water level will pass into Peterson Creek, similar to pre-mining conditions.
- Pipelines (such as tailings, contact water and STP) will be purged, dismantled and disposed in an approved facility.
- Pumping all water in the TSF pond at the end of Operation to the Open Pit to initiate pit filling and allow for reclamation of the TSF.
- Site grading and reclamation of the TSF, along with construction of a spillway, to allow for surface runoff to be diverted to the Humphrey Creek drainage.
- Decommissioning of the Central Pond, although a pond feature may still be maintained as part of the Post Closure landscape.
- Site grading and reclamation of the MRSFs.
- Continued operation of the Kamloops Lake fresh water pipeline to provide a clean source of water for closure activities. The fresh water will be required for dust control and demolition of the site infrastructure. This pipeline will be decommissioned toward the end of the Decommissioning and Closure period.
- Routing contact runoff during the infrastructure removal and reclamation phase to the Open Pit.
- Reclamation of the MSRFs and continued operation of their associated water management ponds until water quality objectives are met.
- Introduction of a passive water supply system to Inks lake.
- Ongoing water quantity and quality monitoring.

The water management strategy flow diagram for Decommissioning and Closure is illustrated on Figure 11.7-14.

11.7.6.2 Water Management Strategy

Water Management Ponds

The EMRSF Pond, SMRSF Pond, and North Embankment Ponds 1 and 2 will all be retained during Decommissioning and Closure and Post Closure. The intent of these structures is act as evaporation ponds during the Post Closure period, and thus minimize surface runoff to Peterson Creek (Lower) to the extent possible. However, modifications to the embankments will be required during Decommissioning and Closure. Under the British Columbia Dam Safety Regulation (http://www.bclaws.ca/Recon/document/ID/freeside/10_44_2000#section1), a dam is defined as:

1. a dam 1 m or more in height that is capable of impounding a volume of water greater than 1,000,000 m^3;
2. a dam 2.5 m or more in height that is capable of impounding a volume of water greater than 30,000 m^3;
3. a dam 7.5 m or more in height; or
4. a dam that does not meet the criteria under paragraph (a), (b) or (c) but has a classification of significant, high, very high or extreme.

Thus, all the embankments will be reconfigured such that the dam heights are less than 2.5 m or the impounded volume is less than 30,000 m^3. Spillways sized for the Q_{i200} will be retained as part of this reconstruction. Reconfiguration of the embankments will not occur until water quality objectives are met for surface discharge from the facilities. Until such objectives are met, any water reporting to these ponds will be pumped to the Open Pit for long-term storage.

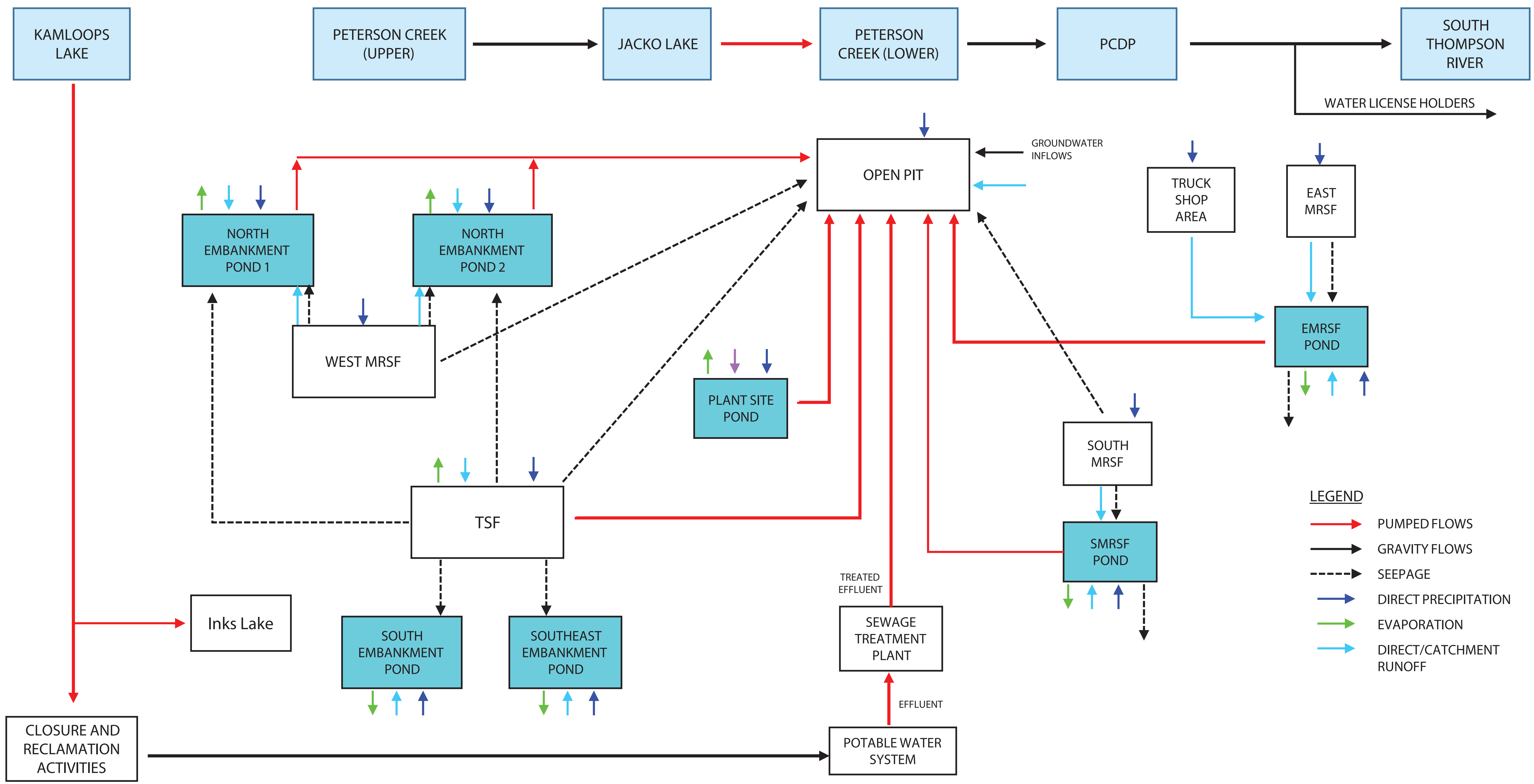
Progressive reclamation of the lower slopes of the MRSFs will be undertaken during Operation as sufficient area becomes available. The MRSFS have the following maximum surface areas:

- SMRSF = 254 ha;
- EMRSF = 101 ha; and
- WMRSF = 239 ha.

Actual surface areas are expected to be less because of use of mine rock for TSF reclamation and reduction of the overburden / soil stockpiles on the EMRSF during the Decommissioning and Closure phase. The proposed cover for the mine rock includes a 0.6 m thick layer of till followed by approximately 0.35 m of topsoil. Unsaturated flow modelling indicates that infiltration is minimized for such a cover (Appendix 6.4-C). The topsoil will be loosely placed to prevent compaction and allow for better seed and moisture retention. The MRSFs will be seeded with a dry land mix of agronomic and native species.

For the South and Southeast Embankment Ponds, runoff will no longer be collected and pumped back to the TSF. Water balance calculations indicate that small ponds will develop against the embankments where inflows into the ponds are balanced against evaporation losses from the pond surface (BGC 2015b, Appendix 6.4-C).

Figure 11.7-14
Water Management Strategy Flow Diagram – Decommissioning and Closure



Ore Stockpiles

The ore stockpiles will be developed on the former Afton Mine mine rock dump that will be levelled using NPAG mine rock to create an area for storing low to medium grade ore for processing near the end of mine life. During Decommissioning and Closure, the ore stockpile pad will be reclaimed by placing and contouring a 0.5 m layer of overburden followed by a 0.35 m layer of topsoil. Sampling of the stockpile footprint will be carried out to ensure that ore material has been removed prior to reclamation.

Jacko Lake and Peterson Creek Diversion

Jacko Lake

The dams on Jacko Lake will be left in place at closure (Norwest 2015a). The normal lake level will remain at an elevation of 892.0 masl. Slopes will be progressively reclaimed during the operational period so as to minimize long term erosion. No major structural changes will be made to the West and Northeast Dams (JLD3 and JLD2). Modifications will be made to the Southeast Dam (JLD1) to reduce a portion of the dam from the operational crest elevation to 892.0 masl forming a broad-crested overflow weir. Excess flows over the 892.0 m normal water level will pass into Peterson Creek, similar to pre-mining conditions. A low level decant system will be established to enable flow control capability. This feature is provided to enable flow control at Jacko Lake for the British Columbia Water Steward.

Dams will be visually inspected by a qualified geotechnical person on a regular basis according to provincial requirements, to monitor for any uncontrolled seepage exiting on downstream areas and to check the overall performance and stability of the structure and its related facilities. An operation, maintenance and surveillance (OMS) manual will be developed by KAM, which will detail long-term monitoring and record-keeping procedures for the structure.

Re-establishment of Peterson Creek Channel

Flow over the Southeast Dam (JLD1) weir and from the decant system will discharge into a closure channel, constructed to re-establish the existing Peterson Creek (Lower) channel (Norwest 2015a). The closure channel will tie in to Peterson Creek (Lower) downstream of the Central Pond and its alignment will be positioned in accordance with appropriate pit offset guidelines as determined by geotechnical design during further studies. The overflow weir and closure channel will be designed to accommodate the closure design flood criteria for Jacko Lake. Adjustments to the operational emergency spillway will be made as necessary to accommodate the closure arrangement.

The Central Pond, through which the restored channel will be established, will be removed entirely to accommodate the channel and reclaimed potentially as forest and grassland or alternatively as wetland.

Peterson Creek Downstream Pond

The current plan is to retain the PCDP at closure, with no structural changes intended. The pond will remain in order to provide the province-appointed water bailiff with a captured water source and flow control capability. Primary inflows to the pond will include flow from the re-established upstream portion of Peterson Creek (Lower), along with flow from Humphrey's Creek.

The dam will be visually inspected by a qualified geotechnical person on a regular basis, to monitor for any uncontrolled seepage exiting downstream areas and to check the overall performance and stability of the structure and its related facilities. Periodic checks will be needed to establish if the pond liner is functioning as intended. This may include drawing down the pond using pumps to visually inspect the liner. An OMS manual will be developed by KAM, which will detail long term monitoring and record-keeping procedures for the structure.

Peterson Creek Diversion System

The PCDS will be decommissioned following the re-establishment of Peterson Creek (Upper) between Jacko Lake and the PCDP.

Tailings Storage Facility

At closure, the TSF surface will comprise an area of approximately 600 ha (including the embankments) built of NPAG rock that will be progressively reclaimed during Operation. Analyses of tailings samples indicate that the tailings will be NPAG and will not require special placement constraints to maintain pH-neutral drainage (Appendix 3-A). The TSF surface will be reclaimed with a cover system designed to store and release water, limit infiltration to underlying tailings and provide a medium for establishing sustainable vegetation cover consistent with the final land use. There will be no ultimate closure pond and excess water will shed to Humphrey Creek via a constructed spillway channel.

At the end of mining, the TSF supernatant pond will be located at the southeast corner of the facility. In the Decommissioning and Closure phase, all water in the TSF will be pumped to the Open Pit. Mine rock will be hauled from the SMRSF and deposited on the TSF surface to accelerate tailings compaction and to provide a trafficable surface for reclamation equipment. A layer of mine rock at least 1 m thick will be installed in the tailings beach areas, with greater thicknesses possible in the pond area. Tailings pore water produced from compaction of the tailings will be pumped to the Open Pit on an ongoing basis during Decommissioning and Closure.

There will be no ultimate closure pond and excess water will shed via a channel connecting the TSF to Humphrey Creek (assumed in the Post Closure phase); in the interim, flow will be pumped to the Open Pit. Water collecting in the North Embankment ponds will be pumped directly to the Open Pit. In the Post Closure phase, these ponds are expected to operate as evaporation ponds with excess flow released to the environment.

The TSF cover system includes a low-permeability layer and overlying growth medium layer including:

- a compacted till (silty clay) layer approximately 0.25 m thick;
- a non-compacted overburden layer approximately 0.25 m thick; and
- a topsoil layer approximately 0.35 m thick.

The TSF surface is mostly targeted for grassland; however, trees and shrubs will be planted in areas having suitable characteristics, such as the toe of the WMRSF and swales where wetter conditions are expected. The TSF embankments will be progressively reclaimed during Operation. This will provide opportunities to test the cover design and re-vegetation prescriptions. Trees will not be planted on TSF embankments to protect the integrity of the structure.

Open Pit

The Open Pit will be allowed to fill passively following the end of operations. Inflows will include groundwater inflows, precipitation within the pit footprint, and runoff from the up gradient catchment. The pit will also receive the TSF supernatant pond water remaining at the end of mining, as well as contact water from the TSF and the MRSF ponds while these facilities are being reclaimed. It is expected that runoff from these facilities will be suitable for discharge to the environment following their reclamation. However, runoff reporting to the water management ponds will continue to be pumped to the Open Pit until water quality objectives are met.

Inks Lake

At the end of Operation, a passive water supply system will be introduced to Inks Lake. A potential water supply option is to divert water to Inks Lake through a valve controlled gravity fed water pipeline from the northwest arm of Jacko Lake. It may be possible to apply and receive a water allocation to satisfy the required inflow and outflow rates through an agreement to acquire a portion of the water allocation from Jacko Lake currently held by FLRNO (Licence No. C132063). Preliminary discussions have indicated this may be possible; however, additional discussions will be necessary once required flow rates have been refined. Other potential options include diversions of upper Alkali Creek to Inks Lake. Feasibility assessment of a passive water supply to Inks Lake will require:

- discussions with FLNRO regarding a water license allocation from Jacko Lake and whether the minimum Inks Lake inflow requirements could be met while satisfying existing allocations;
- topographic assessment of potential channel alignment from Jacko Lake to Inks Lake for inflows and channel alignment from Inks Lake to Alkali Creek for outflows; and
- channel stability assessment for Alkali Creek to confirm capacity for additional flow from Inks Lake.

11.7.7 Post Closure Water Management Plan

For the Post Closure period, the WMP assumes the following:

- the Peterson Creek closure channel is in place and functional;
- the PCDS has been decommissioned;
- the Southeast Dam (JLD1) has been modified such that it functions in a similar fashion to the existing Jacko Lake Dam (overflow spillway and low-level outlet);
- the PCDP will be retained in perpetuity;
- reclamation of the TSF is complete with surface flows discharging into Humphrey Creek;
- reclamation of the MRSFs is complete and surface runoff from these facilities is suitable for release to the environment;

  - the modified downstream ponds associated with the EMRSF, SMRSF and North Embankment will be retained in perpetuity;
- the passive water supply system for Inks Lake is operational and pumping from Kamloops Lake has been discontinued;
- the Open Pit will continue to fill passively. Water balance simulations indicate that after about 300 years the pit lake reaches a static elevation of about 760 masl, which is still 124 m below the low point of the pit perimeter of 884 masl (Appendix 6.4-C, BGC 2015b). Pit lake water will therefore never discharge to the environment.

The TSF pond water has a major influence on the physical stratification of the lake and water chemistry in the lower portion of the lake (Appendix 3-I). After 200 years, the pit lake is predicted to comprise an upper 130 m-thick layer of mixed, more oxygenated, less dense and cooler water separated from an underlying anoxic zone (hypoliminion) with virtually no seasonal variability. The development of anoxic conditions in the lower water column is beneficial for water quality as it is a factor contributing toward the formation of a permanent sink for metals in sediments that form in the base of the pit lake.

The pH of the pit lake is predicted to remain neutral to slightly alkaline; however, the water quality model indicates concentration increases over the simulated 200 year period due to lake evaporation, pit wall run-off and seepage from the TSF. The water quality model indicates exceedance of the BC water quality guidelines for wildlife for molybdenum, selenium and arsenic (Appendix 3-I). The pit lake model potentially over-estimates water quality as it does not account for attenuation mechanisms common in natural lakes that have a high rate of biological activity. Biological productivity can be enhanced by organic additions and fertilization and potentially reduce metal concentrations in surface waters.

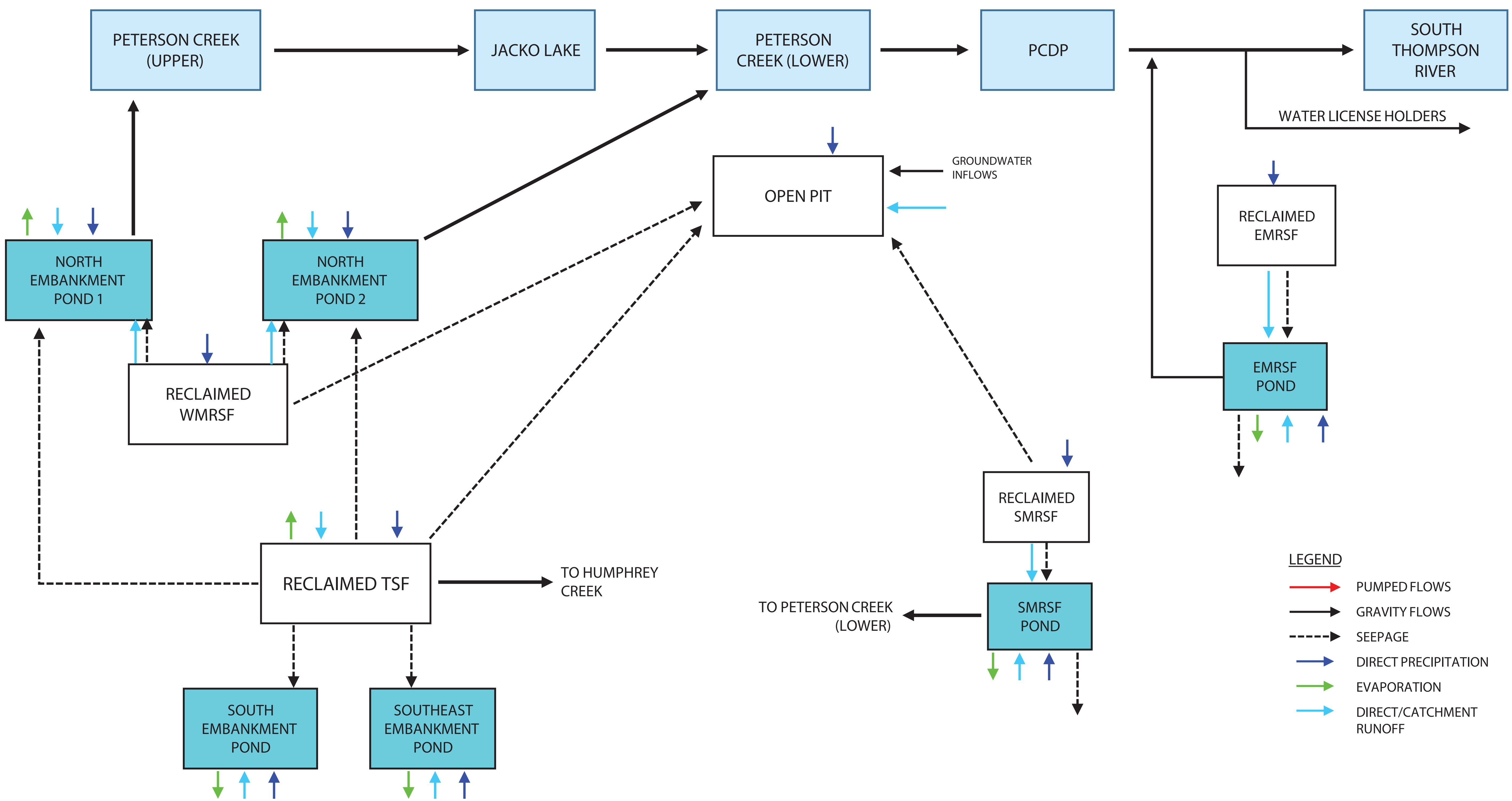
The water management strategy flow diagram for Post Closure is illustrated on Figure 11.7-15.

11.7.8 Hydrometric Monitoring

A climate station will be maintained on-site through Construction, Operation, and Decommissioning and Closure. Surface water flow monitoring will be implemented during all Project phases, as summarized below.

11.7.8.1 Prior to Construction

Prior to Construction, surface water flow monitoring will be continued at the locations and frequency used to collect the baseline.


PETERSON CREEK (UPPER)
JACKO LAKE
PETERSON CREEK (LOWER)
PCDP
SOUTH THOMPSON RIVER
WATER LICENSE HOLDERS
OPEN PIT
GROUNDWATER INFLOWS
NORTH EMBANKMENT POND 1
NORTH EMBANKMENT POND 2
RECLAIMED WMRSF
RECLAIMED EMRSF
EMRSF POND
RECLAIMED SMRSF
SMRSF POND
TO PETERSON CREEK (LOWER)
RECLAIMED TSF
TO HUMPHREY CREEK
SOUTH EMBANKMENT POND
SOUTHEAST EMBANKMENT POND
LEGEND
PUMPED FLOWS
GRAVITY FLOWS
SEEPAGE
DIRECT PRECIPITATION
EVAPORATION
DIRECT/CATCHMENT RUNOFF

11.7.8.2 Construction

During Construction, flow meters will be installed on all the pipelines that will route contact water around the site. These will include:

- the pipeline discharging to the Central Pond from the North Embankment ponds;
- the pipeline discharging to the Plant Site Pond from the SMRSF Pond;
- the pipeline discharging to the Central Pond from the EMRSF Pond;
- the pipeline discharging to the Central Pond from the Open Pit; and
- the tailings pipeline out to the TSF.

Flow meters will also be installed on the fresh water supply pipeline from Kamloops Lake and on the Peterson Creek diversion pipeline.

Continuous flow monitoring (i.e., hydrometric stations) will be installed or continued at the following locations:

- JACINF (the existing gauge located on Peterson Creek (Upper) above Jacko Lake);
- Jacko Lake;
- the PCDP; and
- the flow measurement weir downstream of the PCDP spillway and low-level outlet.

The surface water monitoring program includes continuous measurements of water levels at these stations, along with repeated manual flow measurements throughout the year at JACINF and downstream of the PCDP to capture a range of flow conditions. Pressure transducers will be continuously deployed to monitor water levels at each station, even during winter months.

11.7.8.3 Operation

The surface flow monitoring proposed for the Construction phase will be continued in Operation. Additional flow meters to be installed for this phase will include recording flows pumped from the Central Pond to the process plant and the TSF reclaim pipeline.

11.7.8.4 Decommissioning and Closure

During this phase, the four hydrometric stations will continue to be operated. Flows pumped to the Open Pit from the various water management ponds and the TSF will also be monitored with flow meters. Flow meters will continue to operate on the fresh water supply pipeline from Kamloops Lake and on the Peterson Creek diversion pipeline (until the Peterson Creek closure channel is operational).

Water levels in the Open Pit will be monitored on an annual basis through the Decommissioning and Closure phases.

11.7.8.5 Post Closure

If required, the four hydrometric stations will be retained by the appropriate regulatory authorities and operated during Post Closure. A new station may also be installed along the Peterson Creek closure channel to document flow releases from Jacko Lake. All of the contact and fresh water pipelines will have been purged, dismantled and disposed of during Decommissioning and Closure. As a result, no flow meters on pipelines are currently envisioned for the Post Closure period, unless warranted due to water quality issues with the water management ponds.

11.7.9 Reporting and Recording

11.7.9.1 Reporting

Compliance Reporting

The Mine's Environmental Manager will ultimately be responsible for reporting on observations and monitoring results (Table 11.7-13). Reporting of hydrologic data will be conducted in accordance with regulatory requirements. It is anticipated that much of this information will be kept internal, available for submission or inspection upon request. Key data will be required to be included within formal annual reports required by BC Ministry of Energy and Mines (MEM) and Ministry of Environment (MOE).

Table 11.7-13. Water Management Reporting, Frequency and Responsibilities

Report Type	Frequency	Reporting Responsibilities	Submitted to
Site inspection and maintenance logs	After each inspection	Environmental Technician	Environmental Manager
Water management materials inventories	After each inventory	Environmental Technician	Environmental Manager
Annual report	Annually	Environmental Manager	Mine Manager, MEM & MOE
Environmental incident report	As soon as possible after occurrence	Initial notification by attending manager	Mine Manager & Environmental Manager

External/Internal Reporting

Water management records will be maintained during all Project phases to the end of Closure, including a description of surface water flow paths in relation to each major infrastructure footprint, existing surface water management/treatment measures and assessment of their performance, repairs or mitigation activities undertaken, and a log of dated photographs. The reports will be kept in the Project office or another designated area. Examples of additional records kept include:

- maintenance and monitoring records;
- inspection records; and
- corrective action records.

A log of site inspections, recording the date and pertinent observations, will be established. At a minimum the form will include the work site, time, date, weather conditions, current site activity, list of applicable water management practices or structures, and a date-stamped photo.

Incident Reporting

A report will be prepared for environmental incidents related to the WMP that occur within the Project area. Reports will be forwarded to relevant government agencies as required by regulations and licences. All reports will be reviewed internally by the Mine's Environmental Manager in order to identify necessary improvements in water management procedures.

11.7.9.2 Record Keeping / Tracking

Monitoring Results

Water flow monitoring is on-going at the site and will occur at frequencies and locations summarized in Section 11.7-8.

Continuous Improvement, Follow-up, and Adaptive Management

The purpose of the site monitoring and follow-up program is to evaluate and document if the WMP is successfully avoiding and minimizing potential adverse flow related effects to the environment. Specifically, monitoring will be used in part to verify the accuracy of the predictions of the EA and determine the effectiveness of mitigation measures designed to reduce environmental effects, thus informing management if prescribed actions are meeting objectives. If adverse findings are evident from the monitoring a particular area or process, adaptive management policies will be implemented. All monitoring components will be evaluated regularly to assess if changes to the schedule, frequency or component continue to be required or adaptively changed.

Incident Response Records

A record of all incident responses will be maintained and reviewed internally by the Mine's Environmental Manager in order to identify necessary improvements in WMP procedures.

Data Reporting

Reporting of surface flow monitoring data will be conducted in accordance with regulatory requirements.

11.8 CONTAMINATED SITE MANAGEMENT PLAN

11.8.1 Purpose

The purpose of the Contaminated Site Management Plan (MP) is to manage protection of the surrounding environment and long-term impacts of soil, surface water and groundwater contamination through the effective identification, assessment and remediation of land and water contamination, if required. A 'contaminated site' in British Columbia is defined as an area of land in which the soil or underlying groundwater or sediment contains a hazardous waste or substance in an amount or concentration that exceeds provincial environmental quality standards. A site is contaminated if it is unsuitable for specific uses of land, water and sediment. Contamination at the Ajax Project may be the result of either: 1. historical mining activities or 2: activities over the life of the proposed Ajax Project.

KAM is providing with this Application/EIS an Emergency Response Plan (11.14), various waste management plans (11.04, 11.09, 11.10) and a Spill Contingency Plan (11.16) to mitigate risk and reduce the risk of causing a contaminated site, however, if a potential contaminated site is created during Project life, the framework provided below would be applied.

11.8.2 Framework to Identify and Remediate Contaminated Sites

If KAM identifies "Contamination" through the course of Construction, Operations, Decommissioning and Closure or Post-Closure phases of the Project not otherwise addressed through adaptive management, they will be managed according to industry good practice and in accordance with BC's Contaminated Sites Regulation (BC Reg. 375/96). The following outlines the components of this management approach.

11.8.2.1 Qualifications

Section 63 of the Contaminated Sites Regulation (BC Reg. 375/96) provides general requirements for documentation of professional qualifications in the context of an application for approval of a preliminary site investigation. In accordance with the Regulation, KAM will submit to the Ministry a written signed statement certifying that the person signing the statements to the Ministry (i.e., results of Preliminary and or Detailed Site investigation, and remedial action plans) has demonstrable experience in remediation (which includes investigation) of the type of contamination at the site for which the statement applies (BC MOE 2009a).

11.8.2.2 Criteria

The Contaminated Sites Regulation (BC Reg. 375/96) provides numerical and risk-based standards to determine when cleanup is needed and satisfactorily completed. KAM will follow the risk-based standards of the Contaminated Sites Regulation (BC Reg. 375/96). The numerical criteria appear in Schedules 4, 5, and 10 for soil, 6 and 10 for water, 9 for sediments and 11 for vapours. They also include site-specific and Director's interim standards. A site is contaminated if substances in the soil, water, sediment or vapour at the site exceed the numerical standards (BC MOE 2009b).

11.8.2.3 Site Contamination Characterization

Stage 1 – Preliminary Site Investigation

The first stage of site contamination characterization is to identify Areas of Potential Environmental Concerns (APECs). The Project shall conduct a detailed review of all available information to determine the APECs.

In accordance with the *Environmental Management Act* (2003) and Contaminated Sites Regulation (BC Reg. 375/96), KAM will also prepare a Schedule 1 Site Profile form, which will include the identification of potentially contaminated site(s). The summary is created from readily available information about a site, including a basic description and its past and present uses. A completed site profile is submitted to the local land use office and may be passed along to the BC Ministry of Environment. Under the contaminated sites legislation, the ministry's Director of Waste Management can order a site investigation, prompted by a site profile or other information received (BC MOE 2009a).

Stage 2 – Site Investigation

After identifying any APECs, KAM will initiate an appropriate sampling program, which includes collection of representative samples using industry standard sampling techniques (BC MOE 2003) and quality assurance and quality control measures. Sample analysis will be conducted by Accredited Laboratory (BC MOE 2010a).

After the successful completion of the sampling program, the analytical results shall be compared to the Contaminated Sites Regulation standards (BC Reg. 375/96).

11.8.2.4 Notification of Offsite Migration

If, during investigation or independent remediation, it is determined that one or more substances have migrated (or are likely to have migrated) to a neighbouring property and are causing (or are likely to cause) contamination of that property, KAM shall notify the neighbouring property owner and the Ministry within 15 days of becoming aware of the situation (BC MOE 2010b).

11.8.2.5 Remedial Action Plans

In the event that the results of the investigation indicate the presence of contamination, KAM shall develop a Remedial Action Plan to address the identified concerns. The Remedial Action Plan shall include details on the required monitoring, work schedule and both internal and external reporting (BC MOE 2009c).

11.8.2.6 Soil Relocation

In the event the Remedial Action Plan determines that contaminated soil removal offers the best option, the soil relocation must not result in unacceptable impacts. Where soils are to be relocated, KAM shall use a Contaminated Soil Relocation Agreement (CSRA). A CSRA is an agreement between the owner of a source site, the owner or operator of a receiving site, and the Director of

Waste Management, authorizing the relocation of soils from a contaminated site to a suitable deposit site (BC MOE 2009a). KAM has proposed the construction of an onsite landfarm where contaminated soil may instead be remediated.

11.8.2.7 Monitoring

Monitoring for Offsite Migration

If contamination is identified during site investigation activities, monitoring will be established as part of the Project's groundwater monitoring network. The groundwater monitoring program is established as part of the Groundwater Quality Management and Monitoring Plan (see Section 11.3).

Remedial Action Plan Monitoring

Where site investigation has determined a remedial action is required, KAM will include in these monitoring activities to check on the progress of remediation and confirm the effective clean-up of the area. Remedial Action Plan monitoring shall include:

- strategies (e.g., stakeholders, consultation, and employment activities);
- inspections of works;
- care and maintenance of works;
- internal and external reporting requirements; and
- audits.

Post-remedial Monitoring

KAM will select post-remediation monitoring locations to include locations that will intercept each of the zones most likely to contain the highest concentrations of contaminants.

Locations that KAM remediates in order to meet numerical remediation standards, post-clean-up sampling and analyses shall be conducted to ensure that the contaminants have been removed and that the residual soil, water, and sediment meet the applicable standards.

11.8.2.8 Reporting

Internal reporting on the progress towards the implementation of this management plan and remedial action plans (if applicable) shall be reported monthly to senior management and included in the annual management review, as described in Section 11.1.3.

Throughout the contaminated site assessment and remedial activities, there are a number of external notifications that may be required based on triggers listed in Table 11.8-1. Table 11.8-1 below summarizes the various types of notifications that may be required during site investigation and remediation (BC MOE 2009a).

Table 11.8-1. Summary Table

Report Type	Report Trigger	Report Submitted to: Provincial Regulatory Agency	Report Submitted to: Federal Regulatory Agency
Site Profile	A site profile is usually necessary when a local government receives an application for subdivision, zoning, development, demolition of a structure or soil removal (at specific types of former commercial or industrial operations), or when a Director of Waste Management orders one.	BC Ministry of Environment through local government	
Notification of Independent Remediation	Independent remediation carried out without the involvement of the Ministry but in accordance with the Contaminated Site Regulation only requires Ministry Notification at the start and complementation of the remedial activities.	BC Ministry of Environment	
Approval of a Remediation Plan	A person may request an Approval in Principle of a remediation plan or a Voluntary Remediation Agreement to obtain ministry approval of the conditions required to address contamination.	BC Ministry of Environment	
Notification of Offsite Migration	The neighbouring property owner and ministry must be notified within 15 days of the responsible person becoming aware that on site contamination is causing (or is likely to cause) contamination of that property.	BC Ministry of Environment	
Contaminated Soil Relocation Agreement	A CSRA is required when soil that exceeds the “trigger values” set out in Schedule 7, 10, or 11 of the Contaminated Sites Regulation is proposed for transport to a receiving site that is not permitted under the Act to take the soil.	BC Ministry of Environment	

11.9 SOLID WASTE MANAGEMENT PLAN

11.9.1 Purpose

The purpose of the Solid Waste Management Plan is to facilitate the effective management of solid non-hazardous wastes generated from the Project during operations and closure. Waste management during the construction phase will be managed according to the Construction Waste Management Plan (Section 11.5). The KAM Environment Department will be responsible for establishing, communicating, implementing and maintaining the Solid Waste Management Plan, including setting performance objectives, ensuring compliance with regulatory requirements and adhering to the waste management principles of Reduce, Reuse, Recycle, Recover (4Rs), which are described below:

> **Reduce:** The primary goal is to reduce the quantity of waste generated via effective procurement so that ordered supplies and perishable consumables do not exceed usage rates and generate unnecessary waste. This may also include using effective ways to package materials before they are shipped to site, thereby reducing the amount of packaging that requires disposal.
>
> **Reuse:** Whether on site or at an off-site location, the beneficial re-use of waste by-products requires less energy and is typically more cost efficient than other disposal options. Examples include re-using waste rock for road repair or re-using sewage sludge, where possible, in reclamation activities.
>
> **Recycle:** Recycling is the third option in the waste management hierarchy. Recycling involves recovering materials that can be processed into new products. With secondary recovery, a further distinction is often made on whether the recovered product can be used to reproduce the original item or whether it must be "downcycled" into a lower grade product. Downcycling can prolong the useful life of a material. In limited cases, site waste can be downcycled and used for alternative purposes. Although recycling does help to conserve resources or reduce wastes, there are economic and environmental costs associated with waste collection and recycling. For this reason, recycling should only be considered for waste which cannot be reduced or reused.
>
> **Recover:** Finally, it may be possible to recover materials or energy from waste which cannot be reduced, reused or recycled. Used materials are combusted to generate energy, which can be used to heat buildings or processes as well as to generate electricity.

Where solid wastes cannot be managed according to the 4R principles, it is critical that they be disposed of in an environmentally responsible manner and in accordance with approvals/permits for that activity. Where possible, local approved disposal facilities will be utilized to minimize costs and fuel usage to transport them.

The Solid Waste Management Plan outlines:

- Compliance obligations and methods for managing compliance with these requirements;
- Performance objectives of the Solid Waste Management Plan;

- Estimates of the quantity and type of solid non-hazardous waste to be generated;
- Methods for characterizing and segregating hazardous waste from the solid waste management stream;
- Appropriate disposal, recycling, or re-use options for wastes generated; and
- Tracking environmental performance and evaluating mitigation measures to enable the implementation of adaptive follow-up programs as needed.

Management of waste streams not covered by the Solid Waste Management Plan include mineral wastes (Section 11.5), hazardous wastes (Section 11.10), and wastewater (Section 11.7), which are managed under separate plans.

11.9.2 Applicable Legislation and Standards

A number of legislative and regulatory requirements are applicable to solid waste management and disposal including:

- *Environmental Management Act* (S.B.C. 2003, c. 53) and *Hazardous Waste Regulation* (B.C. Reg. 63/88) – cover management and disposal of wastes considered hazardous, as well as discharges to the environment;
- *Waste Discharge Regulation (*B.C. Reg. 320/2004) – regulates the discharge of wastes into the environment;
- *Storage of Recyclable Material Regulation* (BC. Reg. 133/92) – prohibits the accumulation of recyclable building materials;
- *Open Burning Smoke Control Regulation* (B.C. Reg. 145/93) – establishes the requirements and prohibition for open burning of waste;
- *Fisheries Act* (R.S.C. 1985, c. F-14) – requirements to prevent deleterious substances from entering waters inhabited by fish;
- *Water Act* (R.S.B.C. 1996, c. 483) – requirements for the protection of water in British Columbia and prevention of waste materials from entering waterways;
- *Mines Act* (R.S.B.C. 1996, c. 293) and Health, Safety and Reclamation Code for Mines in British Columbia (B.C. Reg. 126/94) – cover the permitting and reclamation activities associated with mining, including the approval of waste disposal areas and closure of waste areas; and
- *National Fire Code 2010* – includes the requirements for indoor and outdoor storage of materials, including rubber tires.
- *Transportation of Dangerous Goods Act* (S.C. 1992, c. 34) – requirements for the transport of wastes which include discarded dangerous goods.

11.9.3 Performance Objectives

Performance objectives are established to ensure the activities of the Solid Waste Management Plan are contributing to the achievement of intended environmental protection and waste management outcomes of the Project. KAM will manage solid wastes using the following objectives:

- Compliance with applicable regulatory, permit and other solid non-hazardous waste management obligations;
- Effective management that enables efficient procurement, handling, storage and use, reduction and substitution of materials to reduce waste generation;
- Following the 4R principles of waste management;
- The establishment of a solid waste diversion rate (percentage of waste diverted from landfill (on and off site) ; and
- Target 100 percent of onsite employees and contractors to have completed waste management awareness training, achieved through the Project's site-specific environmental orientation training.

Although waste generation will vary over the life of the Project, an estimate of monthly and annual waste quantities for various waste categories is available in Section 3.13.8.

11.9.4 Environmental Protection Measures

11.9.4.1 Construction

The management of solid waste during the construction phase of the Project will be done in accordance with the Construction Waste EMP, section 11.5.

11.9.4.2 Operation

During the operation phase of the Project, solid non-hazardous wastes will follow environmentally responsible handling, storage and disposal procedures. Solid waste will be stored in dedicated, commercially available skips or bins in a designated solid waste storage area. Putrescible waste and any other waste that will attract wildlife (e.g. food containers, recyclables, etc.) will be stored in commercial wildlife-proof containers. The location of the storage areas will also be set back from forested or vegetated areas by 35 metres to minimize the risk of fire in accordance with regulatory requirements (BC MOE 2003).

The solid waste storage and transfer facility will be designed so that:

- It safely contains non-hazardous wastes in a manner which will prevent them from becoming litter;
- It is protected from the elements such as the recyclability of waste streams is maintained;
- Putrescible wastes are stored in wildlife-proof containers; and
- Non-hazardous recyclable materials are separated and stored in dedicated recycling bins.

Hazardous waste materials will be stored in accordance with the Hazardous Waste Management Plan (11.12), which includes dedicated storage areas and containers.

Waste materials will not be permitted to be disposed of through onsite burning or incineration. Should this option be explored in the future; KAM will follow the conditions and notifications required in the *Open Burning Smoke Regulation* and the *Waste Discharge Regulation*.

KAM personnel and contractors with specific responsibilities for handling wastes will be trained on the proper segregation of wastes for temporary storage and management of the solid waste storage facility.

Table 11.9-1 provides a solid waste management matrix that outlines the handling, storage and disposal methods for each solid non-hazardous waste type.

Table 11.9-1. Handling, Storage, and Disposal of Solid Waste

Waste Type	Description	Storage prior to disposal	Possible Disposal Location
Food waste	Putrescible food waste	Solid waste storage facility / Bear-proof containers	Offsite Landfill
Office waste	Non-putrescible waste, plastic food containers, waxed paper containers, tetra packs, textiles and garbage	Solid waste storage facility / Garbage bins and bear-proof containers (for food packaging etc.)	Offsite/Onsite Landfill[1]
Manufactured wood products (particle board, MDF, etc.)	Packaging materials (pallets)	Solid waste storage facility	Offsite Landfill
Cardboard	Packaging materials	Solid waste storage facility	Onsite Landfill/ Offsite Recycle
Clean wood	Packaging materials (pallets)	Solid waste storage facility	Onsite Landfill/ Offsite Recycle / Onsite Reuse
Paper	Packaging materials, office waste	Solid waste storage facility	Onsite Landfill/ Offsite Recycle
Beverage and food containers	Plastics, aluminum	Solid waste storage facility	Offsite Recycle
Ferrous and non-ferrous metals	Packaging, drums, used equipment, etc.	Solid waste storage facility	Offsite Recycle/or reuse
Plastics	Packaging, drums, containers, etc.	Solid waste storage facility – Occasionally containers formerly containing hazardous materials require cleaning/rinsing or neutralizing before being deemed non-hazardous.	Onsite Landfill (non-recyclable products)/ Offsite Recycle (reagent drums; recyclables)

(continued)

Table 11.9-1. Handling, Storage, and Disposal of Solid Waste (completed)

Waste Type	Description	Storage prior to disposal	Possible Disposal Location
Dust	From air pollution control equipment, maintenance activities	Determined following characterization of dust (hazardous or non-hazardous)	Offsite or Onsite Recycle/Offsite Landfill
Sludges	Sewage treatment plants/ oil water separators/process sludges	Determined following characterization of sludge (hazardous or non-hazardous)	City of Kamloops Sewage lagoon/re-process Onsite/ Offsite Recycle
Tires	Old tires from light duty vehicles, haul trucks and other equipment	If indoors in an area meeting the sec 3.2.4 of NFC 2010 and if stored outdoors in accordance with NFC 2010 sec 3.3.3	Offsite Recycle / Onsite Reuse

[1] *Currently the site is proposing to develop an onsite landfill, subject to regulatory permitting. In the event that an onsite landfill is not developed, local approved landfills will be sourced.*

Waste Characterization

Where wastes are generated and it is not known if they are hazardous or not, they will be classified in accordance with the Hazardous Waste Management Plan (11.12). Documentation will be retained onsite of the rationale used to characterize the waste stream.

Waste Reduction

Reducing the amount of material that is consumed is the most effective way of reducing the amount of waste that is generated. Examples of waste reduction include:

- product review, selection, and substitution – recyclable/reusable and non-hazardous materials used instead of non-recyclable/non-reusable and hazardous materials;
- ordering chemicals or lube products in bulk/returnable containers;
- ensuring materials are ordered on an "as needed" basis to prevent over supply to site keeping a workable minimum inventory to prevent expiration of products and resulting generation of waste;
- purchasing coverings, panelling or other materials in shape, dimensions and form that minimises the creation of excessive scrap waste on site;
- ensuring correct storage and handling of construction materials to minimise generation of damaged materials/waste, e.g., keeping deliveries packaged until they are ready to be used;
- assigning individual responsibility to sub-contractors for the purchase of raw materials and for the management of wastes arising from their activities, thereby ensuring that available resources are not expended in an extravagant manner at the expense of the main contractor;
- training personnel on waste minimization and reuse; and

- decreasing the amount of solid waste by reducing the use of disposable items and decreasing the amount of packaging on supplies by requesting that suppliers provide less packaging materials on over-packaged products.

Reuse and Recycling

Material that is generated shall be reused on site or salvaged for subsequent reuse to the greatest extent possible and disposal will be considered as a final option. Initiatives shall be put in place to maximize the efficient use/reuse of materials.

Examples of anticipated waste generated, which may be suitable for re-use include

- scrap metal, conveyor belts, and wood;
- chemical containers that can be returned to the supplier to be refilled; and
- Treated sewage treatment plant sludge, which may be suitable for use in reclamation activities.

Recyclable materials shall be shipped offsite to the nearest recycling facility and may include:

- cardboard;
- used oil filters (oil removed, crushed, and recycled separately);
- lead-acid and alkaline batteries;
- tires;
- plastic petroleum pails;
- oil-based paints; and
- empty drums.

Recovery

Recovery is the fourth level of the waste minimization principles and involves extracting usable material or energy as a by-product for other uses, also called Waste to Energy (WTE). Opportunities for feasible recovery will be evaluated throughout the life of the Project. Typically, waste to energy options are sought after ruling out recycling or reuse as viable outlets for waste disposal.

Landfill Disposal – Onsite

Non-putrescible, non-recyclable, solid non-hazardous industrial waste will be disposed of at an onsite landfill. The industrial non-hazardous waste landfill will accommodate waste generated during all stages of the Project and be operated in a manner that will facilitate landfill closure at the cessation of mine operation. The landfill area will be located within the South MRSF and will consist of a cleared area with cells for the burial of waste material. Landfill areas will be sequenced within mine rock as required.

The industrial non-hazardous landfill location will meet setback requirements outlined in the *Waste Discharge Regulation* and those required by BC MOE. A sign at the entrance to the landfill area outside the SMRSF will list conditions for use, emergency contacts and procedures, and items that may not be disposed of within the facility. The landfill area will include a sea-can container to temporarily house waste generated by contractors and/or operations personnel to enable final segregation of waste to be disposed of at the landfill or destined for off-site disposal or recycling.

Burial of non-hazardous solid waste suitable for landfill will be completed by a trained employee or contractor. Solid waste that will be disposed of at the landfill will include:

- untreated wood;
- corrugated cardboard;
- paper products;
- office waste (dry non-putrescible); and
- non-recyclable heavy plastics (PVC piping, LLDP/HDPE liner scraps, packaging material).

Burial (or deposition) of the following wastes at the onsite industrial non-hazardous landfill will be prohibited:

- recyclable products per the Recycling Regulation;
- liquid waste;
- tires;
- explosives;
- controlled wastes as defined in the Hazardous Waste Regulation;
- putrescible wastes such as food, food containers and packaging;
- reagent containers (super sacks, drums, etc.);
- batteries;
- scrap metal;
- sewage sludges; and
- dead animals.

The onsite landfill will be operated in accordance with the terms and conditions of the permit or approval for the landfill, and the application specifications provided in obtaining the permit or approval. Environmental protection measures that will be included in the operation of the onsite landfill include:

Access control – to ensure that only those trained in the management of the landfill have access to place materials there. This will ensure that only authorized materials are deposited in the landfill.

Signage - detailing the operating parameters of the landfill, including materials permitted to be disposed of, and contact information for the persons operating the landfill

Cover – Based on materials deposited and protection from wind dispersion of debris, coverage of materials on the industrial landfill will be determined in the application and permit/approval for the landfill. Cover is provided over garbage to prevent animal scavenging and wind dispersion of garbage.

The application for the landfill will also evaluate the need for monitoring of impacts from landfill, including leachate generation and landfill gas generation.

Based on the length of time the landfill will be operated for, an approval or permit for the disposal will be required. If the operation is less than 15 months an approval is required. If the landfill will operate beyond 15 months KAM will apply for a permit as per the *Environmental Management Act* (Section 14-15).

<u>Landfill Disposal – Offsite</u>

Solid non-hazardous wastes that are not suitable for reuse, recycling or disposal in the onsite landfill (if constructed) will be disposed of at a municipal landfill in the region authorized to accept industrial solid waste. KAM will obtain copies of the permits for the waste haulers and disposal companies, as well as evidence that they have pollution liability insurance.

11.9.4.3 Decommissioning and Closure

At the completion of site closure activities, all non-hazardous wastes will be removed from site to approved disposal or recycling facilities, along with the bins and other staging areas. Only minimal infrastructure in terms of containers for the storage and segregation of waste will remain for the staff involved in post-closure monitoring and maintenance and as determined required by the closure plan.

A closure plan for the landfill will be developed. This plan will include measures to minimize the generation of leachate and monitoring to determine the closure is successful.

11.9.4.4 Post-Closure

Aside from the industrial landfill, no additional impacts from the historical waste storage areas will remain on site. All waste materials will be removed and waste generation post-closure will be limited to that generated from the monitoring and maintenance activities stated in the closure plan.

11.9.4.5 Design Criteria

Waste staging areas shall be established that take into account compatibility of various waste streams and the prevention of releases to the environment.

Specific design criteria will include:

- secondary containment for liquid waste streams including 100% of the volume for a single container; and groups of containers will include secondary containment for 100% of the largest container volume plus 25% of the group;

- wildlife-proof containers for putrescible and hydrocarbon waste staging areas;
- proper segregation for incompatible wastes;
- inspection access to all waste storage areas;
- weather protection where necessary to prevent release of waste into the environment (e.g., powders, oil covered metals, etc.); and
- protection of stored waste to ensure suitability for future reuse or recycling.

11.9.5 Monitoring

KAM will record details regarding storage, movements and treatment of solid waste during the operation of the Project. Each shipment of waste taken from the site will be subject to documentation, which will ensure traceability of the material to its final destination and allow for tracking of waste diversion.

Monitoring will be completed through weekly inspections of the waste storage areas. Storage areas will be reviewed to ensure proper handling procedures are followed and there is zero discharge to the environment, and that the onsite industrial landfill is being operated in accordance with its permit/approval. Additional monitoring requirements for the landfill may be established following receipt of the approval to operate the landfill. These requirements will be incorporated in the KAM's waste handling procedures.

In addition to the weekly inspections, an annual internal audit will be conducted to ensure the effective implementation of waste handling procedures, see Section 11.1 describing the monitoring, inspection and audit function of the Environmental Management System.

Issues identified from weekly inspections or found during the annual audit will be documented, evaluated and corrective actions will be taken to prevent reoccurrence. Examples of corrective actions include modifying this plan and procedures, implementation, re-design of facilities, and re-training of employees and contractors.

KAM will record waste generated and conduct reviews of waste diversion targets. In the event a target is not met, waste management practices will be reviewed for waste diversion improvement where possible.

11.9.6 Reporting

This plan will be reviewed at least annually to evaluate success in meeting objectives and ensure that it remains suitable and current. Occasions such as a change in legislation related to waste management, discovering significant non-compliances or a change in the method used to manage waste streams should also trigger a review of this plan.

The annual audit report will contain:

- evaluation of the effectiveness of the plan, including if targets were met;

- assessment of additional mitigation measures taken to eliminate or reduce impacts unforeseen during the EA;
- describe and assess effects that mitigation measures have failed to eliminate or reduce, or circumstances in which effects could not be avoided;
- identify any emerging adverse environmental trends; and
- describe proposed revisions to the plan to address emerging adverse trends, or to adjust monitoring programs, if required.

The KAM Environmental Manager is responsible for communicating internally the performance of the Solid Waste Management Plan, including the monthly and annual performance with respect to waste diversion.

Annual reporting on the landfill, including quantity of material disposed and remaining space in the landfill will be completed.

Table 11.9-2 below summarizes the notifications that may be required during under the management of solid waste.

Table 11.9-2. Summary Table

Report Type	Report Trigger	Report Submitted to	
		Provincial Regulatory Agency	Federal Regulatory Agency
Annual Report on landfill operation	The permit obtained for an onsite industrial landfill often includes conditions on reporting of the status of the landfill, including annual quantity disposed of in the landfill and remaining space.	BC Ministry of Environment	

11.10 HAZARDOUS WASTE MANAGEMENT PLAN

11.10.1 Purpose

The Hazardous Waste Management Plan (HWMP) describes the methods KGHM Ajax Mining Inc. (KAM) uses for classifying, handling, storing, transporting and disposing of hazardous waste materials associated with its activities across the mining lifecycle including construction, operations, and closure. Hazardous wastes are defined under the Hazardous Waste Regulation (B.C. Reg. 63/88, Part 1 (1)) as dangerous goods that are no longer used for their original purpose, including those that are recycled, treated, abandoned, stored or disposed of, intended for recycling, treatment or disposal as well as listed wastes (i.e., waste oil, biomedical). The plan also covers the disposal of liquid effluent.

The KAM Environment Department is responsible for establishing, communicating, implementing and maintaining the HWMP, including setting performance objectives, ensuring compliance with regulatory requirements and adhering to classification, handling, storage, transportation and disposal procedures.

The HWMP outlines:

- compliance obligations and methods for managing compliance with these requirements;
- performance objectives of the HWMP;
- tracking the quantity of hazardous wastes generated by type and ensuring waste registration requirements are met;
- proper characterization and documentation of hazardous wastes;
- safe hazardous waste storage and handling methods to prevent releases to the environment;
- preparing for shipment hazardous wastes such that they are transported in a safe and secure manner;
- determining appropriate disposal or recycling options for hazardous wastes generated;
- verifying hazardous wastes are properly received at the approved disposal facility; and
- tracking environmental performance and evaluating mitigation measures to enable the implementation of adaptive follow-up programs as needed.

Management of waste streams not covered by the HWMP include solid non-hazardous wastes (Section 11.9) and mineral wastes (Section 11.5).

11.10.1 Applicable Legislation and Standards

A number of legislative and regulatory requirements are applicable to solid waste management and disposal including:

- *Environmental Management Act* (SBC 2003, c. 53) and Hazardous Waste Regulation (B.C. Reg. 63/1988) – cover the management and disposal of wastes considered hazardous, as well as discharges to the environment;

- Waste Discharge Regulation (B.C. Reg. 320/2004) – regulates the discharge of wastes into the environment;
- Sewerage System Regulation (B.C. Reg. 326/2004) – regulates smaller domestic wastewater systems;
- Municipal Wastewater Regulation (B.C. Reg. 87/2012) – regulates larger domestic (sewage) wastewater systems;
- National Fire Code (2010) – describes the storage and handling requirements for flammable and combustible liquids, aerosols, and separation requirements for hazardous substances, including hazardous wastes;
- Petroleum Storage and Distribution Facilities Storm Water Regulation (B.C. Reg. 168/1994) – storm water protection requirements for large petroleum storage facilities, including waste oil;
- Open Burning Smoke Control Regulation (B.C. Reg. 145/1993) – sets out the requirements and prohibition for open burning of waste regulations;
- *Fisheries Act* (RSC 1985, c. F-14) – protects waters inhabited by fish;
- *Water Act* (RSBC 1996, c. 483) – overarching Act for the protection of water in British Columbia;
- *Mines Act* (RSBC 1996, c. 293) and Health, Safety and Reclamation Code for Mines in British Columbia (B.C. Reg. 126/1994) – cover the permitting and reclamation activities associated with mining;
- Workplace Hazardous Materials Information System Regulation (Mines; B.C. Reg. 257/1988) – regulates labelling and safety datasheet requirements for hazardous materials and requires hazardous wastes to be stored safely through a combination of identification and worker education; and
- *Transportation of Dangerous Goods Act* (S.C. 1992, c. 34) – covers the transport of wastes which are waste dangerous goods.

11.10.2 Performance Objectives

Performance objectives are established to confirm the activities of the HWMP are contributing to the achievement of intended environmental protection and waste management outcomes of the Project. KAM will manage hazardous wastes using the following objectives:

- compliance with applicable regulatory, permit and other hazardous waste management obligations;
- effective management that enables efficient procurement, handling, storage and use, reduction and substitution of materials to reduce hazardous waste generation;
- monthly and annual tracking of hazardous waste generation (as an absolute quantity expressed in kg or L) or a rate based on production levels. Annual reduction targets will be set once operations begin and will be reviewed annually; and
- target 100% of onsite employees and contractors to have completed waste management awareness training, achieved through the Project's site-specific environmental orientation training.

11.10.3 Environmental Protection Measures

11.10.3.1 Construction

The waste management infrastructure for the Project will be established at the onset of site preparation and construction activities and will consist of: secure hazardous waste storage area, bulk waste oil tank, landfarm, and measures for the management of sewage waste.

Before construction of the landfarm, a subsurface baseline study will be conducted on the soil and groundwater quality beneath and surrounding the proposed treatment area to serve as the basis for future comparisons (see Section 11.24 Groundwater Quality Management and Monitoring Plan).

Current plans for the hazardous waste storage area include the use of modified shipping containers which will allow for secondary containment for liquid wastes and segregation of incompatible wastes. For containers storing flammable and combustible liquids the requirements of the National Fire Code will also be implemented (fire suppression, grounding, fire separation, etc.) as required.

Domestic sewage and greywater will be produced by toilets, showers, laundry facilities, and janitorial services which will serve the mine site (administrative buildings, truck shop, plant, etc.). During construction, sewage and greywater will be collected and treated using on site package treatment plants. Treated effluent will be used for construction purposes and sewage sludge will be transported off site to the City of Kamloops wastewater treatment facility for disposal.

During construction a landfarm will be established to manage hydrocarbon impacted soils from the clean-up of small spills and leaks from equipment. A landfarm is a constructed feature to contain and treat hydrocarbon impacted soil. Treatment of the soil is achieved through the enhancement of microbial activity in the soil (also known as bioremediation) by aeration (increasing the oxygen), adding moisture or addition of nutrients to increase microbial activity (Environment Canada 2013). See Section 11.10.3.2 for description of design and operation of the landfarm.

The management of solid non-hazardous waste during the construction phase of the Project will be done in accordance with the Construction Waste Management Plan (Section 11.4).

11.10.3.2 Operation

During operation of the mine and processing plant, hazardous wastes generated onsite will be stored temporarily in modified seacans located in the designated hazardous waste storage and transfer area.

The hazardous waste storage seacans will be designed such that:

- liquid wastes are safely contained with secondary containment with a volume of 110% of the volume for a single container; or 25% of the group, whichever is larger;
- hazardous wastes are stored such that inspection of the wastes is possible including the condition of the containers, labels, and inspection of the secondary containment area;
- incompatible wastes are segregated;

- signage posted on the seacans indicating the contents; and
- wastes are protected from the elements such as the integrity of the container and legibility of the labelling is maintained.

The disposal of hazardous waste through onsite burning or incineration is strictly prohibited.

KAM personnel and contractors handling wastes will be trained on the segregation of wastes for temporary storage within the hazardous waste storage facility prior to disposal.

Table 11.10-1 provides a hazardous and liquid industrial waste management matrix that outlines the handling, storage and disposal methods for each waste type generated from onsite Project activities.

Table 11.10-1. Handling, Storage, and Disposal of Hazardous Wastes and Liquid Effluent (sewage)

Waste Type	Description	Storage Prior to Disposal	Preferred Disposal Location
Sewage (treated effluent)	Domestic sewage and greywater will be produced by toilets, showers, laundry facilities, and janitorial services	Will be directed to on-site treatment system, with no interim storage	Re-used in the process water system or the TSF
Liquid Discharge from Oil Water Separator	Water discharge from oil water separators associated with petroleum storage and distribution facilities, landfarm, and truck wash area	Continuous discharge to final location with no interim storage	Re-use in process water, or discharge off site or in TSF
Dust	From air pollution control equipment, maintenance activities	Determined following characterization of dust (hazardous or non-hazardous)	Onsite landfill
Hydrocarbon contaminated soils	From equipment leaks	Will be moved to the landfarm holding cell and staked until confirmatory sampling confirms acceptable for landfarm	On-site treatment in landfarm and potential use in reclamation / Offsite disposal
Waste oils	Maintenance of plant, equipment	Flammable and combustible seacan for drummed waste oils or bulk waste oil tank.	Offsite disposal/On- or Offsite recycling
Sludges	Sewage treatment plants / oil water separators / process sludges	Determined following characterization of sludge (hazardous or non-hazardous)	Offsite disposal/Offsite recycling/re-use in reclamation activities / Onsite reuse
Biomedical waste	Waste generated in the first aid or health room	Waste products will be put in single use medical waste containers	Offsite disposal facility
Used batteries, wet with acid	Maintenance activities	Storage within warehouse in area protected from damage	Offsite disposal/Offsite recycle

(continued)

Table 11.10-1. Handling, Storage, and Disposal of Hazardous Wastes and Liquid Effluent (sewage; completed)

Waste Type	Description	Storage Prior to Disposal	Preferred Disposal Location
Waste grease	Maintenance of plant, equipment	Flammable and combustible seacan	Offsite disposal/Offsite recycle
Fabrics or other absorbent materials contaminated with oil	Clean-up of spills	Flammable and combustible seacan	Offsite disposal/Offsite recycle
Waste oil filters	Maintenance of plant, equipment	Flammable and combustible seacan	Offsite disposal/Offsite recycle
Waste solvents	Cleaning from maintenance activities, used or off-spec laboratory solvents	Flammable and combustible seacan	Offsite disposal/Offsite recycle
Gasoline	Off-spec fuel	Flammable and combustible seacan	Offsite disposal/Offsite recycle/ return to distributor
Diesel	Off-spec fuel	Flammable and combustible seacan	Offsite disposal/Offsite recycle / return to distributor
Paint Related Materials (solvent based)	Maintenance activities	Flammable and combustible seacan	Offsite disposal/Offsite recycle
Electronic Equipment	Obsolete or broken electronic equipment (i.e., computers, monitors, photocopiers, phones, etc.)	Stored in warehouse	Off-site recycle/ Off-site disposal
Fluorescent lamps	Spent lighting fixtures	Safely in a box to prevent breakage	Offsite recycle
Waste chemical containers, Aerosol cans	Laboratory and Maintenance activities	Based on classification in the appropriate seacan	Offsite disposal/Offsite recycle
Potassium Amyl Xanthate PAX Collector	Off-spec chemicals	Will be stored segregated from other hazardous waste classes by at least 1 m	Off-site disposal/ Offsite recycle/ Return to distributor
Methyl Isobutyl Carbinol(MIBC) / Dowfroth	Off-spec chemicals	Flammable and combustible seacan	Offsite disposal/Offsite recycle/ Return to distributor
Any other assay chemicals	Used for or as by-product of assay processes	As dictated by use permit	Offsite disposal/Offsite recycle

<u>Waste Prevention and Minimization</u>

Where possible, KAM intends to prevent the generation of hazardous wastes and will find non-hazardous material substitutes where technologically and feasibly possible. Efforts to minimize the hazardous waste stream will also be investigated, including finding effective ways to reduce hazardous material consumption and waste generation.

Hazardous Waste Handling and Storage

Specific operating procedures, training and communication will be established for implementing, maintaining, and ensuring conformance with applicable waste management compliance obligations as part of the Project's Environmental Management System (EMS), including mechanisms to:

- classify, label and store hazardous waste properly;
- register as a generator of hazardous waste;
- ensure a waste manifest is properly completed and accompanies shipments of hazardous waste off-site;
- ensure hazardous waste is transported by a registered hazardous waste carrier to a registered receiver;
- ensure the proper disposal of hazardous waste by an acceptable and approved method;
- ensure workers are trained in the management of hazardous waste including emergency response in the event of a spill;
- comply with the regulatory requirements for hazardous waste management including transportation; and
- ensure that the carrier or transporter has the proper placards and labels to identify the material for transport.

Most hazardous waste will be sorted at the source prior to transfer to the designated area for disposal. The management of hazardous waste onsite will be limited to passive storage, meaning activities related to hazardous waste are limited to the placement, retrieval or inspection of the hazardous waste. No processing, treatment, blending or bulking of hazardous wastes will occur.

Waste Characterization

KAM will establish procedures and provide training to those with waste management responsibilities as necessary to properly characterize its waste streams generated from Project activities. The methodology used to characterize waste streams will be done through use of waste generator knowledge, Safety Data Sheets (SDS) and/or sampling where required. Information on the wastes streams will be referenced to the Hazardous Waste Regulation, Transportation of Dangerous Goods Regulation, and the BC Hazardous Waste Legislation Guide (BC MOE 2005a) to ensure correct characterization. Documentation of the rationale used to characterize the waste stream will be retained in onsite records. The waste characterizations will be reviewed periodically to ensure they are still current, or if a new waste stream is generated. Other events which could trigger a review are process changes which could change the nature of the waste stream, either in terms of concentration or constituents.

Waste Registration

KAM will keep a register of hazardous wastes including tracking the quantity stored onsite and generated. This register will allow KAM to determine if they meet the threshold for registering that waste class (on a monthly basis) under the Hazardous Waste Regulation and also evaluate performance in terms of total hazardous waste generated on an annual basis.

Where the quantity of a registered waste stream increases to 10% above the registered quantity, KAM will submit an updated registration (BC MOE 2005b).

Off-site Disposal

Upon delivery to the appropriate hazardous waste disposal area, wastes will be placed or confirmed to be in drums and containers which are compatible with the waste stream and approved under the *Transportation of Dangerous Goods* (TDG) *Act*.

Approved containers, known as standardized means of containment, will be manufactured by facilities approved to do so through Transport Canada. The containers used for hazardous waste will also be checked to ensure they are able to be used within the qualified date. Containers which are expired will be sent for re-qualification when necessary.

Only those KAM employees competent and approved will be permitted to ship hazardous waste. The trained shippers will ensure that prior to shipment all containers are designed, constructed, filled, closed, secured and maintained so that under normal conditions of transport, there will be no accidental release of dangerous goods that could endanger public safety.

KAM will also use a process to validate that all disposal facilities and transport contractors are approved to perform the required service or disposal and that they possess pollution liability insurance and workers compensation coverage.

Shipments of hazardous wastes will include manifests completed in accordance with the *Transportation of Dangerous Goods Act*, the BC Hazardous Waste Regulation and where applicable the Interprovincial Movement of Hazardous Waste Regulation. Manifests will be retained on site for a minimum of two years. KAM will also confirm that the hazardous waste receiver accepted the waste by matching the copy returned from the receiver. The receiver is required to send KAM a copy of the manifests within 3 days of receipt of the waste. Where KAM is unable to obtain the copy from the receiver, they will notify the Ministry within 10 days after the hazardous waste was shipped.

In addition to training on the management of hazardous waste on site, shippers and those packaging hazardous wastes for shipment will have current training on TDG.

Wastewater (Sewage Management)

Sewage management for the Project will be consistent with the requirements of the *Environmental Management Act* and its Municipal Wastewater Regulation.

Domestic sewage and greywater will be produced by toilets, showers, laundry facilities, and janitorial services. Pre-packaged (rotating biological contact) systems for sewage collection and treatment will be installed at the Process Plant and Truck Maintenance areas. The main gate and crusher area will maintain sewage collection in tanks and a truck will transfer sewage from the holding tank to the sewage treatment facility.

The system will be maintained by trained operators, certified under Environmental Operators Certification Program (EOCP), who will also be responsible for conducting regular monitoring of the system. Operations and maintenance requirements of the sewage system will be developed by the Design Engineer for the system.

Effluent from the sewage treatment facility will be treated to the appropriate quality for direct discharge to the nearest water management ponds and pumped to either the process water system or the Tailings Storage Facility (TSF). Sewage sludge generated at the Project sewage treatment plant will be transported off-site for disposal at a licensed facility, currently envisioned to be the City of Kamloops sewage lagoon. If sewage sludge is to be re-used on site, authorization will be obtained from the Ministry of Environment.

Truck Wash

Water will be used in the heavy equipment and truck washing facilities installed at the Truck Maintenance area. An oily water treatment system will also be installed to treat the collected wash water and to the extent possible, treated oily water will be recycled for reuse. Upset conditions are anticipated to occur which will require occasional discharge of excess collected wash water to the East Mine Rock Storage Facility (MRSF) water management pond.

Landfarm

KAM currently plans to develop a landfarm for the treatment of hydrocarbon contaminated soil in accordance with the Hazardous Waste Regulation (B.C. Reg. 63/1988). The facility will be constructed for the progressive treatment and remediation of hydrocarbon contaminated soils as and when required. The land treatment facility will be located adjacent to the southwest corner of the East MRSF and will consist of multiple cells. If soil permeability in the facility is greater than 10^{-6} cm/s, a geo-membrane or other suitable liner will be installed and covered with fine grained gravel or soil to temporarily store and land farm contaminated soil.

Siting and design criteria for the land treatment facility will meet requirements of BC MOE as set forth by Protocol 15 for Contaminated Sites – Soil Treatment Facility Design and Operation for Bioremediation of Hydrocarbon Contaminated Soil (BC MOE 2012). The area will be leveled, sloped and bermed such that run-off from the area can be contained and reused or treated prior to release to the TSF or disposed offsite at approved facility.

Hydrocarbon contaminated soils will be stored within the land treatment facility, nutrients added and the soil remediated by regular tilling for aeration and standard bioremediation practices. Water will be applied as needed to maintain the optimum moisture content in the soil being remediated. Snow will be removed prior to spring freshet to prevent excess runoff from the facility. The construction of multiple cells will allow active treatment of contaminants in one cell while remediated soils can be stored in another cell prior to reuse. No new contaminated soil will be applied when the soil is frozen, covered in snow or saturated with water. Contaminated soils undergoing remediation treatment will be tested for hydrocarbons (F1/F2/F3/F4 hydrocarbons) prior to treatment.

Aeration of hydrocarbon soils will involve mixing and introduction of oxygen to spur biochemical reaction with applied nutrients and water to break down hydrocarbons. Aeration will occur every two weeks and testing of contaminated soils every four weeks. Once the material has been remediated to meet standards set by Section 64 of the *Environmental Management Act*, KAM will seek approval from BC MOE to remove the material from the treatment facility for re-application as required for reclamation activities on site.

A groundwater monitoring program will be implemented to monitor appropriate indicator parameters associated with contaminants of concern related to the landfarm (e.g., hydrocarbons and degradation by-products).

Prior to use of the landfarm, written notification of the proposed storage or treatment will be provided to BC MOE and the storage and treatment will be carried out in accordance with the director's requirements.

The landfarm itself will be designed to capture storm water runoff and direct this to an oil water separator prior to discharge to the environment. When the hydrocarbon contaminated soil which has been treated so that it is no longer a hazardous waste a disposal location approved by the BC MOE director will be selected. Soil treated will be limited to soil from the project (no off-site soil will be received).

<u>Contingency Plans</u>

KAM will prepare and maintain up-to-date contingency plans which document procedures to be followed during emergencies associated with the hazardous waste storage facilities, the sewage treatment plant and the operation and maintenance of the oil water separators. The general contents of the contingency plans are included below:

The Hazardous Waste Management Contingency Plan will contain the following elements:

- shut down procedures;
- communication networks to be used;
- notification procedures for police departments in the vicinity, fire departments in the vicinity, emergency response teams, ambulance and medical services, contractors carrying on business in the vicinity, schools, hospitals and residents, Federal, Provincial and Municipal governments;
- evacuation procedures for facility staff; and
- abatement measures.

The contingency plan for the oil water separators will include:

- procedures for the closure of the discharge valves in the event of a spill or adverse condition is encountered;
- procedure to clean up spills or repair the oil water separator and re-open the oil water separator; and
- reporting to the spills action centre in the event of a release or by-pass (see Spill Contingency Plan in Section 11.16).

The contingency plan for the sewage system will include:

- emergency procedures for the wastewater facility, including lift stations;
- procedures for notifying a health officer when necessary;
- actions to be taken if municipal effluent quality fails to meet the requirements of this regulation; and
- an alternate method of disposal or storage if reclaimed water use is not possible.

11.10.3.3 Closure

Hazardous Waste Storage

Prior to of the first use of the hazardous waste storage facilities, KAM will prepare a closure plan, in accordance with the Hazardous Waste Regulation. The closure plan will be initiated when the mine ceases operation.

At the completion of site closure activities, an inventory of hazardous materials will be completed, including process chemicals and reagents and petroleum products. Hazardous materials and other chemicals will be properly stored onsite prior to removal. All hazardous wastes will be removed from site to approved disposal or recycling facilities. The modified seacans and waste oil storage tank will be decontaminated and removed from site. All remaining soil in the landfarm will be treated to acceptable levels as required by regulation and dismantled.

Only minimal infrastructure in terms of containers for the storage and segregation of waste will remain for the staff involved in post closure monitoring and maintenance and as determined required by the closure plan.

Landfarm

Following successful remediation of soil to the applicable environmental quality standards, the treated soil will be reused or disposed of appropriately. When the soil treatment facility is no longer in use it will be decommissioned and the land surface contoured to its original grade and re-vegetated where appropriate for erosion control. Following decommissioning, closure samples will be collected from the soil beneath and surrounding the former soil treatment facility and from the groundwater monitoring well network. Soil, soil vapour and groundwater samples will be submitted for laboratory analysis of contaminants of concern to establish whether the land has been contaminated during soil treatment.

Industrial Wastewater Infrastructure

Once it is no longer required, infrastructure such as oil water separators and the sewage treatment plant will require all wastes (sludge, oils, wastewater) to be removed and the equipment decommissioned and removed from site.

11.10.3.4 Design Criteria

Hazardous Waste Storage Area

Hazardous waste storage areas established will take into account compatibility of various waste streams and the prevention of releases to the environment. Currently the plan is to use modified shipping containers with the following minimum design criteria:

- the containers will not be placed within the 200-year Floodplain, within 100 m of a Holocene fault and or within 100 m of any land subject to slope failure;
- containers used for the storage of hazardous wastes with free liquids will include a space to allow for manual and visual inspection for leaks;
- containers used for the storage of hazardous wastes with free liquids will be provided with an impervious containment system sufficient to hold the larger of 110% of the largest volume of free liquid hazardous waste in any given container or tank, or 25% of the total volume of free liquid hazardous waste in storage; and
- allow for the protection of the hazardous waste from weather (i.e., precipitation) in order to prevent release of hazardous wastes into the environment or impacting the storm water.

Waste Oil Tank

KAM may install an aboveground storage tank for the storage of bulk waste oils from the maintenance area. The tank design will conform to an acceptable standard under the National Fire Code.

Where the bulk waste oil tank is located within an area where it and the total petroleum hydrocarbon storage exceeds 100,000 L, then the facility in the area will be designed in accordance with the Petroleum Storage and Distribution Facilities Storm Water Regulation. Storm water from the transfer area will be directed to an oil water separator that has been designed in accordance with the regulation.

The oil water separator will be monitored to ensure the effluent does not exceed 15 mg/litre of total extractable hydrocarbon.

Additional design considerations include:

- a minimum volume of 1,000 litres;
- a shutoff valve on the separator outlet;

- a 10-year return period storm event of 60 minutes duration for the nearest rainfall recording station; and
- a water temperature of 5 degrees Celsius and a petroleum-specific gravity of 0.85.

Landfarm

The landfarm will be located in area where controlled access is possible, and is not prone to flooding. The landfarm will be constructed with low permeability soils, liner or lining system (e.g., engineered materials, composite materials, clay layer, etc.) that will impede the migration of impacted storm water into the groundwater. The landfarm itself will be constructed with berm to divert storm water from entering the facility (construction of a berm) and direct storm water falling directly on the landfarm to an oil water separator capable of removing hydrocarbons from the storm water before discharge into the environment.

The landfarm will not be constructed where the slope is greater than 9% or where the seasonal high water table is less than 1 m below ground surface.

Sewage Treatment Plant

The design of the sewage treatment plant will be done by a registered qualified professional in British Columbia. The design will be in accordance with the Municipal Wastewater Regulation and include a copy of the environmental impact study, and an operating plan in accordance with the regulation. A site plan indicating the sludge disposal location or recycle process in relation to the treatment plant will also be provided.

11.10.4 Monitoring

KAM will record details regarding storage, movements and treatment of hazardous waste during the operation of the Project. Each shipment of waste taken from the site will be subject to documentation, which will ensure traceability of the material to its final destination and allow for tracking of hazardous waste generation reduction.

Monitoring will be completed through weekly documented inspections of the hazardous waste storage areas and landfarm.

Storage areas will be reviewed to ensure the handing procedures are followed and there is zero discharge to the environment. The landfarm will be monitored weekly from spring to fall, and monthly during the winter months. Inspection of the landfarm will be to ensure all soil stockpiles are adequately labelled; berms remain in good condition and ensure that site procedures for the landfarm are followed.

The oil-water separators (OWS) will be inspected on a weekly basis to ensure proper maintenance and operation. Where there is no flow through the OWS in the winter months, KAM may decide to lock the discharge valve closed until spring, when the OWS will be opened and weekly inspections resumed.

In addition to the inspections, an annual internal audit will be taken to ensure the effective implementation of waste handling procedures (see Section 11.1 describing the monitoring function of the EMS). Issues identified from the inspections or found during the annual audit will be documented and analyzed, and corrective actions will be taken to prevent reoccurrence.

KAM will record the quantity of hazardous waste generated and conduct reviews of hazardous waste reduction actions.

11.10.4.1 Work Planning and Schedule

The following is a list of the various monitoring activities under the HWMP (Table 11.10-2).

Table 11.10-2. Schedule of Monitoring Activities

Area	Activity	Frequency
Hazardous waste storage areas	Inspection, check inventory	Weekly
	Removal of spillage from secondary containment	As needed
Oil-water separators	Visual inspection looking for by-pass	Weekly
	Measure thickness of petroleum accumulation and sludge accumulation	Monthly
	Removal of sludge or oil accumulation	If sludge exceeds 150 mm or oil accumulation exceeds 50 mm
	Clean and inspect OWS	Every 2 years
Waste oil tank	Inspection of the tank, transfer area and any piping, flanges, or associated hoses and nozzles (if applicable)	Monthly
Sewage treatment plant	Environmental Monitoring (upstream, and downstream of discharge point)	Annual
	Inspection of works	Weekly or as directed by design engineer
	Sewage treatment plant discharge monitoring	Based on permit requirements (likely monthly)
Landfarm	Inspection of landfarm	Weekly March to November, monthly December to February
	Testing of new soil for treatment	Within 30 days of receipt at landfarm
	Testing of soil treatment progress	Every 4 weeks to a maximum length of annually
	Groundwater Monitoring	Annual

11.10.5 Reporting

The HWMP will be reviewed at least annually to review success in meeting targets ensure that it remains current. Occasions such as a change in legislation related to waste management, discovering significant non-compliances or a change in the method used to manage waste streams should also trigger a review of this plan.

The annual review report will contain:

- evaluation of the effectiveness of the plan, including if targets were met;
- assessment of additional mitigation measures taken to eliminate or reduce impacts unforeseen during the EA;
- describe and assess effects that mitigation measures have failed to eliminate or reduce, or circumstances in which effects could not be avoided;
- identify any emerging adverse environmental trends; and
- describe proposed revisions to the plan to address emerging adverse trends, or to adjust monitoring programs, if required.

The KAM Environment Manager is responsible for communicating internally the performance of the HWMP, including the monthly and annual performance with respect to hazardous waste reduction.

Additional regulatory reports, notifications, authorizations or other submissions to regulatory authorities may be required as follows in Table 11.10-3.

Table 11.10-3. Summary Table of Reporting Requirements

		Report Submitted to	
Report Type	Report Trigger	Provincial Regulatory Agency	Federal Regulatory Agency
Notification	Required prior to the treatment of hydrocarbon contaminated soil in the on-site landfarm	Director – Ministry of Environment	
Authorization	Required prior to the removal of treated soil from the landfarm.	Director – Ministry of Environment	
Registration	Where the total cumulative capacity of hydrocarbons (including waste oil) exceeds 100,000 litres), must register the storage and distribution facility.	Director – Ministry of Environment	
Authorization to Discharge Municipal Wastewater	If sewage discharge is greater than 22.7 m^3/day	Director – Ministry of Environment	
Notification of discharge start and final submission of final design of wastewater facility	30 to 60 days prior to initial discharge of sewage	Director – Ministry of Environment	
Permit for a sewage holding tank	Required where a sewage holding tank is installed.	Regional Health Authority	
Authorization for a sewerage system	Required for the construction of sewage system where the sewage discharge is less than 22.7 m^3/day	Regional Health Authority	

(continued)

Table 11.10-3. Summary Table of Reporting Requirements (completed)

Report Type	Report Trigger	Report Submitted to: Provincial Regulatory Agency	Report Submitted to: Federal Regulatory Agency
Hazardous Waste Registration Initial	When the quantity of a category of hazardous waste stored at one time or generated in a month exceeds the registration quantity, an initial Generator Registration will be submitted.	Director – Ministry of Environment	
Hazardous Waste Registration Update	Registration information will be kept current. An update will be submitted within 30 days of a change in any of the following: • generator legal name • generator legal address • the maximum amount of hazardous waste managed at a site is more than 10% above the registered amount • hazardous waste properties or description • handling method • generation site address • company managing the hazardous waste or • management site address	Director – Ministry of Environment	
Operational Plan	Where management of hazardous waste on site goes beyond passive waste, or includes long term storage then an operational plan will be prepared.	Director – Ministry of Environment	
Closure Plan	Where management of hazardous waste on site goes beyond passive waste, or includes long term storage the closure plan will be submitted for approval.	Director – Ministry of Environment	
Contingency Plan	Where management of hazardous waste on site goes beyond passive waste, or includes disposal in a secure building the contingency plan will be submitted for approval.	Director – Ministry of Environment	

11.11 Explosives Management Plan

11.11.1 Purpose

The purpose of the Explosives Management Plan for the Project is to provide the initial framework for KAM to protect the health and safety of employees, contractors and the public during the storage, manufacture, transport, and use of explosives throughout the life of the mine. Similarly, components of the biophysical environment such as water, air, and vegetation, as well as the fish and wildlife that depend on them, must be protected.

The information contained in this plan is at a level of detail appropriate for the Application/EIS submission. It is a living document and will be further developed into detailed plans prior to commencement of blasting activity. Blasting procedures will be established as part of KAM's overall Occupational Health and Safety Management Plan to be developed as required under the *Mines Act* (1996) and the Explosive Management Plan will be integrated with KAM's Environmental Management System (EMS) presented in Section 11.1, including but not limited to the Emergency Response Plan (Section 11.14) and Spill Contingency Plan (Section 11.16). Note that the EMS for the Project reflects KGHM International's Environmental Policy (KGHM 2012).

With the typical open pit production cycle envisaged for the Project, namely drilling, blasting, loading and hauling, the importance of efficient and safe management of explosives in maintaining the productivity of the mine is clear. A critical component of the Explosives Management Plan is a rigorous handling and storage policy, to be achieved through having systematized and well-defined operating procedures in place. Note that KAM has a site-specific Safety Procedure for explosives and blasting in place (KGHM International 2014), and that a blast review report has also been prepared for the Project (BAI 2014). These two documents will be vital informants for the permit-level plans related to explosives described in the next section.

11.11.2 Regulatory and Policy Framework

The use of explosives is regulated by Natural Resources Canada (NRCan), under Part 7(1)(a) of the *Explosives Act* (1985a). Significant revisions were made to the Explosives Regulations (SOR/2013-211) in 2013[1]. For the issuance of an Explosives Magazine Licence, information on the type and volume of explosive to be used, how it will be handled, appropriate safety measures, and a monitoring and reporting program are required. These and other regulatory considerations relevant to the design, construction, and ultimate operation of an explosives facility and use of explosives on the Project site include the following:

- Explosives Regulations (SOR/2013-211); Ammonium Nitrate Storage Facilities Regulations (CRC, c 1145);

[1] Note: Related guidelines and directives derived from the Explosives Regulations (SOR/2013-211) comprise an Ammonium Nitrate Security Plan Guideline, Explosives Security Directive, Fire Safety Plan Guideline, Key Control Plan Guideline, Received Comments and Concerns, Answers, and Resulting Modifications, Screening Guideline, and Security Plan Guideline (http://www.nrcan.gc.ca/explosives/13975).

- Transportation of Dangerous Goods Regulations (SOR/2001-286);
- Environmental Emergency Regulations (SOR/2003-307 as amended by SOR/2011-294); and
- NRCan's (2010) Guidelines for Bulk Explosives Facilities.

Under the *Mines Act* (1996), the Health, Safety and Reclamation Code for Mines in British Columbia (BC MEMPR 2008) also regulates the transportation, use, care, and handling of explosives. An Explosives Storage and Use Permit from the Ministry of Energy and Mines is required before a magazine is located, erected, built, put into service, or modified, or before carrying out any maintenance work including the installation of lighting or heating. The explosives facilities at the Project, as well as all employees and contractors handling, transporting, and using explosives, will comply with all regulatory requirements throughout the Construction, Operation, and Closure phases of the Project.

Under the Environmental Emergency Regulations (SOR/2003-307 as amended by SOR/2011-294), the storage of ammonium nitrate in quantities greater than 20 tonnes require that KAM notifies Environment Canada and prepares an Environmental Emergency Plan. This will occur as part of the permitting submission and will build on the Application/EIS Emergency Response Plan (Section 11.14).

Note that a Workplace Hazardous Materials Information System (WHMIS) will be in place prior to commencement of construction of the Project. The WHMIS will meet the intent of the *Hazardous Products Act* (1985b) and the Controlled Products Regulations (SOR/88-66). KAM currently have a site-specific WHMIS in place (KGHM International 2015).

11.11.3 Performance Objectives

This Explosives Management Plan is designed to meet four performance objectives, as follows:

- To have a WHMIS in place prior to commencement of construction of the Project, that will continue for the life of the Project with adjustments as required to reflect changing types and levels of blasting activities and the knowledge gained over time.
- To maintain an inspection procedure that confirms the effectiveness of the explosives storage and manufacturing facility, that includes maintaining an inventory of explosives, as well as their handling, transportation and application, that ensures compliance with established systems throughout the life of the Project.
- No unintended property damage or injury to persons.
- No significant adverse environmental effects related to the transportation, on-site manufacturing, storage, and use of explosives.

The overall approach to blasting and explosives handling for the Project is described in the following paragraphs.

Prior to commencement of pre-production mining activity, KAM will award a contract to a competent and licensed explosives supplier to construct and operate the explosives manufacture, storage and supply facility at the Project. The contractor will be obligated to comply with this plan. KAM will provide on-site services, diesel fuel and a cleared, leveled and graded site with foundations installed, while the contractor will supply complete facilities including bulk storage or raw materials, explosives storage and magazines, and personnel and equipment.

Bulk explosives will be manufactured by the contractor and delivered to the blast-hole by a dedicated properly labelled delivery vehicle. KAM will take delivery of the explosives down the hole and the mine blasting crew will be responsible to load and fire the explosive charges. All KAM blasting crew personnel will hold proper blasting certifications.

Activities during pioneering work and initial pit development will include removing overburden, developing mine access roads suitable for large mining equipment, and exposure of the initial pit into productive set-ups for the large shovel and mining equipment. Blasting will be required during such preparatory work and in these cases, drilling and blasting will be contracted to a licenced drilling and blasting contractor who will supply all of their own supplies, including storage magazines and blasting agents, as well as acquire any necessary permits and licences. Blasting requirements during construction are expected to be more limited and localized when compared to the peak production years during operation, and will therefore not require the same quantity of explosives in bulk on site.

11.11.4 Environmental Protection Measures

Explosives will be utilised for the Project during the Construction and Operations phases in particular. Material Safety Data Sheets (MSDSs) will be required for each of the products that comprise the explosives materials.

This Explosives Management Plan is considered a preliminary conceptual-level plan and additional components to be developed for permitting purposes will include:

- detailed plans of the explosives facility at the preferred location between the open pit and the East Mine Rock Storage Facility, including the various explosive materials and products, and typical quantities within the facility, as well as details of the bulk delivery and application of explosives to active blast site drill holes;
- detailed specifications for the maintenance of an inventory system that records the receipt, storage and issuance of explosives materials, that includes volumes, types, stock on hand, delivery manifests, a logbook of delivery and issuance events, and records of inspections of the explosives facility;
- locations and description of various services and connections to the explosives facility, such as water, fuel, communications, etc.;
- plans of the road access to the explosives facility and control by means of a locked gate;
- linkages to the Transportation Management Plan (Section 11.20) that will specify mine site access control measures to ensure public safety during blasting activities, per the *Mines Act*; and
- linkages to the Emergency Response Plan (Section 11.14) that will provide specific information concerning criteria for initiation of emergency and evacuation plans, resources, detailed contact lists, and review and testing of plans, etc.

11.11.4.1 Design Criteria

To ensure worker, contractor and public safety, design criteria for all manufacturing and storage facilities for explosives at the Project will conform to the regulatory requirements listed in Section 11.11.2 above. The technical specifications of the structures and facilities for the transport, manufacture, handling and storage of explosives will be detailed in the Explosives Storage and Use Permit application.

11.11.4.2 Safety Considerations

KAM holds ultimate responsibility for site safety and the oversight of contractors. The explosives contractor will be responsible for the safe management of explosives at the Project, up to delivery down the blast holes. The Spill Contingency Plan (Section 11.16) and the Emergency Response Plan (Section 11.14) will be developed further and will include details on procedures for dealing with incidents involving explosives.

11.11.4.3 Construction

Blasting for pre-mining construction activities, e.g., foundation excavations such as at the crusher, mill and truck maintenance platforms, will be carried-out by a licenced drilling and blasting contractor who will supply all of their own supplies, including storage magazines and blasting agents. Blasting requirements are expected to be limited and localized during construction, and will therefore not require significant quantities of explosives. As a result, bulk explosives will not be required and explosives used will be of the packaged type. Temporary blasting explosives will be stored on site at the same location proposed for the permanent facilities.

The explosives manufacture and storage facility that will serve for the entire life of the mine will be installed during the Construction phase of the Project and will be licensed by the explosives contractor in accordance with the *Explosives Act* (1985a) and criteria established by NRCan's Explosives Regulatory Division.

The explosives manufacture and storage facility will:

- be in the charge of an authorized person who will carry out all required inspections of the facility;
- be locked at all times, except when explosives are being moved, and only authorized person(s) will be in possession of the key;
- have an up-to-date inventory of contents in a logbook kept at the facility, where all entries will be signed by the authorized person in charge;
- be kept clean, dry, and free from grit at all times;
- be kept free of broken explosives packages or spilled explosives and, when necessary, the shelves and floors will be treated with a suitable neutralizing agent to remove all traces of explosive substances;
- have its contents arranged in a tidy and organized manner, including any explosives returned from a workplace;

- not contain any exposed iron or steel except in fixtures; and
- have stock rotated to ensure that the oldest stock for each type and size of explosive will be used first.

Explosives and detonators will not be stored or transported together. Smoking will be prohibited while handling, transporting, or using explosives. Only persons with a valid or provisional blasting certificate will be permitted to conduct blasting operations. All transportation of explosives and detonators will be consistent with the Transportation of Dangerous Goods Regulations (SOR/2001-286).

11.11.4.4 Operation

A mixture of ammonium nitrate/fuel oil (ANFO) and emulsion explosives products will be used during the Construction and Operations phases to break rock for open pit mining activities. Their transportation, storage, handling and use will be consistent with the regulatory requirements mentioned in Section 11.11.2 above. On a daily average basis, approximately 50 tonnes of ammonium nitrate in prill form and 38 tonnes of emulsion will be stored within designated silos at the explosives facility.

The explosives contractor will transport the materials to the work site and supply the mixed explosives products down the hole with the use of blend and pumping trucks on an as-needed basis. The mine blasting crew will work closely with the drilling and blasting engineer.

The transport of the bulk explosives will necessitate the following:

- MSDSs will accompany all goods and materials;
- non-compatible materials will be transported in separate shipments;
- fire extinguishers and fire prevention materials will be adequate and appropriate for the material being transported;
- containers will be appropriate for the material being shipped;
- containers will be properly secured;
- containers and trucks will be properly marked, labelled, and placarded;
- manifests will be maintained in accordance with federal and provincial regulations;
- spill response materials will be adequate and appropriate for the materials being transported; and
- drivers will be adequately trained and equipped for spill first response, containment, and communication.

Blasting procedures will be established as part of KAM's Explosives Storage and Use Permit to be developed as required under the *Mines Act* (1996) and typically includes such measures as:

- notifying all mine employees of the time and location of all blasts;

- notifying all identified off-site interested and affected parties of the time and location of all blasts (see Blast Time Procedure below) and apply stringent access controls to ensure public safety during blasting activities;
- strictly prohibiting smoking or open flames within 20 m of explosives, detonating devices, and loaded blast holes;
- no entry to a blast pattern perimeter for employees without first receiving permission from the blaster in charge;
- no equipment operation within a stipulated distance of a loaded hole, except for authorized loading equipment;
- strictly prohibiting the operation of mobile equipment on a loaded blast pattern without the supervision of the blaster in charge, and only allowing equipment associated with explosives on a blasting pattern;
- no entry to a blast pattern perimeter for employees while in the possession of matches, a lighter, or any other source of ignition;
- applying a Blast Time Procedure as part of the Explosives Storage and Use Permit to ensure that:
  - blast times will be posted;
  - radio silence will be established during blasting; and
  - communications will be restricted to the Pit Supervisor and blaster until "all clear" given;
- except for an emergency, restricting the use of the mine radio frequency during the countdown to detonation to the Mine Manager, blaster, and guards until the blast has been detonated and the "all clear" has been given by the Mine Manager;
- employees being on the alert for blasting signs when travelling in the pit; and
- strictly prohibited the unauthorized use or possession of explosives and/or blasting accessories.

11.11.4.5 Decommissioning and Closure

Limited volumes of explosives are expected to be required during the Decommissioning and Closure phase of the Project. Some blasting may be required to prepare the Tailings Storage Facility drainage channel at closure. Management of explosives will continue to be the same as during the Operations phase. When explosives are no longer required, the explosives facility will be deactivated and removed, the sites ripped and capped with available overburden and topsoil, and seeded. The related access road will be deactivated when it is no longer required for maintenance of the site.

The Landscape Design and Restoration Plan (Section 11.26), Soil Salvage and Handling Plan (Section 11.3), and Reclamation and Closure Plan (Section 3.17) provide specific information regarding activities relevant to the closure of the explosives facility and associated infrastructure.

11.11.4.6 Post Closure

The reclaimed explosives facility area and access road will be monitored for erosion, geotechnical stability, and revegetation success. Any erosion or instability will be addressed and any significant areas of under-performing revegetation will be investigated and remedial action taken.

The Landscape Design and Restoration Plan (Section 11.26), Soil Salvage and Handling Plan (Section 11.3), and Reclamation and Closure Plan (Section 3.17) provide specific information regarding Post-closure phase activities relevant to the explosives facility and associated infrastructure.

11.11.5 Monitoring

Storage facilities for explosives will be inspected regularly for leaks or non-compliance with policies, plans, and procedures. Inspections will include tanks, pipelines, connections, valves, gauges and meters, sumps and separators, and inventory records. Inspections will be recorded in a systematic manner and such records will be maintained at the explosives facility in accordance with KAM recordkeeping standards. Blast noise levels will also be monitored as described in the Noise Management Plan (Section 11.22).

Manifests for delivered explosives components and products will be reviewed by the appointed contractor to ensure that all explosives and related materials are accounted for. Similarly, magazine inventories and logbooks will be maintained and any deficiencies reported to the Mine Manager or appointed designates immediately. A detailed description of the inventory system is provided in Section 11.11.4.

In the event of upset conditions related to explosives, the Emergency Response Plan Coordinator described in the Emergency Response Plan (Section 11.14) will launch an investigation of the incident. Together with the Emergency Response Planning Committee, key members of the explosives contractor, KAM management team, and relevant health and safety personnel (as appropriate), a joint incident investigation and root cause analysis will be undertaken. The findings of the investigation will serve to modify the Explosives Management Plan if the investigation shows that shortcomings pertained. Such modifications will be subject to the regular annual review of the plan, to ensure optimal effectiveness.

11.11.5.1 Work Planning and Schedule

The Health and Safety Manager will communicate the performance objectives and protection measures related to the management of explosives to all Project personnel that have a direct or indirect influence on such management during the Construction, Operation, Closure, and Post-closure phases. Communication of the performance objectives and their acceptance as performance indicators by responsible individuals will be recorded. Performance against the indicators will be tracked and reported annually, during the scheduled annual review of the Explosives Management Plan.

Personnel with specific responsibilities relevant to the management and use of explosives will be properly certified as competent persons. All employees will be made aware of the general issues and concerns surrounding the use of explosives as part of their routine environment, health and safety induction and training.

11.11.6 Reporting

11.11.6.1 Reports

Routine reporting according to a schedule of monitoring inspections will be undertaken by KAM as well as the explosive contractor in a co-ordinated and structured manner such that the storage and use of explosives can be accurately tracked. Inspections will cover the explosives facility, as well as related documentation such as inventories, manifests, and logbooks, and such documentation must be reconciled on a daily basis. The frequency of scheduled inspections will be dictated by the relevant policies, plans, and procedures, and the maintenance and auditing of the inventory system described in Section 11.11.4 will receive particular attention.

The Explosives Handling Plan will be subjected to review to ensure optimal effectiveness. Where required, reports will be forwarded to relevant government agencies as stipulated by regulations and licences, as reflected in Table 11.11-1.

Table 11.11-1. Reporting Summary Table

		Report Submitted to	
Report Type	Report Frequency	Provincial Regulatory Agency	Federal Regulatory Agency
Review Report	Annual	BC Ministry of Energy and Mines	

Where explosives-related emergency or spill incidents occur, these will be reported per the requirements of the Emergency Response Plan (Section 11.14) and Spill Contingency Plan (Section 11.16).

11.11.6.2 Reporting Responsibilities

The explosives contractor manager will be responsible for monitoring and reporting on the management of explosives, with oversight from KAM. The Health and Safety Manager for the Project will be responsible for reporting any discrepancies in the inventory and ensuring that overall site performance objectives and protection measures are achieved.

Appropriately qualified personnel will be employed throughout the life of the Project to supervise, direct, monitor, and implement the management actions required by this Explosives Handling Plan.

11.12 RISK MANAGEMENT PLAN (ACCIDENTS AND MALFUNCTIONS)

11.12.1 Purpose

The purpose of the Risk Management Plan (the Plan) is to ensure that accidents and malfunctions scenarios identified as part of the environmental assessment process continue to be proactively managed through the life of the Project (Construction, Operations, Decommissioning and Closure or Post-closure phases). Through its health/safety management systems, KAM will need to manage many more risks than the specific scenarios identified in the Application/EIS (which focusses on worst-case failure modes with the potential for impacts to the environment). Thus this plan is intended to be high level, such that it can fit within larger systems developed for the Project.

This plan is intended to support proactive management of the accidents and malfunctions scenarios described in Section 17.6. The management of Natural Hazards such as terrain stability, flooding and seismic events and the associated risk to Project facilities and personnel is described in the Natural Hazards Management Plan (Section 11.13). Preparedness planning for appropriate response in the event that a failure mode should occur is addressed through other plans, including the Spill Contingency Plan (Section 11.16) and Emergency Response Plan (Section 11.14).

The plan directly supports KAM's commitment to Zero Harm to the environment, made through the KGHM International Environmental Policy (November 1, 2012; KGHM 2012), and is a component of the Project's Environmental Management System (Section 11.1).

11.12.2 Performance Objectives

The formulation of performance objectives for the Risk Management Plan recognises the array of accidents and malfunctions scenarios relevant to the Project, as summarised at the end of this section. The accidents and malfunctions scenarios have been subjected to assessment of potential environmental effects at three levels of evaluation, namely a Failure Modes and Effects Analysis (FMEA) covering all Project activities and components except failure of the tailings storage facility (TSF), a Potential Failure Modes Analysis (PFMA) of the TSF and related impoundments, and an evaluation of potential downstream effects associated with the inundation models applied in the PFMA. A methodological analysis has thus been applied that includes an estimation of the probability, potential magnitude, and consequences of accidents and malfunctions associated with the Project.

The performance objectives of the Risk Management Plan comprise the following:

- major risks are identified early in the project life-cycle and that risk identification continues through all phases of the Project, i.e., Construction, Operation, Decommissioning and Closure or Post-closure phases;
- formulating, applying, and monitoring the performance of, training and awareness programs that establish and maintain a culture of risk prevention among personnel;
- formulating, applying, and monitoring the performance of, emergency preparedness and other relevant management plans that serve to protect the environment, personnel, and the public in case of Project-related accidents and malfunctions; and

- applying risk reduction, loss control and other strategies to minimize the effects on the environment, personnel, and the public in cases where the elimination, avoidance, or transfer of risk is not possible.

The performance objectives of the Risk Management Plan are largely related to early evaluation of possible accidents and malfunctions, and to applying engineering design factors in response to the potential risks identified. The outcome of the FMEA undertaken for the Project included a risk profile for 25 failure modes that were identified as posing medium or high risks. These are described in detail in Section 17.6 and in summary comprised risks collectively related to the following:

- open pit high wall failure;
- overloaded blast holes;
- Peterson Creek Aquifer delineation;
- groundwater seepage post closure;
- Jacko Lake water retention failure;
- mine rock management and slope failure of rock storage facilities (including potentially acid-generating material);
- tailings/reclaim pipeline;
- concentrate, hazardous goods, or fuel truck accident and spill;
- potential release or groundwater seepage of contact water into Jacko Lake;
- failure of collection ponds;
- grassland or forest fires;
- fuel spills and repetitive leaks; and
- failure of the Kinder Morgan pipeline.

The risk register and risk profiles that have been developed through undertaking the FMEA have been incorporated into KAM's internal risk management systems. For the purpose of this Risk Management Plan, only certain risks are believed to require specific environmental protection measures, as described in the next section.

11.12.3 Environmental Protection Measures

The risks of major concern that warrant specific environmental protection measures are failure of the pit wall adjacent to Jacko Lake, and failure of the TSF through dam break and inundation. The proactive/preventative nature of the measures should be recognized, whereas the Spill Contingency Plan (Section 11.16) and Emergency Response Plan (Section 11.14) that appear elsewhere in Chapter 11 are reactive in nature. The specific risks of major concern and preventative measures undertaken as part of Project design are described in the following sections.

11.12.3.1 Design Measures – Pit Wall Failure

While it is not possible to remove all risks, those identified through the FMEA are believed to be typical of the risks associated with similar open pit mining operations. The engineering design of the Project incorporates standard preventive measures to address these typical open pit mining risks.

A unique aspect of the Project worth mentioning in particular is the location of Jacko Lake relative to the Open Pit. The proximity of the Open Pit (at its maximum size) to the lake has raised the risk profile of the pit wall failure scenario, and KAM has consequently undertaken detailed investigations to understand current hydrogeological and geotechnical conditions between the lake and the proposed pit. These investigations are described in the Project Description (Section 3.3 - Geology). As detailed geotechnical monitoring plans are further developed, they will be focused on effectively managing this risk. This failure mode (pit wall failure propagating to Jacko Lake) is not considered credible at the start of Operation, when the pit rim is the furthest from Jacko Lake. The risk will increase through the first few years of Operation as the pit rim advances toward the lake; however, this will be balanced by a robust system monitoring the geotechnical and hydrogeologic conditions and adjustments to the mining operation based on the results of the monitoring programs. The risk will then decrease again during the later stages of the Operation as the IPMRSF is developed, with lower risk conditions carried into Post-Closure. KAM is committed to the development, operation, and closure of the Project in a manner that demonstrably recognizes the environmental, social and cultural values associated with Jacko Lake.

11.12.3.2 Design Measures – Dam Breach and Inundation

A dam breach inundation study has been undertaken that evaluates the possible failure of the TSF in any of the Project phases and to varying spatial extents. The outcome of the PFMA was the identification of several potential dam failure scenarios but none of these qualified as posing significant risks beyond the Project property boundaries.

The TSF design includes several design features that significantly improve embankment stability and protect against downstream slope failures that could lead to a breach. These are:

- a mine rock buttress and/or mine rock storage facility included on the downstream side of the north and east embankments to increase the Factor of Safety against a breach several times higher than the minimum design requirement;
- additional freeboard allowance for Probable Maximum Flood conditions and wave-run up for all stages of dam development;
- an absence of continuous weak layers that could adversely impact dam foundation stability; and
- the supernatant pond located several hundred meters from the dam (post start-up).

11.12.4 Monitoring

Adaptive management techniques will be employed to ensure continual appraisal and improvement for all risk training and awareness, management, mitigation and response plans associated with the

Project. To inform any adaptive management actions that may prove to be required, monitoring of the risk protection measures incorporated in the engineering design of the Project will be undertaken. The envisaged monitoring of the pit wall adjacent to Jacko Lake, and of the structural integrity of the TSF, are described in the following sections.

11.12.4.1 Pit Wall

Active, continuous monitoring of pit wall stability will be undertaken. This will be achieved by constant monitoring of slope stability through a combination of Automated Total Station Networks, Non-reflective Light Detection and Ranging scanning, Slope Stability Radar and/or Global Positioning Systems. Monitoring will be done on a daily basis to allow for real-time identification of stability issues that can be rectified in a timely manner through adaptive management. See further discussion in Section 11.13 (Natural Hazards Management Plan).

An adaptive response will be implemented based on monitoring observations, which will include escalation as appropriate (e.g., reinforcement of wall, evacuation of pit, evacuation of Jacko Lake). The mine plan will be continuously optimized and refined through the Operations phase of the Project to ensure long-term stability.

11.12.4.2 TSF Structural Integrity

Discussion of monitoring at the TSF is provided in Section 11.13 (Natural Hazards Management Plan). Specific factors related to dam breach and inundation, and thus the structural integrity of the TSF, will continue to be better understood once the recommendations for additional site investigation in support of detailed design have been carried out. A Quantitative Risk Assessment of dam breach risk is envisaged and additional mitigation measures will be evaluated for inclusion in the next stage of design.

11.12.5 Reporting

Although unlikely to occur, the severity of an accident or malfunction event would necessitate it being addressed by KAM at the highest level. The President and Board of Directors of KGHM will have the ultimate responsibility for risk management and related reporting, and will direct, instruct, and approve such internal and external reporting accordingly.

The Mine Manager has overall responsibility for the construction and operation of the Project, and responsibility for onsite environmental monitoring and compliance relating to risk management. The Mine Manager reports to the President and Board of Directors and coordinates with the Vice President, Environmental and Regulatory Affairs to ensure that risk management objectives are being met. Reports will be forwarded to relevant government agencies as required by regulations and licences.

11.13 NATURAL HAZARDS MANAGEMENT PLAN

11.13.1 Purpose

The purpose of the Natural Hazards Management Plan (NHMP) is to describe the rationale, framework, strategy, and scope of the plan used to manage and mitigate risks of natural hazards to mine personnel and facilities to be implemented during the Construction and Operations, Decommissioning and Closure, and Post Closure phases of the Project. The NHMP is not intended to meet any specific Provincial or Federal regulatory requirements.

The following natural hazards are covered in the NHMP:

- terrain stability;
- flooding; and
- seismic events.

The NHMP focuses on ensuring the safety of mine personnel and facilities related to risks associates with natural hazards, monitoring the effectiveness of management and mitigation measures, and verifying the predictions completed as part of the effects assessment presented in Sections 6.2 (Geology, Landforms, and Soils) and 17.5 (Effects of the Environment on the Project) of this Application. The NHMP adopts the spatial and temporal boundaries presented in Sections 3 (Detailed Project Description), 6.2 (Geology, Landforms, and Soils), and 17.5 (Effects of the Environment on the Project) of this Application.

The NHMP provides a conceptual level outline of the monitoring design, responsible parties and reporting requirements.

11.13.2 Performance Objectives

The performance objective of the NHMP is to avoid, minimize or control adverse effects on the safety of mine personnel and facilities related to risks associates with natural hazards, by meeting the following:

- identifying and assessing of risks associated with natural hazards and then implementing a hazard management plan based on the hierarchy of:
  - elimination,
  - substitution,
  - engineering controls,
  - administrative controls, and
  - personal protective equipment;
- implementing a monitoring program that meets the Project's personnel and property safety requirements;
- designing a monitoring program that will confirm the conclusions of the effects assessment, including the anticipated effectiveness of mitigation measures; and

- using the results of the monitoring program to adaptively manage adverse effects on the safety of mine personnel and facilities related to risks associated with natural hazards, as needed.

11.13.3 Environmental Protection Measures

Implementation of the protection measures to avoid, minimize or control adverse effects on the safety of mine personnel and facilities related to risks associates with natural hazards will be the responsibility of the Project's Health and Safety Manager, Mine Environmental Manager, General Manager and Mine Operations Manager with delegation of duties to Project personnel as required.

KGHM Ajax Mining Inc. (KAM) is committed to developing the Project to meet or exceed applicable requirements in a manner consistent with industry best practice. This includes proactively implementing proper protection measures so that specific safety needs and interests of mine personnel and facilities are accounted for during Project planning and implementation. As such, the Project is designed to minimize interactions between mine personnel and facilities and natural hazards through mitigation by design, which accounts for terrain stability, flooding and seismic risks.

Very few natural terrain hazards were identified within either the regional or local study areas (see Figure 6-2.4), and greater than 99% of those hazards that were identified were classified as potentially unstable (low risk). For this reason, the Project relies almost exclusively on engineering and administrative controls to abate the risks associated with natural terrain hazards. Mitigation by design (an engineering control) ensures that risks are mitigated by incorporating Factor of Safety (FoS) into the design basis that protect against foreseeable risks by minimizing the Probability of Failure.

11.13.3.1 Open Pit

<u>Terrain Stability</u>

During the Construction and Operation phases, the primary concern related to the Open Pit is stability of the pit walls associated with steepness and material integrity/strength of the exposed rock faces. The pit design selected for the Construction and Operation phases emphasizes reliability and performance while recognizing the relatively short life span of the pit slopes and the high level of monitoring (accuracy and frequency).

The primary concern related to the pit slope configuration is rockfall resulting from slope instability (unloading response, slope dilation, or failure). Based on recommendations made by external consultant SRK, appropriate pit slope design parameters were incorporated (SRK 2014). These design parameters meet industry-accepted FoS design criteria (Read and Stacey 2009). When applied in conjunction with specified slope dewatering activities, overall pit slopes are expected to be stable for the Project's life-of-mine. Bench and berm widths were selected to retain minor rockfalls and prevent further movement down the pit wall.

In the Decommissioning and Closure phase, pit wall stability becomes less of a concern for the safety of mine personnel and facilities/equipment as there will be very minimal activity in the Open Pit coupled with the removal of salvageable equipment. In the Post-Closure phase most of the terrain stability risk is removed by allowing the Pit Lake to form and by precluding access to the Pit Lake with exclusionary measures (such as fencing or berming).

Flooding

During the Construction and Operation phases, the Open Pit will be equipped with a dewatering system with adequate pumping capacity to move the required volume of water from the base of the pit to the central collection pond. As the pit volume increases, it provides increasing storage capacity in order to mitigate potential effects of flooding without risks to worker health and equipment. During the Construction and Operation phases, avalanche risk in the Open Pit is low, as the potential for significant accumulation of snow on the exposed pit walls and benches is low.

In the Decommissioning and Closure and Post-Closure phases, salvageable equipment will have been removed and filling will be encouraged to establish and maintain the Pit Lake.

Seismic Events

Earthquakes have produced small shallow slides and rockfalls in open pits but none on a scale sufficient to disrupt mining operations. For example, large open pit mines located in seismically active areas (such as Papua New Guinea and Chile) have remained stable during and after seismic events up to Richter magnitude of >7. Based on information published by Natural Resources Canada[1], KAM is located in a low seismic hazard region.

11.13.3.2 Tailings Storage Facility

Terrain Stability

Taking into consideration the potential for failure of the Tailings Storage Facility (TSF) dam, the Project has sought to ensure mine personnel and facility safety through mitigation by engineering design. This process relied on the completion of a dam hazard classification in conformance with the Canadian Dam Association's Dam Safety Guidelines (CDA 2007). The dam hazard classification is a multi-step process that first identifies community health and safety risks (including the population at risk and incremental losses of life, environmental and cultural values, infrastructure and economics) and then prescribes design criteria for floods and earthquakes to ensure the protection of these valued components.

The hazard classification for the TSF dam was carried out by considering the potential "incremental" consequences of a dam failure, defined by the CDA as "the total damage from an event with dam failure minus the damage that would have resulted from the same event had the dam not failed." The consequences of failure considered include loss of life, environmental and cultural impacts, and economic loss. The CDA recommended values for design flood and earthquake events based on the dam classification that was determined for any given structure.

An EXTREME dam hazard classification, which is the most conservative classification available, was assigned to the design of the TSF dam for all phases of the Project to ensure that the structure maintains its integrity under the most extreme foreseeable conditions. The TSF embankment design

[1] Refer to online hazard maps and databases located at www.earthquakescanada.nrcan.gc.ca.

incorporates appropriate FoS to satisfy the requirements of an EXTREME consequence dam safety classification.

An additional safety measure to ensure the stability of the TSF's North and East Embankments is the buttressing of these structures with the West and South Mine Rock Storage Facilities (WMRSF and SMRSF), respectively. These two MRSFs, which are larger than the respective embankments reinforce the dam structure as a buttress that was already designed to meet the requirements of an EXTREME consequence dam safety classification.

During Operation, Decommissioning and Closure, and Post-Closure phases typical erosion control measures including runoff collection ditches, energy dissipaters, sediment traps, slope drains, surface roughening, filter bags, water bars, diversion structures, silt fences, sediment basins, temporary seeding, and mulching will be relied on to maintain the integrity of the structure.

Stability analyses of the current TSF design (Norwest 2015) were carried out with the computer program Slope/W, which uses the limit equilibrium method of slices to calculate the FoS in two dimensions. FoS is specified using Spencer's Method to solve for force and moment equilibrium. Cross-sections were developed through the highest portion along each of the TSF embankments for use in the two dimensional stability models. Starter dam and ultimate embankment configurations were analyzed. The starter dam only applies to the north embankment as the other embankments are not required until later production years. The starter dam was analyzed with a water elevation equivalent to the startup water volume of approximately 2 Mm^3. The ultimate dam heights were also analyzed for all of the TSF embankments with tailings at the maximum storage elevation. All four cross sections for each embankment exceed the minimum FoS requirement for both static and pseudo-static conditions (i.e., end of construction and long term). The results of the analysis are presented in Norwest 2015.

Flooding

An Inflow Design Flood (IDF) was selected based on the dam hazard classification and potential consequences of failure, as outlined in the Dam Safety Guidelines (CDA 2007). For an EXTREME dam hazard classification, the IDF which was used as a design criterion was the Probable Maximum Flood (PMF) event, calculated as the 24-hour Probable Maximum Precipitation (PMP) plus the 1-in-100-year snowpack minus the average annual snowpack. The TSF capacity was determined on the basis that it can contain the tailings, supernatant pond, and the IDF while maintaining a 2-metre freeboard allowance for wave run-up and embankment settlement at each stage of Construction and Operation. During Closure, ponded water in the TSF will be pumped to the Open Pit. The tailings surface will be covered and recontoured with an earth fill cover to minimize ingress of surface water and to pass runoff (upon meeting water quality requirements) into an engineered channel towards the south of the TSF and into Humphrey Creek. This dry closure option will be designed to minimize ponded water within the TSF footprint and infiltration into the tailings in perpetuity.

Seismic Events

The design earthquake considered for EXTREME (dam safety) conditions was the Maximum Credible Earthquake (MCE) with a Peak Ground Acceleration (PGA) of 0.34 g and an annual exceedance probability of 1/10,000 years. By incorporating this seismic design criterion it is expected that the tailings dam and appurtenances will remain functional and any damage from the occurrence of earthquake shaking would be easily repairable and that limited deformation of the tailings dam would be acceptable provided that the overall stability and integrity of the TSF was maintained and that there was no release of stored tailings or contact water.

11.13.3.3 Mine Rock Management Facilities

Terrain Stability

The slope stability analyses for the MRSFs followed the recommended approach presented in the Mined Rock and Overburden Piles - Investigation and Design Manual Interim Guidelines (BC MWRPRC 1991). The BC MWRPRC guidelines provide recommendations for stability assessments of the MRSFs. These guidelines include a Dump Stability Rating (DSR) scheme. The DSR system provides a semi-quantitative method for assessing the relative potential for instability and recommends the appropriate level of investigation and design. This is based on individual point ratings for each of the main factors affecting dump stability. Each factor is given a point rating based on qualitative and/or quantitative descriptions accounting for the possible range of conditions. An overall DSR is calculated as the sum of the individual ratings for each of the various factors. The DSR scheme was used to classify the three MRSFs and the overburden and topsoil stockpiles. The MSRFs were classified as Low to Moderate Hazard facilities.

Slope stability analyses for the Mine Rock Storage Facilities (WMRSF, SMRSF, and EMRSF) were carried out for final design heights, end of construction and Post-Closure conditions. The stability analyses for the Mine Rock Storage Facilities were carried out for static and pseudo-static conditions using the limit equilibrium computer program SLOPE/W. FoS were calculated using the Morgenstern-Price method of analysis. The calculated FoS for both static and pseudo-static analyses for each MRSF at each phase exceeded the required minimum FoS.

Flooding

There are no flooding issues expected to be related to the MRSF. Stormwater will be managed as outlined in the Water Management and Hydrometric Management Plan (Section 11.7) and the Sediment and Erosion Control Plan (Section 11.2).

Seismic Events

Seismic loading was modelled by performing a pseudo-static analysis for the 1-in-475-year earthquake event as recommended by the BC MWRPRC guidelines. The pseudo-static analysis applies a horizontal force (seismic coefficient) to the model to simulate earthquake loading. The 1-in-475-year earthquake corresponds with the peak ground acceleration (PGA) of 0.10 g for class C/D conditions. A seismic coefficient of 0.05 was adopted for the pseudo-static analysis, which is equal to one-half the peak ground acceleration as commonly used in embankment stability analyses. The minimum required FoS of for pseudo-static analysis is 1.1. Satisfying this requirement implies that the 1-in-475-year earthquake event would result in deformations much smaller than 1 m. These deformations are acceptable and do not affect the integrity of the facilities. The pseudo-static analyses were conducted for end of Construction and Post Closure conditions.

A deformation analysis was also completed for the MSRFs to estimate the potential deformations resulting from a 1-in-10,000-year earthquake event for Post-Closure conditions (no excess pore pressures). The 1-in-10,000-year earthquake corresponds with a PGA of 0.34g for site class C/D, and has a design earthquake magnitude of 7.3.

Potential deformations resulting from the 1-in-10,000 year earthquake were calculated using the Newmark (1965), Makdisi and Seed (1977), and Bray (2007) methods, and are predicted to be less than 10 cm. Potential crest settlements under seismic loading were estimated to be less than 40 cm using the Swaisgood (2003) method. Deformations resulting from the 1-in-475-year earthquake would be even smaller. The earthquake loading would have negligible impact on the integrity of the stockpile and little, if any, impact on other mine site facilities.

11.13.3.4 Other Areas

Terrain Stability Mapping was used to describe the predicted response of the terrain to timber harvesting/vegetation stripping at proposed sites for infrastructure development throughout the Project Area. The Terrain Stability Mapping indicated that the majority of the Study Areas are 'stable', having a 'negligible' to 'low' likelihood of landslides in relation to mine construction disturbance (see Section 6.2). No areas of 'unstable' terrain were identified at the proposed mine facility sites. There are generally only small, isolated areas of 'potentially unstable' terrain within the footprints of the proposed mine facilities. No areas of 'potentially unstable' natural terrain were identified along the route of the Water Supply Pipeline. The Transmission Line alignment crosses local areas of 'potentially unstable' terrain comprising the incised side slopes of Peterson Creek. These areas of 'potentially unstable' terrain do not represent a significant risk to the safety of mine personnel and facilities.

11.13.4 Monitoring

Stability monitoring is a key component of the protection strategy to mitigate the risk to the safety of mine personnel and facilities. Stability monitoring will be the responsibility of the Project's Health and Safety Supervisor, Mine Environmental Supervisor, and Mine Operations Manager, with delegation of duties to Project personnel. As required, individuals that complete the monitoring will be suitably qualified professionals.

For the Open Pit, the slope stability will be constantly monitored through a combination of Automated Total Station Networks, non-reflective LIDAR (Light Detection and Ranging) scanning, Slope Stability Radar (SSR), Global Positioning System (GPS), and vibrating wire piezometers. The Automated Total Station Networks and SSR will enable real-time monitoring, which can be alarmed to provide immediate indication of possible slope instability. Used in conjunction with a calibrated trigger-action-response-plan (TARP), exceedance of established triggers levels (based on slope velocities) will enable an appropriate response.

For the TSF and the MRSFs, geotechnical instrumentation will be installed along planes through the TSF Embankments. The instrumentation will be installed during Construction and monitored over the life of the Project. Geotechnical instrumentation is anticipated to include vibrating wire piezometers, slope inclinometers, and surface movement monuments, and installed in the foundations, embankment fill, and on the embankment crests. Instrumentation monitoring will be completed routinely (monthly) during Construction and Operation. Measurements during Construction will be taken and analyzed on a routine basis to monitor the response of the embankment fill/mine rock and the foundation from the loading of the embankment fill/mine rock. The frequency of monitoring for piezometers and inclinometers may be decreased once effects from initial construction have dissipated. Surface monuments will be surveyed at the frequency specified in the *Mines Act* permit.

11.13.5 Reporting

Reporting for the stability monitoring program will be internal to the Project and the reports are required to be distributed to the Health and Safety and Environmental departments. Reporting for the stability monitoring program will also be distributed to the Ministry of Energy and Mines as specified in the Mines Act Permit.

11.14 EMERGENCY RESPONSE PLAN

11.14.1 Purpose

The purpose of the Emergency Response Plan for the proposed Ajax project (the Project) is to provide the initial framework for the proponent, KGHM Ajax Mining Inc. (KAM), to manage emergencies during the various phases of the Project, by outlining the response procedures and preventive measures for achieving effective management of emergency situations.

The Emergency Response Plan is intended as a precursor to ensuring that unplanned or episodic events that may have potentially harmful consequences to workers, the environment, or mine property are responded to in a timely and efficient manner, thereby containing and mitigating such consequences.

An emergency is a situation that immediately threatens the well-being of persons, the environment, or mine property, to the extent that a controlled and coordinated response is required. Note that this Emergency Response Plan does not include the management of accidental spills including those of hazardous materials. These are dealt with separately in the Spill Contingency Plan (Section 11.16).

This Emergency Response Plan addresses three levels of response in an emergency situation, namely containment, notification, and mobilization. It outlines the common set of practices that enable employees to act in an organized and efficient manner when responding to an emergency situation. The premise of the plan is that employees must first ensure their own safety, and then contain the emergency as quickly as possible. If unable to contain the emergency, a series of escalating responses will be initiated.

Note that a Risk Management Plan that addresses identified accidents and malfunctions scenarios is provided in Section 11.12 of this chapter. The Risk Management Plan reflects a proactive approach to identifying and reducing risks of major concern, whereas this Emergency Response Plan is designed to ensure KAM is prepared for quick and appropriate response in the event of an emergency situation.

11.14.2 Performance Objectives

The objectives of emergency response planning generally are to provide:

- guidance for personnel, such that they are able to respond efficiently to an emergency situation;
- a common set of practices and procedures that allow for the orderly governance of the various activities needed for responding to an emergency situation, and scheduled reviews of such practices and procedures;
- a means of appropriately engaging with authorities and communities in the event of an emergency, such that their interests may be protected or their assistance elicited;

- assistance to responsible personnel in implementing strategies for early containment and control of an emergency situation, with the ultimate intention of ensuring that the post-mitigation effects of an emergency are not significant; and
- a common set of training protocols and material for all personnel that have emergency response performance commitments.

A premise of the plan is that emergency situations should be prevented, or responded to and contained very quickly if they do occur. Therefore, formulating procedures that address the complete array of possible emergencies will be a vital informant in the avoidance of such emergencies. The importance of appropriate training of personnel, together with the provision of purpose-designed equipment, is clear.

Insofar as performance objectives are concerned, it is worth noting that emergency response plans are required for all mines in British Columbia, according to the Health, Safety and Reclamation Code for Mines in British Columbia (BC MEMPR 2008), which is empowered under the *Mines Act* (1996b). The Health, Safety and Reclamation Code requires, in summary, that:

- the Mine Manager develops and maintains such a plan and is responsible for ensuring that sufficient resources in the form of people, equipment, and facilities are available to respond to emergencies;
- the Mine Manager is responsible for providing training to all personnel involved in emergency operations;
- in situations where mine rescue personnel need to be deployed at a mine, the mine rescue teams come under the direction of the Mine Manager, unless otherwise directed by the Chief Inspector of Mines; and
- the Mine Manager carries the financial responsibility for all costs related to establishing, equipping, operating, and maintaining mine rescue teams, as prescribed by the Chief Inspector of Mines.

11.14.3 Emergency Preparedness Measures

The BC MEM has published a guideline titled *Mine Emergency Response Plan: Guidelines for the Mining Industry* (BC MEMNG 2012), that requires an emergency response plan to include the following elements:

- Policy Directive;
- Mine Emergency Response Plan Coordinator and Planning Group;
- Emergency Identification, Prevention, and Protection;
- Emergency Notification Plan;
- Emergency Management Organization for Incident Command;
- Emergency Operations Centre;
- Duties and Responsibilities of Personnel;

- Mine Emergency Response Procedures;
- Action Plans;
- Mine Plan;
- Evacuation Plan and Map of Escape Routes;
- Check-in/Check-out Procedure for Emergency Operations;
- Mine Rescue Equipment Inventory;
- Mutual Aid Agreement;
- First Responders Consultation;
- Communication Services;
- System for the Dissemination of Information;
- Training Plan;
- Practice Session Plan;
- Plan for Review and Updating; and
- Costs.

Other source documents that provided guidance in the compilation of this Emergency Response Plan include the *Guidelines for Preparing Contingency Plans for Carriers of Hazardous Waste* (BC MOE 2011), *Emergency Preparedness and Response* (WHSCC 2010), *Environmental Emergency Plans Implementation Guidelines* (EC 2004), and *Spill Reporting Regulation* (B.C. Reg. 376/2008).

The following sections describe how KAM will address these requirements in the more detailed Emergency Response Plan to be developed during the application and permitting process per the *Mines Act* (1996b) and that will evolve as the Project progresses through the Construction, Operations, Decommissioning and Closure, and Post-Closure phases. Besides the guidelines referred to above, requirements of the Chief Inspector for Mines and the British Columbia Fire Code (B.C. Reg. 263/2012), inter alia, are also described below. These address mine rescue, firefighting, first aid, evacuation, power failure, road closure, and water and tailings management failure.

This Emergency Response Plan describes the purpose-designed actions that are envisaged to:

- ensure the safety and well-being of personnel, the environment, and property;
- identify evacuation routes and muster station locations;
- ensure effective communication between personnel and the emergency team;
- ensure that procedures exist to respond to, intervene in, stop, or limit the emergency situation;
- initiate response procedures and follow-up programs for emergencies; and
- ensure when occurrences are investigated, root cause determination and mitigation measures are implemented to prevent reoccurrence.

It should also be noted that KAM currently maintains emergency procedures, including an "Emergency Response Site Action Plan" (KA39-KGHM-SPP-000032, February 24, 2014).

11.14.3.1 Policy Directive

The Emergency Response Plan will indicate the linkage with KAM's environmental policy (KGHM International Environmental Policy, November 1, 2012; KGHM 2012) outlining the support of the plan, since their first priority is the health and safety of workers and the public. Other priorities are to protect the environment, avoid adverse social and economic effects, and preserve heritage resources.

The Emergency Response Plan for the Project will be a key element in meeting KAM's environmental policy and priorities. While every effort will be made throughout the life of the Project to prevent emergencies, the Emergency Response Plan will ensure that the Project is resourced with appropriate equipment, procedures, and trained staff to respond quickly and effectively to every potential event throughout the life of the Project.

The Mine Manager will be ultimately responsible for the Emergency Response Plan, and will appoint an Emergency Response Plan Coordinator and an Emergency Response Planning Committee. Committee members will comprise responsible management and operational personnel, in accordance with the BC MEM guideline (BC MEMNG 2012). The Mine Manager will ensure that the Project budget addresses the requirements of the Emergency Response Plan and related training.

KAM has developed a number of other plans as part of the Application/EIS submission that are applicable to emergency situations, namely:

- Erosion and Sediment Control Plan;
- Metal Leaching and Acid Rock Drainage Management Plan;
- Air Quality Monitoring and Dust Control Plan;
- Water Management and Hydrometric Monitoring Plan;
- Fisheries And Aquatic Life Monitoring Plan;
- Contaminated Sites Management Plan;
- Solid Waste Management Plan;
- Hazardous Waste Management Plan;
- Explosives Management Plan;
- Risk Management Plan;
- Natural Hazards Management Plan;
- Fire Hazard Abatement Plan;
- Spill Contingency Plan;
- Transportation Management Plan;
- Access Management Plan; and

- Noise Management Plan.

11.14.3.2 Emergency Response Plan Coordinator and Emergency Response Planning Committee

The Health and Safety Manager for the Project will act as or designate a person to act as the Emergency Response Plan Coordinator. The Emergency Response Plan Coordinator will be a key member of the Project Management Team and will have the full support of the operating company to successfully implement the Emergency Response Plan. The Emergency Response Plan Coordinator will engage the Emergency Response Planning Committee in the development of a comprehensive plan, and in the regular review of that plan to ensure optimal effectiveness.

The Emergency Response Plan Coordinator will engage with Aboriginal Groups and other interested community groups in the initial development of the plan, and in the regular review process throughout the mine life. Engagement will, at minimum, include hosting meetings to present the current version of the plan, to report on any outcomes or significant revisions, and to receive comments/questions. Responses received during these meetings would be used to inform further updates to the plan, particularly in relation to communications and reporting protocols.

11.14.3.3 Emergency Identification, Prevention, and Protection

The Emergency Response Plan Coordinator and the Emergency Response Planning Committee will examine possible scenarios for each area of the Project, together with the possible means of prevention and protection, and the actions to be taken. The pre-planning exercise will be reviewed periodically as conditions change over time and possible emergency situations might include the following:

- Fire (electrical/mechanical);
- Storage dams or seepage pond discharges;
- Unexpected/unplanned explosions;
- Aircraft/ground vehicle accidents;
- Non-life and life threatening injury or fatality;
- Flooding/snow storm/blizzards/ice storms; and
- Natural disaster, etc.

Initially, all areas and processes of the Project will be inspected to determine the risks associated with the work environment, including fires, explosions, falls of ground, runs of muck, inrushes of water, and pit wall failure. Each contractor working on the Project will be required to develop plans that comply with the Health, Safety and Reclamation Code (BC MEMPR 2008) for the work that they are performing. The Emergency Response Planning Committee will also consider uncommon and unlikely events, such as earthquakes, bomb threats, and sabotage. A risk register will be documented and maintained for the Project, which identifies credible threats and risks and the controls established to address them.

The Emergency Response Planning Committee will review mitigation designed to prevent emergency events from occurring and reduce the adverse effects of such events. The review will assess the effectiveness of the mitigation and consider alternatives where necessary. The Emergency Response Plan Coordinator will engage supervisors and workers in the identification of hazards and the development of prevention and protection measures.

The Emergency Response Planning Committee will confirm the appropriateness of training and procedures, safe working practices, housekeeping programs, and first aid training to help prevent a minor emergency from becoming a crisis or a disaster.

11.14.3.4 Duties and Responsibilities of Personnel

The job titles of key emergency personnel with their corresponding duties and responsibilities will be comprehensively described in the Emergency Response Plan.

11.14.3.5 Emergency Notification Plan

The Emergency Response Plan will include a procedure to notify required personnel to support the efficient notification or call-out of key individuals in the event of an emergency.

11.14.3.6 Emergency Management Organization for Incident Command

Per the BC MEM guideline, the Emergency Response Plan should establish an Emergency Management Organization under the Incident Command System consistent with the BC Emergency Response Management System (BC MEMNG 2012), to enhance the ability to integrate with other first responders and agencies involved in an emergency situation. This consistency will allow for reduced communication error, clear definition of roles, and a defined chain of command.

11.14.3.7 Emergency Operations Centre

An emergency operations centre will be established and its location will be carefully selected for ease of access and communication. The location and telephone numbers will be identified in the Emergency Response Plan and posted prominently throughout the Project.

11.14.3.8 Mine Emergency Response Procedures

The Emergency Response Plan will address the three levels of response in an emergency situation, namely containment, notification, and mobilization.

<u>Containment Level</u>

Containment Level is the initial step in the effort to control an emergency and exists from the moment a problem is discovered until emergency response personnel are notified. The steps in the Containment Level include discovery and reporting of the problem, monitoring the situation, and early and immediate action. The goal at this level will be for on-site personnel to follow concise emergency response procedures immediately.

Major events such as pit wall collapse will result in an immediate escalation to Notification Level.

Notification Level

The Notification Level will start when management decides outside help is needed to handle a situation or additional notification is necessary. Action will be taken immediately to minimize hazards to all persons and to get assistance as efficiently as possible. If an emergency occurs, managers will notify their own personnel of the hazards and, if required, get them to safety and notify key personnel in order to activate the emergency response procedures contained in the Emergency Response Plan. The procedures to be followed will be clear and concise to avoid confusion or delays.

All supervisors and persons named in a notification process will be trained in how to initiate the Notification Level. Normal operating procedures cease to apply during the Notification Level. The notification level procedures will be kept simple and will contain only those names absolutely required.

Mobilization Level

The Mobilization Level will take effect when the emergency operations centre has been established and senior management has assumed direction of emergency operations. All key persons will report to the emergency operations centre upon arrival at the Project. The Mine Manager or a designate (e.g., the Emergency Response Plan Coordinator) will assume the role of incident commander on arrival.

11.14.3.9 Action Plans

The emergency response procedures will serve as action plans and will be developed in a concise fashion for each potential emergency, to ensure that supervisory and other personnel have an understanding of the duties and responsibilities and are aware of the tasks needed to control the particular situation.

Based on a thorough assessment of the levels of response required, action plans will be written and assigned to those responsible for their execution. The action plans will typically contain the following types of information and documents:

- copies of all documents for recording events;
- lists of emergency support groups with names of contacts and telephone numbers (e.g., police department, fire department, ambulance service, doctors and medical specialists, paramedics, hospitals, and transportation services such as airlines, air charters, and helicopters);
- list of mine rescue equipment available on site, to include BC MEM recommended items;
- list of specialized equipment and where it can be obtained, e.g., lifting bags or hydraulic jacks;
- list of BC MEM contacts and other key provincial personnel contacts and BC government resource agencies;
- list of key Canadian federal contacts;
- list of key community and First Nations contacts; and

- list of special consultants, technical advisors, and contractors.

11.14.3.10 Mine Plan

The Emergency Response Plan will include a copy of the physical layout of the Project (mine plan as per Part 3.7.11 of the Code; BC MEMPR 2008) and maps covering all surface operations, including site and access roads and utility supply lines.

11.14.3.11 Evacuation and Evacuation Plan

Safe evacuation procedures for the Project will be developed and posted in conspicuous places. Each employee will be instructed in the evacuation procedures and will be familiar with the emergency escape routes from the Project. An emergency warning system will be implemented, and drills conducted at least every 12 months to ensure that all employees can recognize the evacuation warning. Reports of these tests will be documented, retained and reviewed by KAM's mine management.

The Mine Manager will implement a system to account for all of the persons on the Project property. This system will facilitate the early determination of any missing persons in the event of an emergency. A written copy of this system will be available for inspection.

In a severe emergency (e.g., because of danger from a major earthquake or wild fire), the entire Project property might need to be evacuated. A specific Project evacuation plan will be developed that includes procedures for plant shutdown and other protection measures. Transportation requirements will be included in the plan.

An evacuation plan that includes a map of escape routes will be prepared. The evacuation plan will be consistent with the current mine plan as per Section 11.16.3.10 above.

11.14.3.12 Check-in/Check-out Procedure for Emergency Operations

A check-in/check-out procedure for emergency operations will be established.

11.14.3.13 Mine Rescue Equipment Inventory

Per the BC MEM guideline (BC MEMNG 2012), a mine rescue equipment inventory list should be compiled and kept current, and submitted to the BC MEM Emergency Preparedness Committee in Victoria via the Regional Inspector.

11.14.3.14 Mutual Aid Agreements

The Project will investigate the practicality of establishing customized mutual aid agreements with other first responders operating in the region, including other mine rescue teams. For instance, the Projects' emergency service will work with the Thompson-Nicola Regional District, City of Kamloops and the nearby New Gold Mining New Afton mine, to provide a cooperative emergency response plan. KAM will have on-site security to ensure that public access is restricted and to assist off-site emergency.

11.14.3.15 First Responders Consultation

To ensure that first responders are prepared to respond to a mine emergency, the Mine Manager will consult with identified agencies to provide a copy of the Emergency Response Plan and current Project plans, including an up-to-date map identifying appropriate and safe route(s) of travel to the Project. A review of any hazards that may affect first responders will also be provided.

11.14.3.16 Communication Services

The Emergency Response Plan will require the establishment of an emergency communication system to ensure:

- the flow of information, including all orders, reports, and assignments during the entire operation;
- timely assessment of changing conditions;
- timely transmission of reports used to monitor conditions and actions; and
- command officials have the ability to keep track of available personnel, resources, and services.

The Emergency Response Plan Coordinator will identify personnel who are knowledgeable in the operation and maintenance of communications technology and will appoint a staff member to assume coordination of communications. Additional personnel will be assigned as backup support.

The communications coordinator will be responsible for:

- evaluating the envisaged communications system and assessing its capacity for handling calls during an emergency;
- determining and selecting the technical and logistical components of the emergency communications system;
- developing backup and alternative means of communication;
- establishing a policy governing the authorized use of communications systems at peak periods of an emergency;
- identifying and selecting personnel to activate the communications system and to check to ensure it is operating;
- setting up a rotation schedule and confirming the assignment of personnel who will monitor and record all communications during each shift; and
- establishing a standardized system for recording calls, messages, and information.

11.14.3.17 System for the Dissemination of Information

KAM will have a formal communication plan in place in the event of a serious or fatal incident. The plan will follow established protocols for communicating to the public about incidents. A designated media spokesperson will be assigned and lead the dissemination of information, per the Mining Association of Canada's "Towards Sustainable Mining" Crisis Management Planning

Assessment Protocol (MAC TSM 2014). Specifically, families of those affected will be informed as early as possible and prior to any media releases. The names of the people affected will not be released publicly until they have been rescued or recovered and authorization from their families has been received.

All outside calls will be directed through the person designated by KAM as responsible for public and media relations. A strategy will be developed for the release of information to the media.

11.14.3.18 Training Plan

The Emergency Response Plan will outline a training plan, particularly for the personnel named in the emergency procedures as well as for the media spokesperson mentioned in Section 11.16.3.17 above.

In general, training sessions should be undertaken in a scheduled manner and such sessions should be provided to:

- all new personnel – on first entry onto the site (together with health and safety training);
- all personnel – an annual refresher course; and
- personnel with specified responsibilities (e.g., the Mine Rescue Team) - not less than eight hours in each three-month period of mine operations.

11.14.3.19 Practice Session Plan

Management will test procedures and evaluate performance of personnel in practice drills on a regular basis to develop and build upon a reliable response system. Drills will cover all actions ranging from the moment of discovery to the marshalling and deployment of emergency response teams, and will consist of setting up the emergency operations centre and establishing communications.

11.14.3.20 Plan for Review and Updating

As frequent revision of the plan is a key element in the program, the Mine Manager will ensure that the Emergency Response Plan is revised and updated at least annually.

11.14.3.21 Costs

The Mine Manager will ensure that adequate funds are provided in the annual Project budget for Emergency Response Plan activities.

11.14.3.22 Mine Rescue

A Mine Rescue Emergency Response Plan will be developed and filed with the Chief Inspector for Mines. The Mine Manager will ensure that there is a fully trained mine rescue team. A mine rescue team will have a normal complement of six workers including a team captain, vice-captain, and coordinator. The team will have a qualified trainer and will practice for not less than eight hours in each three-month period of mine operations. A training logbook will be kept on site. Training will include mine rescue, as well as hazardous materials handling, firefighting, crisis management, and incident command training.

Where the number of people employed in the open pit at one time is:

- more than 25 per shift, the Mine Manager will ensure that there is one fully trained and equipped mine rescue team; and
- between 10 and 25 per shift, the Mine Manager will ensure that there are four persons trained in mine rescue procedures.

During the Construction phase, an emergency response team will be assembled from the site personnel. It will be organized and led by the Health and Safety Manager. Personnel will receive training in:

- first aid;
- firefighting;
- rescue techniques; and
- hazardous material handling and clean up.

The team will be provided with the following emergency equipment, as a minimum:

- protective gear for firefighting and hazardous material handling;
- a fully equipped rescue vehicle;
- dedicated communications devices (hand-held and vehicle-mounted); and
- tools (e.g., axes, shovels, cutters, and saws).

These teams will form the core of the emergency response organization, responsible for rescue and firefighting duties in the event of an emergency.

11.14.3.23 Firefighting

Firefighting equipment will be provided and maintained at locations throughout the Project where fire may endanger life or property. Firefighting personnel will be part of the mine rescue team and a fire truck has been provided in the planned fleet of mobile support equipment. The fire truck will be housed and maintained at the administration building at the process plant for rapid deployment in emergency response situations.

The British Columbia Fire Code will dictate the level of firefighting equipment required. Water systems for fire suppression are incorporated into the Project design. A fresh/fire water tank will be equipped with a standpipe which will ensure that the tank is always holding at least 40 m^3 of water, equivalent to a two hour supply of fire water in the process plant.

Inert gas suppression complete with fire alarms and fire detection will be equipped within the electrical room, control room, and tool room of the process plant. Ventilation in these rooms will be equipped with dual action (fusible link and mechanical actuation) dampers that will close and isolate the room in the event of a fire.

Fire extinguishers for fire suppression, fire alarms and fire detection will be installed in the process plant and other infrastructure on site. All vehicles will be equipped with fire extinguishers.

Fire hazard areas, such as fuelling stations, may be designated as areas where no means of producing heat or flame will be permitted. Such areas will be clearly marked with warning signs. Fire protection facilities including fire extinguishers, smoke and heat detectors, and exterior manual pull stations will be provided as part of the fuelling facility package, and strategically located adjacent to the fuel storage area.

Upon discovering a fire, all employees will be expected to be aware, and capable, of carrying out initial containment measures. These measures will include an attempt to control the fire with the nearest extinguisher, raising the alarm, and seeking assistance. A fire within any enclosed structure will trigger a building evacuation.

In the event that a fire necessitates the evacuation of the open pit, the design of the haulage roads of 35 m width (20 m at pit bottom), including ditches and berms, and a maximum gradient of 10%, will facilitate the egress of personnel.

If there is a wild fire near the Project Site, management will initiate close monitoring of the fire and seek advice from the BC MFLNRO. Key personnel will be put on standby pending an evacuation.

Extreme fire conditions may cause the access roads into the Project to be closed to traffic. This could result in the cessation of operations until such time as the roads are once again passable.

11.14.3.24 Medical Emergencies

Part 3.6.1 of the Health, Safety and Reclamation Code (BC MEMPR 2008) requires that the Mine Manager provides and maintains first aid supplies and services as required by the Workers Compensation Board (WorkSafeBC). During the Operations phase, a first aid station will be equipped and maintained at the administration building at the process plant, where the ambulance for the Project will also be located. All site personnel will be informed of the first aid and medical arrangements and the protocol for activating the emergency procedure. Notices indicating contact details for first aid personnel (or appointed persons), the emergency contact number and/or radio frequency, and the location of first aid kits will be posted around the site.

In the event of medical or related emergencies, any person who discovers someone injured will implement initial response and initiate backup assistance from the appropriately qualified on-site first aid personnel. Exposure to and the consequences of extreme temperatures would qualify as medical emergencies if the physiological effects prove to be severe.

The on-site first aid personnel will implement their protocols to address medical emergencies, providing further care, coordinating uninjured personnel to assist in the response and arrange transfer to other health care facilities as necessary.

If the injured require facilities and services beyond that which can be given on site, they will be evacuated to receive further medical treatment. The nearest major hospital is in Kamloops located approximately 25 km by road from the site and accessible by ambulance. A designated helicopter landing area will be identified at the Project and a specific procedure will be developed for summoning either a road ambulance or provincial air ambulance, dependent on the circumstances.

An accident and injury procedure will be developed that details the actions and record keeping required for minor, serious, and major injuries. In the event of a fatality at a work site, KAM will exercise discretion for, offer counselling to, and consult with family as well as meet all regulatory requirements for notification and scene preservation.

11.14.3.25 Snow Avalanche

Geophysical activity that results in snow avalanche that could pose risk of harm humans to is not expected in the area and none of the Project components are likely to be affected by such an occurrence.

11.14.3.26 Extreme Weather Conditions

When prolonged extreme weather conditions such as cold or poor visibility present health and safety concerns, the risk will be assessed and activities will be curtailed or modified, as appropriate. Work activities that are affected by severe winds will be curtailed as appropriate.

11.14.3.27 Power Failure

The Project will be primarily dependent upon electricity delivered by an overhead transmission line from the provincial electricity grid. This will be by means of a new 9 km 230 kV line on single wooden monopole towers and some H-frame towers that will be constructed from the BC Hydro transmission line 2L265 to the east of the Project area near Knutsford, to the Project's main substation located adjacent to the processing plant.

For construction, a 25kV overhead power line will be constructed from the BC Hydro transmission line along Lac Le Jeune Road to the west of the Project and follow the access and haul road alignments.

Backup power will be provided by diesel or natural gas generators. To reduce diesel use, the preferred approach is to use natural gas-fueled backup generators. The connection to the Fortis natural gas pipeline to the east of the Project will be via a buried pipeline that follows the power line corridor.

11.14.3.28 Mine Access Road Closure

Primary access to the Project will be via the Inks Lake Interchange off Highway 5 and then along the main access road east to the Project Site. During the Construction phase, the Lac Le Jeune Road will provide access to both Highway 5 and Highway 1.

It is possible that sections of the roads may be blocked or otherwise impassable at times, due to floods, washouts, landslides, severe weather (heavy snowfall), or wild fires. If the mine access road becomes impassable, the alternative Lac Le Jeune Road can be used to access the Project. The Project is also currently accessed by small private roads off Goose Lake Road to the south of the Project Area.

During the Construction phase, a road closure would disrupt the delivery of heavy equipment but the alternate route may provide an alternative to allow personnel to be moved in and out of the site. During the Operations phase, a road closure would disrupt the trucking of concentrate off site. In such circumstances, goods and personnel may be able to use the alternative Lac Le Jeune Road route.

Medical or other emergencies may require helicopter support in the case of impassable roads.

11.14.3.29 Missing or Overdue Persons and Vehicles

To reduce the potential for missing persons, personnel will check in regularly and execute proper remote work practices as outlined in KAM's or contractors' health and safety plans. Trucks will remain in contact with dispatch while departing from and enroute between sites. In the event that a truck does not report, the relevant supervisor will be notified and they will investigate and in turn initiate the appropriate emergency response actions. Additional support for rescue operations will be implemented with site personnel and appropriate regulatory authorities as needed.

11.14.3.30 Automobile and Equipment Accidents

Accidents with vehicles and other equipment will be reported to a supervisor as soon as possible to initiate the appropriate emergency response actions. Priority response, if warranted, will be given to necessities of life. After priority issues are resolved, equipment will be removed from service and will not operate until repairs have been made.

11.14.3.31 Wildlife Encounters and Incursions

Bear safety training will be provided to Project personnel as part of site orientation. Specific personnel will be provided with training to monitor and respond to bear encounters. Other wildlife will be avoided and allowed to move unhindered. Wildlife feeding will not be permitted under any circumstances.

Vehicle collisions with wildlife are a possibility and to minimize collisions, personnel will abide by the prescribed speed limits imposed on Project-related traffic. Wildlife fatalities from traffic incidents or other events will be reported to the Project's Environmental Manager who will in turn track such information and make recommendations to prevent further occurrences. Private firearms will be prohibited at all sites.

11.14.3.32 Seismicity

Seismic occurrence training will be provided to Project personnel as part of site orientation. The Government of British Columbia Building Code and the National Building Code will be used for the basis of seismic design of the Project structures.

11.14.3.33 Ground Instability

Incidents relating to ground instability could involve embankment or pit wall collapse, leading to environmental impacts or injuries or damage to equipment or facilities. There will be a focus on incorporating geotechnical knowledge, adequate design and quality installation into all Project facilities. If a situation arises where the risk of geotechnical failure becomes apparent, proactive preventative measures will be taken to address the problem and ensure geotechnical stability is reinstated. In such emergencies, the Mine Manager will be notified so that the necessary response action can be implemented. A qualified professional will inspect the area of suspected failure and will ensure that the area is properly secured and isolated. The incident will be documented and appropriate mitigation and prevention programs developed to limit or minimize subsequent incidents and risks. In the event of an incident, pre-existing preventative measures will be revaluated and updated or adjusted to ensure similar incidents do not occur again.

11.14.3.34 Water or Tailings Management Failure

The likelihood of failure of the pit, TSF, WRSF, berms, diversion structures, and water management ponds to a level that would trigger emergency response is considered 'rare', given that the designs have been carried out by qualified professionals who are particularly experienced with the capabilities of the structures. However, the severity of consequences could be very high, and as such these failure modes are managed as medium- to high- level risks.

Inspections of the facilities, structures and ponds will be conducted following extreme precipitation or runoff events. Any spills will be contained by means of available heavy equipment and mitigated as deemed appropriate. Note that a separate Spill Prevention and Response Plan (Section 11.16) has been prepared for the Project, which also addresses water and tailings management failures.

11.14.4 Monitoring

Given the unpredictable nature of emergency events, pre-emptive monitoring is not practical outside of the inspections carried out as part of the maintenance of the Project in entirety. Reliance will thus be placed on the efficient and comprehensive maintenance of those Project components that pose the greatest risk of accidents or failure. These typically comprise facilities where fire or explosion may occur or areas prone to damage by extreme weather episodes such as floods.

In the event of an emergency incident, and once it has been brought under control, the Emergency Response Plan Coordinator will launch an investigation of the incident. Together with the Emergency Response Planning Committee, key members of KAM's mine management, and relevant health and safety personnel (as appropriate), a joint incident investigation and root cause analysis will be undertaken. The findings of the investigation will serve to modify the Emergency Response Plan if the investigation shows that shortcomings pertained. Such modifications will be subject to the regular annual review of the plan, to ensure optimal effectiveness.

11.14.4.1 Work Planning and Schedule

Work planning and scheduling for Emergency Response Plan activities will largely amount to maintaining a high level of preparedness of both personnel and equipment.

An Emergency Response Plan requires that personnel generally, but particularly those with specified responsibilities, are subjected to purpose-designed training, as described in Section 11.16.3.18 above.

All the equipment provided for safety and emergency purposes will be maintained and serviced according to manufacturers' specifications and be in a state of instant readiness at all times.

11.14.5 Reporting

11.14.5.1 Reports

A report will be prepared for every emergency incident that occurs and on every incident that might have become an emergency if not for timely response. Reports will be forwarded to relevant government agencies as required by regulations and licences. All reports will be reviewed internally by the Emergency Response Planning Committee in order to identify necessary improvements in the emergency prevention and response procedures.

As a minimum, a written incident report will include the following information, as available:

- date and time of incident;
- location or map coordinates if warranted;
- party responsible for the event;
- type of event;
- status of the event;
- photographic record of the event and mitigation efforts;
- factors affecting the event and mitigation efforts;
- corrective action taken or proposed to mitigate incident;
- whether assistance was required and in what form;
- whether the event posed a hazard to persons or property;
- comments and recommendations;
- name, position, and supervisor of person reporting; and
- name, position, and department of person to whom the incident is reported.

11.14.5.2 Reporting Responsibilities

Designated job titles and corresponding responsibilities of emergency personnel will be listed in the detailed plan developed for specific permitting prior to commencement of each phase of the Project.

11.15 FIRE HAZARD ABATEMENT PLAN

Under the BC Wildfire Regulations, industrial operators conducting activities in forest or grassland areas must ensure they are conforming to the *Wildfire Act* (2004), which includes having a current fire hazard assessment. Compliance with the *Wildfire Act* and associated Regulations through the implementation of safe and legal operating procedures is important to improving worker safety, avoiding administrative penalties and costs, and in reducing potentially devastating wildfires and the associated environmental, social, and financial costs.

11.15.1 Purpose

The Fire Hazard Abatement Plan (FHAP) is designed to provide broad strategies for fire hazard assessment and abatement at the Ajax Project (the Project) during the Construction, Operation, Decommissioning and Closure, and Post-closure phases. This document is intended to provide environmentally responsible, realistic and operationally feasible fire hazard assessment and abatement guidance and is based on the principles and methods outlined in the Fire Safety Plan Documentation Guide (Fire Prevention Officer's Association of British Columbia 2013) and the *Wildfire Act* (2004).

11.15.2 Performance Objectives

The broad performance objectives of the FHAP are to:

1. Prevent the occurrence of wildfire through the identification, prioritization, and control of fire hazards on the property.
2. Monitor and evaluate the efficacy of the fuel abatement and fire control measures.

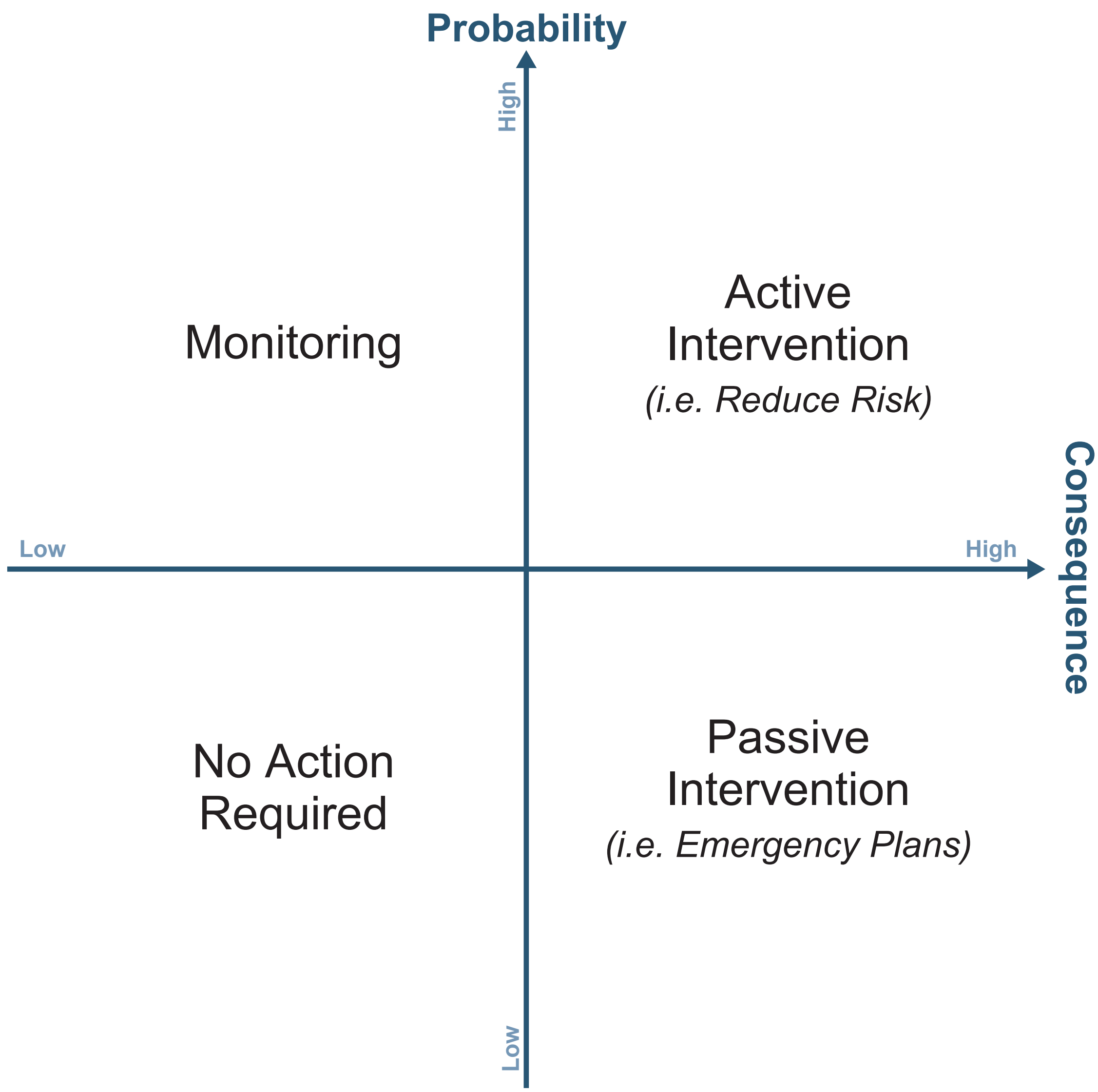
11.15.3 Design Criteria

Decision analysis tools such as the Wildfire Risk Management System (WRMS; Ohlson et al. 2003) or fuels mapping and FireSmart risk assessment principles (Partners in Protection 2008) will be used to aid in hazard abatement planning and prioritization. Fire risk is the probability and consequences of wildfire at a specified location under specified conditions (Ohlson et al. 2003). The intent of the risk assessment is to determine the probability of a fire based on ignition sources, fuel characteristics, site conditions, etc. as well as the consequences of a fire on valued resources, including buildings, occupants, traditional use areas, wetlands, etc. The WRMS provides a summary of the spatial and temporal fire risk at a given site based on available inputs. The WRMS is interactive and can be updated based on available data.The WRMS provides a framework for risk reduction through the identification of cause and effect. This approach has been employed in various fields from wildfire, flood, and ecological risk management (Figure 11.15-1; Sayers, Hall, and Meadowcroft 2002; Ohlson et al. 2003; Blackwell et al. 2004).

Figure 11.15-1 provides a schematic representation of how probability and consequence can help managers develop and prioritize their mitigation strategies. The results of the risk assessment serve to inform Project planning, management, and mitigation strategies to avoid, minimize, and monitor fire abatement and control measures.

Figure 11.15-1

Schematic of Probability and Consequence in relation to Management Strategies



11.15.4 Environmental Protection Measures

Environmental protection measures based on sound ecological principles will be established to avoid and reduce effects to the environment related to the fire abatement activities. Environmental protection measures will be conducted during the Construction, Operation, Decommissioning and Closure, and Post-Closure phases and will include:

- identifying the fuel hazard and fire risk in relation to adjacent resources;
- ensuring fuel abatement activities are coordinated with other management plans including, but not limited to the Emergency Response Plan (Section 11.14), the Air Quality Management Plan (Section 11.6), the Soils Salvage and Handling Plan (Section 11.2), the Fisheries and Aquatic Life Monitoring Plan (Section 11.25), and the Wildlife/Vegetation Monitoring Plan (Section 11.21);
- identifying ecosystems/wildlife habitat with low resiliency to disturbance activities related to fuel abatement measures using resources such as ecosystem mapping, soil mapping units, wildlife habitat suitability mapping, existing environmental monitoring datasets and land use planning documents;
- developing ecosystem-specific fuel treatments for sensitive or unique ecosystems (e.g., grasslands, red and blue listed ecosystems, rare plant and lichen habitat, wetlands, and habitat for species at risk). For example, retaining structural diversity through the retention of snags and multiple canopy layers in old-forests while still reducing fuel connectivity;
- avoiding removal of old forests, which provide multiple ecological functions, such as diverse wildlife habitat, where feasible;
- working with the City of Kamloops to ensure coordination with the principles and goals in the City of Kamloops Community Wildfire Protection Plan (City of Kamloops 2008);
- coordinating with the Wildfire Management Branch to develop advanced planning and to mitigate and manage the consequences of the fires such as power or telephone outages and other threats to critical infrastructure;
- developing a vegetation management program for the powerline to ensure hazard trees are not an ignition source;
- establishing communication procedures between on the ground employees and environmental managers to facilitate timely reporting of any incident or concern during each phase of the Project; and
- providing appropriate education and training for employees and contractors outlining how to safely and effectively reduce fuels on site.

11.15.5 Fire Risk Reduction

Fire risk reduction depends on the combination of reducing ignition sources, using FireSmart building principles that reduce risk of fire to infrastructure, and reducing hazardous fuels in priority zones around infrastructure (Partners in Protection 2008).

To ensure the Project is not at risk from wildfire and reduce potential liabilities associated with ignitions caused by Project activities, the Project will ensure structures are not susceptible to ignition and that potential ignition sources are mitigated. To do this, a fire risk assessment based on FireSmart principles (Partners in Protection 2008) will be undertaken. This will consist of a review of all existing or planned structures to ensure building envelopes are fire resistant, screens and other openings are sufficient to stop embers from entering buildings, and setbacks and other fire prevention tools are adequate.

To reduce risk associated with fuels, an evaluation of fire behaviour based on fuel types, site conditions, and fire weather indices will be conducted prior to application of abatement measures. The existing fuel types and fire risk will be clearly documented by a qualified professional with experience in fuel mapping and management in order to track changes over time and to update management as needed.

Where fire abatement measures are identified as necessary to reduce fire risk, fuel treatment prescriptions will be developed. Fuel treatment prescription are operational plans that identify where fuels must be reduced, the amount and type of fuels, the methods used, and consideration of site constraints such as sensitive ecosystems or species at risk. These must be completed by a qualified forest professional. The focus of the prescriptions will be on the reduction of ignition sources, reduction of hazardous surface fuels, ladder fuels, and aerial or crown fuels on site in order to reduce the probability and severity of potential fires on site.

Surface fuels include all combustible material lying on the soil surface, including forest floors. Fuel reduction focusses on reducing fine coarse woody debris fuels < 12 cm in diameter. These fuels dry quickly, are easily ignitable, and contribute to fire spread rates. Reducing the continuity and amount of fuels is key to reducing surface spread rates.

Ladder fuels are fuels that connect surface fuels to crown fuels. They contribute to fire movement from surface fuels into crown fuels. Ladder fuels are often lower branches in trees or suppressed and intermediate trees that provide continuity between surface and crown fuels.

Aerial fuels are the crowns or foliage, bark, lichens, and branches of live and dead trees. Aerial fuels can be measured by height to live crown (distance to branches above the ground), crown bulk density (the mass of crown present / unit area), and crown closure, which is a measure of continuity between tree crowns and the ease with which fire could move from tree to tree. Reduction of aerial fuels focusses on increasing height to live crown through pruning and thinning trees with low crowns and reducing crown connectivity by thinning from below (remove smaller diameter trees while retaining larger diameter trees).

Fire risk reduction measures will include but not be limited to the following:

- identification of potential ignition sources and development of mitigation measures;
- development of FireSmart Zones (Partners in Protection 2008) around Project infrastructure to guide the assessment of hazardous fuels and guide the development of fuel treatments where necessary;

- conduct a preliminary fuel hazard assessment prior to Construction to determine fire hazard and the need for fuel treatments (hazard abatement);
- map forest and grassland fuel types according to the Canadian Forest Fire Danger Rating System (CFFDRS) fuel types if hazards are identified during the preliminary hazard assessment;
- document hazardous surface fuels if hazards are identified during the preliminary hazard assessment;
- identify sensitive ecosystems or habitat to guide treatment prescription development;
- develop and implement fuel treatment prescriptions, as required, to reduce hazardous fuel types in FireSmart Priority Zones;
- fuel treatment prescriptions and maps should be developed by a qualified professional with wildfire and fuel treatment experience; establish plots to monitor pre- and post-fuel treatments and evaluate treatment efficacy;
- on site water trucks, pumps and hoses;
- vehicles equipped with firefighting equipment such as maddocks, shovels, water cans, and fire extinguishers; and
- personnel trained to respond to a fire incident, including knowledge of fire suppression measures, equipment and procedures on site.

11.15.6 Monitoring

The purpose of the Monitoring Program is to evaluate the efficacy of the fuel abatement measures. Specifically, monitoring will help determine if the stated performance objectives are being achieved and if remedial actions are required. Monitoring frequency will be determined in conjunction with the Wildfire Management Branch pre-construction based upon the results of the wildfire risk analysis for the Project. Monitoring will include a description of the following:

- evaluation of the fire hazard abatement measures in relation to the planned activities for the site;
- evaluation of the effectiveness of the fire hazard abatement measure in relation to the stated performance objective(s) in the fuel treatment prescriptions;
- identification of low resiliency ecosystems that may require monitoring in the subsequent year due to ongoing or proposed future fire related activities;
- assessment of the communication procedures established between site employees and environmental managers to facilitate timely reporting of any incident or concern during as well as recommendations for improvement;
- assessment of the education and training for employees and contractors related to fire hazard management;
- identification and evaluation of any emerging negative environmental trends possibly attributable to the Project as identified by the monitoring program (e.g., increase in the

occurrence of fire, detrimental effects to wetlands, wildlife, etc.); as well as a rationale to probable causes and strategies to address the negative trend.

11.15.7 Reporting

A reporting program will be developed, to include a summary of the following:

- evaluation of the fire hazard abatement measures in relation to the planned activities for the site;
- assess all existing and planned infrastructure to identify susceptibility to wildfire using FireSmart principles and propose mitigation as required;
- identify potential ignition sources and strategies to reduce ignition potential;
- evaluation of the effectiveness of the fire hazard abatement measure in relation to the stated performance objective(s). Effectiveness will be evaluated in terms of adoption of recommended mitigation strategies. Fuel treatment effectiveness will be evaluated using plots to determine if treatment goals, as outlined in the fuel treatment prescriptions have been met;
- summaries of the inventory, treatment measures, and monitoring outlined in this document, including a pre and post photographic record of treatment areas;
- proposed revisions to the FHAP to address emerging negative trends, or to adjust monitoring programs, if required;
- actions taken to improve the program if relevant; and
- reporting will occur after fuel treatment prescriptions have been implemented and a follow-up monitoring report of fuel conditions will be submitted every five years to document current conditions and identify if subsequent treatments are required.

11.15.7.1 Reporting Responsibilities

The Environment Manager will be responsible for ensuring that the Performance Objectives are achieved and reported. Records of inventory, fuel treatment and monitoring activities will be summarized into an annual report. Copies of the forms and reports will be kept at the mine site and will be submitted to Wildfire Management Branch and the Ministry of Energy and Mines as required. Senior personnel and a qualified forest professional will be employed throughout the life of the Project to supervise, direct, monitor, and implement the FHAP.

11.16 SPILL CONTINGENCY PLAN

11.16.1 Purpose

The purpose of the Spill Contingency Plan (the Plan) is to provide KAM workers and contractors with a guideline to respond to an unanticipated discharge or spill of hazardous materials during Project Construction, Operation, Decommissioning and Closure, or Post-Closure phases, in an effective and responsible manner. The Plan identifies lines of authority and responsibility, establishes proper reporting and communication procedures and describes an action plan to be implemented in the event of a spill.

The Plan intends to protect the health and safety of KAM workers and those working on its behalf, and limit the detrimental effects that a spill may have on the natural environment. It directly supports KAM's commitment to Zero Harm to the environment, made through the KGHM International Environmental Policy (November 1, 2012; KGHM 2012), and is a component of the Project's Environmental Management System (Section 11.1).

It should be noted that the Spill Contingency Plan works in coordination with other Project management plans, including the Emergency Response Plan (Section 11.14) and the Hazardous Waste Management Plan (Section 11.10). An integrated approach will be adopted in the implementation of the various environmental management requirements and reporting for the Project.

The information contained in this Plan is presented at a level of detail appropriate for the Application/EIS submission and will be further developed into a more detailed Plan for permitting prior to commencement of each phase of the Project. Spill reporting and response procedures, specific to each stage of the Project lifecycle, will be established during the various Project stages to provide more detailed actions.

A *spill*[1] is a discharge of a hazardous material that is:

- released into the natural environment;
- from or out of a structure, vehicle or other container; and
- abnormal in quality or quantity in light of the circumstances of the discharge.

The materials covered under this Plan and used at the Project include:

- petroleum products (e.g., fuels such as diesel and gasoline, lubricants such as automotive oil, cutting oil, gear oil, hydraulic oil, or other petroleum-based or synthetic oil where the concentration of oil is greater than 3% by weight);
- dangerous goods/materials (e.g., solvents such as acetone, Cleansolv, Petrosol, and Citrusol);
- process water; and
- tailings.

[1] The definition of a spill is a release or discharge into the environment, not authorized under the *Environmental Management Act* (2003).

11.16.2 Performance Objectives

The performance objectives of the Spill Contingency Plan are, generally, to ensure:

- human life is protected and the potential for injury is minimized to the extent possible;
- adverse environmental impacts are kept to a minimum;
- the protection of mine infrastructure and facilities from damage or loss;
- required corporate and regulatory reporting is completed on time and in the prescribed manner; and
- compliance with relevant federal, provincial, and regional legislation and regulations pertaining to spill contingency planning and response.

Additional Spill Contingency Plan performance requirements specific to each phase of the Project lifecycle may be established during those times.

11.16.3 Environmental Protection Measures

The Project uses a mining industry standard approach to spill contingency planning, which includes risk assessment, regulatory compliance, and application of Best Management Practices.

11.16.3.1 Risk Assessment

The analysis of risk to inform the development of management measures is a standard component of spill contingency planning. This analysis will identify all potential on-site and off-site potential spill hazards, and the type of damage that may result. In completing the analysis, it will consider regulatory requirements, high-risk/sensitive impact areas, normal and abnormal operating conditions, the toxicological, physical, and chemical properties of the substances being handled, potential impact on downwind air quality or downstream water quality, and danger to human and animal health. An analysis of risk was undertaken for the Application/EIS as part of Accidents and Malfunctions (Chapter 17.6).

Once the risks are identified, prevention, mitigation, and response measures are identified, which may include ensuring the design safety of new and existing equipment, standard operating procedures, preventive maintenance, operator training, accident investigation procedures, risk assessment for unit operations, emergency planning, and internal and external procedures to ensure that these programs are being executed as planned.

11.16.3.2 Spill Prevention and Response

The preferred manner to deal with spills is first by avoidance through appropriate storage, handling, and transportation measures. The prevention of spills is achieved through initiatives such as:

- facility design incorporates best management practices for spill containment including:
  - all fuel storage vessels will be double walled or include appropriately lined secondary containment with a sump and oil/water separators;

  - double containment of all fuels and dangerous or hazardous materials, with protective barriers where there is potential for impact from vehicles;
  - secondary containment with capacity to accommodate 110% of the largest vessel in the area;
  - individual container shut-off valves where more than one container share a distribution line; and
  - separate storage and sump systems for storage areas of incompatible products;
- documented operational procedures for tasks that have an identified risk, such as fuel handling, explosives manufacturing and handling, and waste management;
- certification of vehicles and drivers for transportation of dangerous goods;
- ensuring that vehicle cargos are adequately contained and secured;
- a high level of preventative maintenance of vehicles, equipment, storage containers, etc.;
- regular housekeeping and environmental audits of facilities to ensure maximum protection is in place;
- fuel levels in tanks will be measured and records of deliveries and dispensing compared as part of a regular capacity audit;
- fuel delivery will comply with all appropriate regulations, standards, and best management practices, including Transportation of Dangerous Goods Regulations (SOR/2001-286);
- fuel transfer procedures will include best management steps to ensure no overtopping of tanks or spillage. In addition, inventories will be tracked regularly to check on any possible losses;
- a risk evaluation program for identifying vulnerabilities and management of improvements; and
- documented inspection schedules and procedures for dangerous goods and hazardous materials stored on site.

The KAM spill response plan sets out the basic mechanisms, organizational structures, responsibilities, and procedures to guide staff in responding to spills. For the plan to be effective, all employees must be made aware of its provisions and their responsibilities under the plan.

In the event of a spill, the following initial response steps will be taken:

- the safety of employees, site personnel, and the public will be ensured;
- the spill material and source of the spill will be identified;
- the necessary equipment and crews to stop, contain, and clean up the spill and rehabilitate the site to protect the environment will be mobilized;
- if safe to do so:
  - measures will be taken to stop the flow;

  - barriers will be constructed with available materials (e.g., snow, earth, or absorbent pads) to prevent the spread of material; in particular, to prevent the spill from entering any watercourse;

- if the material or circumstance is unsafe, the relevant Environmental Manager and health and safety representative will be notified to initiate an Emergency Response Plan;
- immediate hazards associated with the spill material or near the spill (e.g., aromatic substances, flammable material, or ignition sources) will be mitigated;
- the responsible Environmental Manager and health and safety representative will be notified; and
- depending upon the severity of the incident, other appropriate stakeholders will be notified. These include government agencies and any nearby communities or landowners. The prompt notification of government agencies, most notably the BC Provincial Emergency Program, is essential.

A site-wide communication system will allow for rapid notification of any observed spills depending upon the severity of the spill. The communication system will include coverage of the access road. The site will have a trained Emergency Response Team with resources to contain and recover spills to reduce the size of any spill and thus reduce any potential adverse environmental or health effects.

A key component of spill response is having appropriate materials readily available on-site to contain and abate a spill in a timely manner. KAM will compile spill kits designed for specific areas, with contents selected to manage the potential materials, volumes, and environmental sensitivities of each area. Typical contents will include oil absorbent pads and booms, pumps and skimmers, absorbent socks, granular absorbent, and berm and dike materials, as well as protective equipment such as gloves, goggles, and suits. Kits will be stored in weather-resistant containers and located in visible locations. They may also be contained on a trailer or truck, as required, for rapid deployment to a spill scene, and will be easily transferable to allow for helicopter delivery, should that be necessary. They will be inspected on a regular basis to confirm that they are complete and functional. KAM will maintain a list of suppliers of specialized spill response services and materials that can be contacted to provide support on short notice.

Initiation of the Spill Contingency Plan and Emergency Response Plan will be the responsibility of the Mine Manager (or designate). Response mobilization will depend on the nature of the spill, the substances involved, and the location. Members of the Emergency Response Team will be called in for assistance, as they will have been trained in response methods and will have the knowledge of required resources and their locations. All other personnel will be directed to pre-determined locations. Muster stations will be clearly identified around the Project site and site personnel will have been made aware of them during orientation and follow-up training programs.

Once the initial response has been undertaken, possibly affected environmental receptors will be identified and protected, particularly surface waterbodies. If the spill cannot be handled by on-site trained personnel or on-site available spill response equipment, an external spill response contractor will be arranged to attend to the situation. A plan for cleanup and remediation will be developed by the relevant Environmental Manager in coordination with external consultants, if required.

Typical cleanup techniques for major or serious spills will include the following:

- construction of berms around the spill with gravel, earth, or overburden using heavy equipment (e.g., loader, dozer, or excavator);
- excavating a sump using a backhoe, lining it with appropriate impervious lining material (e.g., tarp or poly), and diverting the spill into the sump;
- blocking culverts with plywood, poly, and/or sandbags;
- diverting spill into stormwater pond or diversion channels where it can be isolated;
- diverting spill into site drainage sump and blocking inlet and/or outlet;
- using absorbents (e.g., oil pads) for hydrocarbon spills;
- using granular absorbents where appropriate; and
- using emergency response kit.

Specific spill clean-up and disposal procedures will be developed for:

- a tailings spill;
- a gasoline and solvent spill;
- a diesel, hydraulic, lube, and waste oil spill; and
- an acetylene, argon, and propane spill.

If an emergency response is triggered, control of the situation will be transferred to the Emergency Response Team. The team will be guided by KAM's overall Emergency Response Plan (Section 11.14).

Typical disposal techniques for major or serious spills will include the following:

- all contaminated materials resulting from a spill cleanup will be collected and stored in sealed, labelled containers. The details for the storage and labelling of containers will be provided during the permitting stage of the Project;
- all contaminated materials will be shipped off site, unless otherwise approved, in waste manifested loads taken by a carrier with a list of emergency contacts and emergency measures clearly indicated;
- oily sorbents resulting from ongoing operations will not be disposed of by burning in a drum or incinerator; and
- particulate sorbent used to treat spills, including Oil Gator, must be removed and not left in place unless approved by the BC MOE.

Other disposal methods may be prescribed by the Environmental Manager if approval by BC MOE is provided.

11.16.3.3 Design Criteria

Design criteria for the handling and storage of hazardous waste and waste oil, as well as the management of the sewage treatment plant, may be found in the Hazardous Waste Management Plan (Section 11.10). Essential elements are the use of secure containers and storage tanks, and design that accords with the Municipal Wastewater Regulation (BC Reg. 87/2012).

Hazardous waste storage areas established will take into account compatibility of various waste streams and the prevention of releases to the environment. Currently the plan is to use modified shipping containers and specific details on the design criteria are presented in the Hazardous Waste Management Plan (Section 11.10.3.4).

A landfarm will also be constructed on site to manage hydrocarbon-impacted soils from the clean-up of small spills and leaks from equipment. A landfarm is a constructed feature to contain and treat hydrocarbon impacted soil. Treatment of the soil is achieved through the enhancement of microbial activity in the soil (also known as bioremediation) by aeration (increasing the oxygen), adding moisture or addition of nutrients to increase microbial activity (Environment Canada 2013). More information on the landfarm is available in the Hazardous Waste Management Plan (Section 11.10).

With reference to the possibility of tailings spills outside of the tailings storage facility (TSF), the design of tailings delivery is via an overland pipeline running within a bermed corridor located along the pipeline access road from the process plant to the TSF. Inline isolation valves installed at intervals along the delivery pipelines will allow the tailings discharge locations to be moved as appropriate for controlled beach development.

Diesel and gas storage facilities will be present on the Project site. Refuelling stations for mobile equipment will be located adjacent to the haul road accessing the open pit and adjacent to the truck shop/maintenance building and will be used throughout the operational life of the open pit.

Fuel handing, transportation, and storage facilities and activities will be consistent with the Health, Safety and Reclamation Code (BC MEMPR 2008) and the Ministry of Water, Land and Air Protection's publication, A Field Guide to Fuel Handling, Transportation and Storage (BC MWLAP 2002). The transportation, storage, and handling of fuels required for the Project during Construction, Operation, Decommissioning and Closure, and Post-Closure phases will be addressed by the Hazardous Waste Management Plan (Section 11.10), which will be modified as required over the life of the Project. Refueling stations will have a containment area to contain minor spills or leaks during refueling. Fuel transfer is done by pumps.

Each fuel storage area will be designed to have bermed spill containment with a capacity of 110% of the volume of the largest tank. The lining within the bermed area will be an impervious HDPE liner membrane. The design of these facilities will be based on industry standards for construction, installation, and maintenance of the facility and membrane to ensure its integrity.

Water collected within the secondary containment will be pumped through oil/water separators. Water collected in this fashion will be contained in the TSF or introduced to the process circuit where proximity and planned infrastructure allow it. Where this is not practicable, such water will be contained and disposed offsite in an approved facility permitted to handle this waste.

KAM may install an aboveground storage tank for the storage of bulk waste oils from the maintenance area. Additional details regarding the waste oil tank are provided in the Hazardous Waste Management Plan (Section 11.10.3.4).

11.16.3.4 Construction

The specific materials that pose spill risks during the Construction phase of the Project are petroleum products, existing open pit water, and dangerous goods and hazardous materials.

Petroleum Products

During Construction, site fuel storage tanks will be built and installed to comply with all regulatory and best management practices, including the Field Guide to Fuel Handing, Transportation, and Storage (BC MWLAP 2002).

The landfarm will be available during the Construction phase and will be used to manage hydrocarbon impacted soils from the cleanup of small spills and leaks from equipment.

Existing Open Pit Water

There is currently water that is stored in the historic Ajax pits. This contact water will need to be removed from the pits during Construction, but is not currently of suitable quality for direct release to the environment. Potential options for use of the water during Construction are described in the Water Management Plan (Section 11.7), and include dust control, concrete batch plant requirements, aggregate production (screening and crushing), water required for initial earthworks construction, and water required for temporary facilities such as the temporary truck maintenance facility and workshop. The Water will be treated before use where required.

Procedures for use of this contact-water will be developed and implemented to ensure that this water is appropriately used on-site, and that appropriate treatment is in place to prevent the potential for unplanned release to the environment.

Dangerous Goods and Hazardous Materials

The proper storage procedures described in the Hazardous Waste Management Plan (Section 11.10) will be followed to minimize the risk of spills of those products. They will be clearly labelled and stored in proper containers in secure locations, where they will be accessed by trained personnel only. Secondary containment will restrict the spread of spilled product and conveniently located material safety data sheets and spill kits will facilitate safe and timely cleanup.

11.16.3.5 Operation

The specific materials that pose spill risks during the Operation phase of the Project are tailings, petroleum products, and dangerous goods and hazardous materials.

Tailings

The tailings delivery pipeline will be an overland pipeline within a bermed corridor to ensure spill containment. Other spill prevention measures will include development of an Operation, Maintenance and Surveillance (OMS) manual that includes surveillance, visual monitoring, instrumental monitoring, inspections, and emergency planning and response. In addition, the pipeline is equipped with automatic shutoff switches that will reduce or stop the tailings flow if there are changes in the pipeline pressure.

Petroleum Products

Most material-specific actions, spill prevention, spill response, triggering of Spill Contingency Plan, and disposal practices used during the Construction phase of the Project and described in Section 11.16.3.2 are applicable to the Operation phase as well.

During the Operation phase, fuel levels in tanks will be measured and records of deliveries and dispensing compared as part of a regular capacity audit.

Dangerous Goods and Hazardous Materials

Any storage or use of dangerous goods and hazardous materials will follow the Hazardous Waste Management Plan as described in Section 11.10.

11.16.3.6 Decommissioning and Closure

The specific materials that pose spill risks during the Decommissioning and Closure phase of the Project are tailings, petroleum products, and dangerous goods and hazardous materials.

Tailings

Closure plans includes decommissioning and removal of all tailings pipelines. Pipeline corridors will be re-vegetated and water in the TSF supernatant will be diverted to Open Pit. However, prior to decommissioning and removal of tailings pipelines, all spill prevention measures described in Section 11.16.3.2 during the Operation phase, will be applicable during the Decommissioning and Closure phase.

Petroleum Products

At the completion of site closure activities, only minimal infrastructure in terms of fuel containers for the storage will remain for the staff involved in post-closure monitoring and maintenance and as determined and required by the closure plan.

In comparison to the Construction and Operation phases, site use and the number of vehicle trips and use of fuel, fuel tanks, and fuel storage areas will diminish considerably since concentrate will no longer be hauled off site. However, spill prevention, spill response, and disposal practices as described in Section 11.16.3.2 remain in force while closure activities are taking place.

Dangerous Goods and Hazardous Materials

Any storage or use of dangerous goods and hazardous materials will follow the Hazardous Waste Management Plan as described in Section 11.10.

11.16.3.7 Post-Closure

Spill prevention, spill response, and disposal practices as described in previous phases and in Section 11.16.3.2 will be maintained into the Post-Closure phase, but only until an acceptable level of closure and rehabilitation has been reached and the presence of personnel diminishes to an infrequent level.

11.16.4 Monitoring

Since accidental spills are unpredictable, reliance must be placed on ensuring preparedness to deal with such events. Monitoring of equipment and operations may provide some pre-emptive indications of possible spills. Inspection and maintenance of the spill kits, and assurance of their availability and functionality, will be undertaken in a scheduled and systematic manner. The adequacy of effectiveness of spill prevention and response measures will be monitored through:

- equipment and secondary containment monitoring and inspection;
- regular spill kit inspections and inventory;
- post-spill sampling of media (e.g., soil or water) in the vicinity of the spill location and/or flow path;
- regular inspections of spill impacted areas until all effects of the spill have been remediated;
- investigation into the root cause of significant spills; and
- review of the effectiveness of corrective and preventive actions.

11.16.4.1 Work Planning and Schedule

Work planning and scheduling for spill prevention and response will largely amount to maintaining a high level of preparedness of both personnel and equipment.

A Spill Contingency Plan requires that personnel generally, but particularly those with specified responsibilities, are subjected to purpose-designed training. This will require that a spill prevention and response component is included in the emergency preparedness briefings that all newcomers to the Project Site are subjected to as part of their environment, health and safety induction. Similarly, the one-off emergency response training sessions to be held on a scheduled basis, as well as the training and practice sessions required for specified responsibilities such as mine rescue teams and firefighting teams will include a spill prevention and response component.

The Health and Safety Manager and Environmental Manager are accountable for implementing a training program for employees and contractors to ensure that they have the risk spill contingency planning, procedures, and equipment in place. The Health and Safety Manager and Environmental Manager also review the credentials of contractors to ensure that they meet KAM procurement safety and environmental requirements, including having the necessary competence, training and awareness to effectively prevent, identify, respond, and report spills.

11.16.5 Reporting

A Spill Report will be completed for all spills on the Project. The Spill Reporting Regulation (BC Reg. 263/90) requires that a Spill Report be submitted within 24 hours to the BC Provincial Emergency

Program at 1-800-663-3456, if prescribed spill quantities are exceeded (*Environmental Management Act* 2003). Table 11.16-1 reflects the reportable quantities, as defined by the Act.

Table 11.16-1. Reportable Quantities under the Spill Reporting Regulation

Substance Spilled*	Examples	Reportable Spill Quantity
Explosives (Class 1)	Ammonium nitrate/fuel oil, stick powder, emulsions	Any
Flammable gases (Class 2, Div 1), other than natural gas	Propane	10 kg
Non-flammable gases (Class 2, Div 2)	Halon	10 kg
Poisonous gases (Class 2, Div 3)	Aerosols, ammonia, chlorine	5 kg
Corrosive gases (Class 2, Div 4)	Ammonia, chlorine	5 kg
Flammable liquids (Class 3)	Brake or hydraulic fluid, diesel fuel, ethylene glycol, gasoline, paints, solvents	100 L
Waste asbestos	Asbestos	50 kg
Flammable solids (Class 4)	Metal alkyds, aluminium metal	25 kg
Oxidizing substances (Class 5, Div1)	Ammonium nitrate	50 kg
Organic compounds (Class 5, Div 2)	Organic peroxides	1 kg
Poisons (Class 6)	Arsenic, mercury	5 kg
Infectious organisms	Raw sewage	Any
Radioactive materials (Class 7)	Instrumentation in processing	All discharges or a radiation level exceeding 10 mSv/h at package surface and 200 uSv/h at 1 m from the package surface
Products of Class 8	Acids, battery acid, caustic	5 kg
Miscellaneous products (Class 9, Div 1)	Lead, ammonium hydroxide with not more than 10% ammonia	50 kg
Miscellaneous products (Class 9, Div 2)	PCBs, lead compounds, DDT	1 kg
Miscellaneous products (Class 9, Div 3)		5 kg
Waste oil	Waste oil	100 L
Waste containing a pest control product	Pesticides	5 kg
A substance not covered by items in the above categories that can cause pollution		200 kg
Natural gas	Natural gas	10 kg if there is a breakage in a pipeline or fitting operated above 100 psi that results in a sudden and uncontrolled release of natural gas

Sources: Environmental Management Act *(2003), Spill Reporting Regulation (BC Reg 263/90), Transportation and* Dangerous Goods Act *(1992), and Transportation of Dangerous Good Regulations (SOR/2001-286).*
** These substances are those that are regulated and are not necessarily Project-specific.*

Detailed reports will be compiled on every emergency incident that occurs and on every incident that might have become an emergency if not for timely response. All reports will be reviewed internally by the Emergency Response Planning Committee in order to identify necessary improvements in the emergency prevention and response procedures. The Spill Report stipulates that the following information is recorded:

- the reporting person's name and telephone number;
- the name and telephone number of the company;
- the location and time of the spill;
- the type and quantity of the substance spilled;
- the cause and effect of the spill;
- details of action taken or proposed to comply with regulations;
- a description of the spill location and of the area surrounding the spill;
- the details of further action contemplated or required;
- the names of agencies on the scene; and
- the names of other persons or agencies advised about the spill.

11.16.5.1 Responsible Persons

Personnel involved with the execution of this procedure include the person discovering the spill, the Supervisor, and the Environmental Manager. The person discovering the spill is responsible for the initial assessment of the spill and the immediate control or containment of the spill if they are able to do so without endangering the health and safety of personnel. The nature and location of the spill must be immediately reported to a Supervisor.

The Supervisor is responsible for responding to the spill, providing assistance with clean-up, and collecting and containing contaminated soil and or clean-up materials. The Supervisor must report the spill to the Environmental Manager, Health and Safety Superintendent, or their designate.

The Environmental Manager is to be notified of all reportable spills as soon as possible and all non-reportable spills within 24 hours after knowledge of the release. The Environmental Manager and or supporting staff is responsible for directing the response and clean-up activities as appropriate and assisting with spill clean-up activities if required. They must determine whether the spill is classified as externally reportable in conjunction with senior and corporate management and report accordingly. If necessary, they must prepare and submit written report to the appropriate authorities and investigate spills as defined in the Accident and Incident Investigation Procedure.

11.17 INVASIVE PLANTS MANAGEMENT PLAN

The term "invasive plant," used within the Invasive Plant Management Plan, includes plants referred to as invasive plants, invasive alien plants, and noxious weeds. Invasive plants can aggressively compete with and displace native vegetation when introduced into natural settings (Haber 1997). As such, they pose a serious threat to biodiversity.

Interior grassland ecosystems are particularly sensitive to invasive plants, due to their sparse ground cover and lack of canopy which allows pioneer species to proliferate with ease. As native bunchgrasses are replaced by invasive plants, there may be an increase in surface water runoff, a loss of soil, and a consequential sedimentation of watercourses. In addition, displacement of native grassland plant species affects wildlife foraging and leads to a lack of palatable range forage for domestic cattle (Fraser Basin Council 2003).

11.17.1 Purpose

The purpose of the Invasive Plant Management Plan is to maintain ecosystem functions in order to avoid the introduction and spread of invasive plants resulting from the Construction, Operation, Closure, and Post-closure activities of the Project. This plan provides strategies and mitigation measures for the ongoing management of invasive plants at the Project site and is based on the guiding principles outlined by:

- Invasive Species Council of British Columbia (ISC);
- Southern Interior Weed Management Committee (SIWMC);
- *Southern Interior Pest Management Plan (PMP) for Invasive Alien Plants on Provincial Crown Lands in the Southern Interior of British Columbia* (BC Ministry of Forests and Range 2010); and
- *Invasive Alien Plant Program: Reference Guide* (Ministry of Forests and Range 2010).

Invasive species management is considered in all aspects of work conducted on the Ajax Project Site, including the movement of equipment and vehicles on and off site, interim and final reclamation activities and the movement of animals (cows) through the site.

11.17.1.1 Regulatory and Policy Framework

The following legislation, guidelines, management plans, and governing agencies are applicable or of relevance to the provincial management of invasive plant species:

- *Forest and Range Practices Act* (Government of British Columbia 2002). This act specifies that activities should not encourage the establishment or spread of invasive plants.
- *Weed Control Act* (Government of British Columbia 1996a). Administered by the Ministry of Agriculture, this act imposes a duty on all land occupiers to control designated noxious plants; they may not be introduced or spread to unaffected areas.

- *Seeds Act* (Government of Canada 1985). Regulates the grading of seed sold, imported, and exported in Canada, requiring that seed in Canada is free of prohibited noxious weeds and ensuring standards of purity.
- *Species at Risk Act* (Government of Canada 2002). Specifies that invasive plant species that threaten rare wildlife species' habitat must be controlled.
- BC *Integrated Pest Management Act* (Government of British Columbia 2003). This act regulates the use of herbicides to control weeds (invasive plants).
- *Invasive Alien Plant Program: Reference Guide* (Ministry of Forests and Range 2010). A resource manual for all agencies and partners involved in invasive plant management in British Columbia.
- Invasive Species Council of British Columbia. This registered charity has a primary goal of educating the public and professionals about invasive species and their risk to ecosystems and economies. Relevant outreach materials include a variety of brochures, pamphlets, and booklets, including the Targeted Invasive Plant Solution (TIPS) series.
- Southern Interior Weed Management Committee (SIWMC). This group is made up of representatives from a number of public and private agencies. These agencies are actively engaged in operational and educational invasive plant management programs throughout the Thompson-Nicola Region.
- Kamloops Land and Resource Management Plan (LRMP) (Kamloops Interagency Management Committee 1995) contains zones, objectives and strategies for weed management including:
  - General Resource Management - Monitor use and ensure compliance with regulations to reduce soil erosion and the spread of noxious weeds that can result from the use of trail systems.
  - Grasslands and Rangeland Management - Control noxious weeds by implementing noxious weed control plans.
- City of Kamloops noxious Weeds, Invasive Plants, and Pesticide Use Control By-law No. 26-2 regulates the use of pesticides on residential properties

11.17.2 Performance Objectives

The Invasive Plant Management Plan is designed to provide environmentally responsible, realistic, and operationally feasible guidance for ecosystem, soils, and vegetation management related to invasive plants.

The performance objective of the invasive plant management plan is to prevent invasive plant establishment through maintenance of ecosystem integrity, such that the composition, structure, function and resilience are retained. This will be done through:

- avoiding the introduction and spread of invasive plant during all phases;
- removing invasive plants that are present at site or become introduced; and

- restoring ecosystem integrity at sites altered by Project activities to prevent establishment of invasive plants.

11.17.3 Environmental Protection Measures

Preventing the initial establishment and spread of invasive plants is the single most effective method of invasive plant control. Invasive plants will invade those areas that provide suitable habitat for their survival and proliferation. Often this includes areas of soil disturbance such as road and recreation trail developments, right of way clearing for fence construction, and timber harvesting. Preventing invasive plant seeds or propagules from being deposited on these sites, revegetating disturbed areas to ensure vigorous competing vegetation, and maintaining healthy, native plant communities through appropriate grazing management practices are important preventative measures.

11.17.3.1 General Prevention Measures

An ecosystem-based approach to vegetation and soil management is required to effectively prevent the introduction and spread of invasive plants related to the Project. Ecosystems are complex interactions of abiotic (i.e., snow duration, recent glacial history, natural disturbance, etc.) and biotic components (i.e., nutrient-fixing mycorrhizae, disease, pollination, competition, etc.) that result in unique species composition, structure, and functions. Minimizing effects to these ecological processes and ultimately ecosystem integrity will reduce the likelihood of invasive plant establishment and spread. Impacts to ecosystem integrity will be minimized through the following actions:

- Minimization of all clearing dimensions during construction activities as invasive species thrive in recently disturbed areas where there is little shade and competition from other plant species.
  - Reseed all sites disturbed by machinery and industrial equipment as promptly as possible to prevent the establishment of new weeds.
- Minimization of soil degradation i.e., erosion, by adhering to the Soil Salvage and Handling Plan (**Chapter 11.3**). Specifically, soil will be salvaged during appropriate weather conditions, transported to stockpiles within appropriate time frames of salvage, and controlled for surface erosion.
- Vehicle inspections for target invasive plants at designated Project checkpoints. Project vehicles (i.e., bulldozers, mine trucks excavators, etc.) transported from other areas will be thoroughly inspected, target species will be removed (if present), and if the inspection indicates washing is required vehicles will be properly washed, , at an appropriate location where the removal of dirt or plants can be effectively achieved without harm to natural ecosystems.
- Detection and eradication of invasive plants, through the implementation of an effective early detection system, inventory, control, and monitoring program. Treatment options include mechanical, chemical, cultural, biological, or a combination of these methods using an ecology-based approach, commonly referred to as integrated pest management. The ecological cause (e.g., disturbance, favourable light conditions, and compacted soil) and

likely succession of the invasive plant population will be used to help select an ecologically appropriate treatment option(s).

- Follow-up monitoring of controlled sites will occur to evaluate efficacy of treatment and requirements for follow-up treatment.
- Appropriate education and training for employees and contractors, including those responsible for moving equipment to the site, will be provided in a series of fact sheets or small handbook outlining what invasive plants are, why they matter, and how to avoid introduction and spread of invasive plants during regular operations. This information will be prepared and made available to all employees on site. Invasive species references currently available for use include, but are not limited to the following:
  - Best Practices for Managing Invasive Plants Along Roadsides: A Pocket Guide for British Columbia's Maintenance Contractors (Invasive Plant Council of British Columbia 2010);
  - Invasive Species Council of BC website (Targeted Invasive Plant Solutions (TIPS) brochures); identification of key plant species, with pictures and brief habitat and management information (Invasive Species Council of British Columbia 2015);
  - Forest and Range Practices Act (FRPA; 2002): Invasive Plants Identification Field Guide (Province of British Columbia 2008); developed to help identify the FRPA-listed invasive plants throughout BC; also provides basic habitat and impact information;
  - Field Guide to Noxious Weeds and Other Selected Invasive Plants of British Columbia (Ralph et al. 2007); and
  - Guide to Weeds in British Columbia (British Columbia Ministry of Agriculture, Food and Fisheries 2002);
- Enhanced training in existing provincial legislation, ecology, available data entry tools, and reporting programs related to invasive plant management will be provided to the Project's Environmental Personnel.

The following section outlines specific measures to address invasive plant populations in the event that they occur.

11.17.3.2 Treatment and Control

In the event invasive plants are identified on site, the SIWMC or an appropriate authority will be consulted to determine if control or monitoring is required. If control is required, appropriate treatment options and timing will be addressed. The appropriate treatment for invasive plants depends on the species involved, site conditions and location, and the size of infestation. Invasive plant species vary in their aggressiveness and ability to dominate a site, so some are inherently easier to eradicate than others. Larger infestations are also more difficult to control than smaller ones. The SIWMC provides a guide for determining if, when, and how to control different invasive plants in southern interior BC (BC Ministry of Forests and Range 2010). KAM will work with the SIWMC (and/or the Invasive Plant Council, depending on availability) to determine a species and site-specific best treatment option for the invasive plant population.

Potential treatment options include mechanical, cultural, biological, and chemical methods. Mechanical control adopts physical means of removal, such as pulling by hand. Cultural control uses targeted grazing, re-vegetation and/or fertilization. Biological control uses living organisms, such as insects, to control pest populations of invasive plants, and chemical control uses herbicides to reduce and eradicate plant populations.

If herbicide use is deemed a recommended treatment, the *Handbook for Pesticide Applicators and Dispensers* (BC Ministry of Environment 2005) provides detailed methodology for treatment activities and includes measures (including designation of pesticide-free and no-treatment zones) to protect waterbodies and riparian areas. To the extent possible, approved herbicides will be applied using spot-control methods rather than broad spraying techniques to minimize adverse effects to the surrounding environment.

Further details regarding control methods, including legislation and site-specific use of herbicides (from storage and transport to application and disposal), is available within the Invasive Plant *Pest Management Plan for the Southern Interior of British Columbia* (BC Ministry of Forests and Range 2010).

11.17.4 Monitoring Program

The aim of the Monitoring Program is to evaluate and document if the Invasive Plant Management Plan is successfully preventing the introduction and spread of invasive plants resulting from the Construction, Operation, Closure, and Post-closure activities of the Project.

<u>General Mine Site</u>

In general, monitoring will be on an observational basis with different parts of the mine covered each year, with the entire mine covered over two years. A trained observer will walk high-risk areas based on an "intuitive" sampling method focused on areas of greater risk of harbouring invasive species.

These include: disturbed areas, bare soils, areas with transported fresh soils, and areas with high traffic, such as parking lots, walkways, muster areas, recreational areas, etc. While the general Mine Site will be evaluated with a general survey for invasive species, specific areas will require more systematic sampling. These are listed below.

<u>Cleared Sites</u>

Ideally, cleared sites are to be re-vegetated:

- with “certified” seeds (and/or plants) suitable for the local area and ecosystems (Conceptual Landscape Restoration and Reclamation Plan); and
- during the appropriate growing season and conditions to ensure maximum survival rate and to avoid establishment of invasive plants.

During Construction monitoring of cleared sites will be conducted on an annual basis. Monitoring of cleared and progressively reclaimed sites during operations will be conducted will be conducted every second year (biennial). If follow-up treatments are required more frequent monitoring may ensue to evaluate treatment results. This information will be collected using a monitoring/reporting form designed specifically for the Project. This will facilitate on-site adaptive management.

Roads

Biennial monitoring will occur along Project roads to determine the presence/absence of invasive plants. The timing of the surveys will be determined by the Environmental Manager (or designated qualified personnel) based on plant phenology (e.g., timing of biological activities such as flowering, propagation, and seed dispersion).

If invasive plants are observed, information will be collected to help determine appropriate future actions. Recorded information includes: ecosystem type, species present, soil texture, species density and distribution, proximity to water, structure, elevation, slope, and any other characteristics that may contribute to the way in which the site is managed.

Monitoring Forms

When a target species is detected, the information is recorded on a *Site Invasive Plant Inventory Record*. If it is a new site, information specific to the site and the invasive plant is recorded. If the site is an existing site, only the Site ID and data specific to the survey of any invasive plant infestation(s) will be recorded.

Information recorded at an invasive plant site includes the UTM coordinate (northing, easting and zone), location, date, species, estimated size of the infestation in hectares, distribution, density, and any pertinent site characteristics or additional information. Site photos may also be taken. If the surveyor is unable to correctly identify a particular plant species a sample will be collected for proper identification. Invasive plant surveys and inventories are conducted in accordance with the methodology outlined in MFR's Invasive Plant Program Reference Guide (http://www.for.gov.bc.ca/hra/Plants/application.htm).

Invasive plant survey and inventory data is housed within the IAPP application. This comprehensive database and mapping application allows extraction of relational data, statistics and spatial mapping information, and is housed at the following web site:
http://www.for.gov.bc.ca/hra/Plants/application.htm.

11.17.4.1 Work Planning and Schedule

The Environmental Manager (or designated qualified staff) will disseminate the performance objectives and actions with all Project personnel that have the potential to directly or indirectly influence vegetation, soils, or ecosystems on site during the Construction, Operation, Closure, and Post-closure activities. Communication of this information and sign-off by individuals will be recorded, and tracked as a key performance indicator.

Employees participating in invasive plant education and training initiatives will be identified by KAM and will receive training within the first year of employment. All employees will be made aware of the general issues and concerns surrounding invasive plants. Fact sheets describing various invasive plant species of concern will be made available to all KAM employees working at the Project site.

Monitoring will occur annually during Construction, biennially (between June and September) during Operation, and Closure. Monitoring frequency during Operation will be reviewed after the first scheduled monitoring cycle. Additional monitoring schedules will be determined for the Post-closure depending on the amount of ground disturbance activities associated with final Reclamation.

If herbicide treatment is required, it will be applied before the flowering stage (early spring) when plants are most susceptible (BC Ministry of Environment 2005). A minimum of two weeks between treatments will be observed. Treatments applied after flowering (autumn) will involve the removal and disposal of seed heads to an appropriate waste disposal location.

11.17.5 Reporting Requirements

Annual reporting of the environmental monitoring inspection reports will include a description of the following:

- Records of inventory, treatment, monitoring, and restoration activities will be summarized into the *Mines Act* (Government of British Columbia 1996b) annual reclamation reporting requirements. A photographic record of invasive species surveyed locations as well as a copy of all data forms filled in for that year will be included in the report. Collectively, this information will be used as a means of tracking progress and determining future management activities.
- Quality assurance and quality control protocols employed to ensure:
  - data accuracy (e.g., all invasive plant species names were entered correctly according to the most current accepted names for any one taxon);
  - all GPS UTM coordinates were entered correctly (checked against the field plot card); and
  - no blanks or duplicates are included in any pertinent database fields (e.g., site number or name, photo number, or UTM coordinates).
- Assessment of the effectiveness of the inventory, treatment, and monitoring methodologies and actions taken to improve the program if relevant.
- Proposed revisions to the Invasive Plant Management Plan to address emerging negative trends, or to adjust monitoring programs, if required.

To further develop the provincial invasive species database, occurrences will be entered into the "Report-a-Weed" Program, a provincial online mapping and reporting tool associated with the IAPP Application within the same year as the surveys. Once the data (report) are entered, they are automatically compared to known locations of the reported species in the IAPP Application, and are then sent directly to a provincial Invasive Plant Specialist for the region.

The Project's Environmental Manager or their designates will ultimately be responsible for the development, implementation, and monitoring of the Invasive Plant Management Plan and its reporting.

11.18 ARCHAEOLOGICAL SITES MANAGEMENT PLAN

11.18.1 Purpose

The purpose of the Archaeological Sites Management Plan (the Plan) is to mitigate potential effects and detail the protection for archaeological resources that have been identified within or adjacent to the Project footprint, as well as archaeological resources that may be encountered during the course of the Construction, Operation, Decommissioning and Closure, and Post-Closure phases of the Project. The Plan has been prepared as part of the Project's Environmental Assessment Application and follows the AIR Guidelines (BC EAO 2014) set out in collaboration with the BC Environmental Assessment Office and the Working Group for the Project. The Plan will be reviewed and updated on an as-needed basis as the Project proceeds through detailed design and the Construction, Operation, Decommissioning and Closure, and Post-Closure phases.

In BC, the primary legislation protecting archaeological resources (both recorded and unrecorded) is the *Heritage Conservation Act* (1996), which protects all sites predating 1846 Common Era (CE) on Crown and private land. Sites such as burials and Aboriginal rock art sites are protected regardless of age. The Archaeology Branch of the Ministry of Forests, Lands and Natural Resource Operations (Archaeology Branch) is the provincial ministry responsible for the administration of the *Heritage Conservation Act* (1996), issuing permits for heritage inspection and site alterations, and maintaining a database of known archaeological sites. Burials and gravesites are also protected in British Columbia by the *Cremation, Interment, and Funeral Services Act* (2004).

11.18.2 Performance Objectives

Archaeological sites in BC are afforded protection by the legislation mentioned above, which includes both known and as-yet unrecorded sites. Consequently, developments that involve excavating, moving, or disturbing soils may affect archaeological sites. Certain types of sites, such as Culturally Modified Trees (CMT), can also be affected by logging or the clearing of vegetation. For the Project, it is anticipated that earth movement (blasting, cutting and filling, road building, and landscaping) will be the principle types of disturbance. As such, unknown archaeological sites that may be present within or adjacent to the proposed Project developments have the potential to be adversely affected.

For all archaeological sites, whether known or as-yet unrecorded, which are within or adjacent to the Project footprint, avoidance during Construction, Operation, and Decommissioning and Closure is the preferred management and protection measure. This can be achieved by adaptive Project redesign or by considering Project alternatives. Where Project redesign or use of Project alternatives are not feasible and for archaeological sites that are discovered during Construction, Operation, or Decommissioning and Closure phases, the management and mitigation strategies outlined in Section 11.18.3 will be followed.

Project personnel will thus be trained to use the Heritage Chance Find Procedure and the protocols and steps outlined in the procedure will be followed should heritage resources be encountered during Project activities. This procedure is discussed further in Section 11.18.5.3.

11.18.3 Environmental Protection Measures

This section includes an inventory of known protected heritage resources within the Project's Local Study Area (LSA). The LSA includes a 500 metre (m) buffer on the proposed Project footprint within which indirect effects may occur due to Project activities.

Section 11.18.3.1 provides general guidance pertaining to the management and mitigation for archaeological sites in relation to the Project. These general strategies are applied in a more site-specific manner in Sections 11.18.3.2 and 11.18.3.3 and chance finds that may be discovered due to Project footprint revisions are discussed in Section 11.18.5.3.

The Project footprint considered in this Plan and the LSA are illustrated in Figure 11.18-1. Due to the sensitive nature of archaeological sites, locational information is not provided in this document but will be illustrated on construction maps. Should Project footprint components be revised during the course of Construction or Operation, the site inventory and construction maps showing the locations of these sites will be consulted to determine if any known archaeological sites may be in conflict.

11.18.3.1 General Heritage Management and Mitigation Strategies

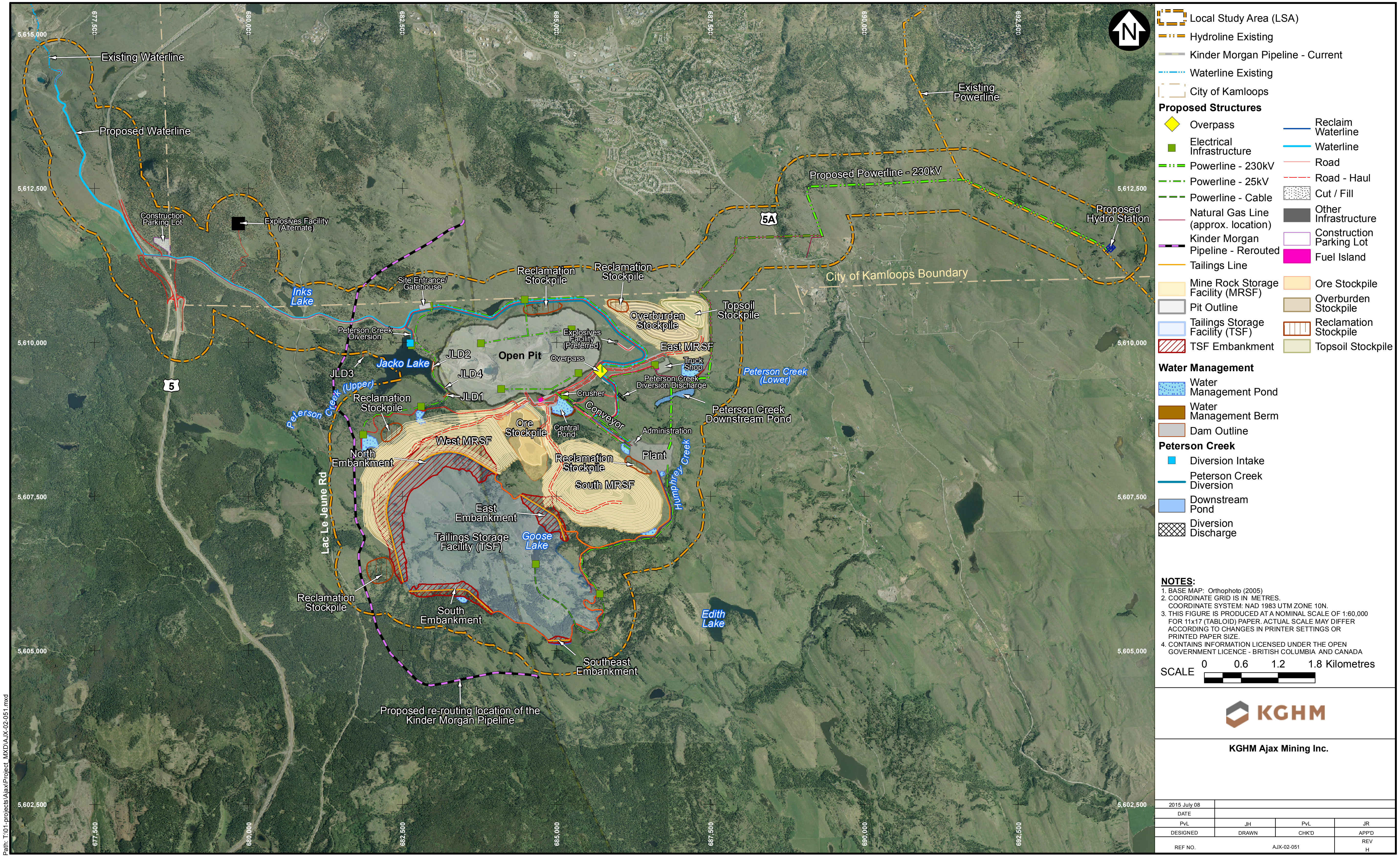
Project activities associated with the movement, excavation, or disturbance of soil, such as clearing and grading roads, building foundations and footings, earthworks, excavations, and blasting, have the potential to cause direct effects to protected heritage sites within the LSA, if present. In addition, protected heritage sites can be impacted by increased human presence in the area, as sites in this region often contain cultural materials present on the surface. Therefore, several levels of direct and indirect impacts have been considered. Where a site is located within:

- **0 to 50 m** of ground-altering activities, direct impacts by construction with a high potential for adverse impacts are anticipated;
- **50 to 500 m** from Project components, indirect impacts through increased human presence during Construction, Operation, and Decommissioning and Closure, with a low to moderate potential for adverse impacts are anticipated;
- **500+ m** from Project components, no impacts by the Project are anticipated and therefore are not considered.

Where sites fall within **0 to 50 m** of proposed ground-altering activities, the risk of direct impacts from construction activities is high. Typically, site avoidance through Project design is the recommended management option, with the areas marked as "No Work Zones" on development maps. An Environment Department staff member will be present during construction activities near such sites and/or site boundaries will be flagged or fenced to limit any indirect impacts. Caution will be exercised during construction activities near the site. If avoidance is not possible, mitigation will be conducted prior to Project activities. Mitigation measures will be determined in consultation with the British Columbia Archaeological Branch and Aboriginal Groups. Mitigation may involve monitoring, detailed mapping, photography, and/or systematic data recovery through surface collection and/or controlled excavations of evaluative units if subsurface deposits are present. See Section 11.18.5.1 for additional reporting details.

Figure 11.18-1

Ajax Footprint and Heritage Local Study Area



Where sites fall within **50 to 500 m** from Project components, the risk of indirect impacts through increased human presence during Construction, Operation, and Decommissioning and Closure is considered to be moderate. These areas will be marked as "No Work Zones" on development maps. An Environment Department staff member and archaeological monitors will be present during construction activities near such sites and site boundaries will be flagged or fenced to limit any indirect impacts. Caution will be exercised during construction activities near the site. Sites will be inspected on a case-by-case basis to determine if impacts have occurred. If direct impacts at these sites are anticipated during construction and/or have occurred, mitigation measures will be required (see above). Reporting pertaining to archaeological monitoring activities is described further in Section 11.18.5.2.

Sites that fall beyond **500 m** from Project components are at low risk of direct and/or indirect impacts from construction and/or human presence, unless the Project footprint is revised during Construction and/or Operation. Therefore, sites beyond 500 m of proposed infrastructure are not discussed further in this plan.

Note that these stipulations are generic and would only be activated if heritage resources were present, uncovered or discovered during Project activities in the area. Specific management and mitigations measures for known heritage resources are described in Section 11.18.3.2.

11.18.3.2 Protected Heritage Sites within the Local Study Area and Site-specific Effects, Management, and Mitigation

There are 46 archaeological sites documented in the Project's LSA within 500 m of the Project footprint and effects are anticipated at 28 of these sites (Table 11.18-1). Avoidance of archaeological sites is always the preferred management recommendation. Site specific management recommendations based on the potential impacts are also detailed below. These management recommendations will require consultation with, and the approval of the Archaeology Branch and Aboriginal Groups.

<u>Sites EdRc-6, EdRc-7, EdRc-10, EdRc-23, EdRc-27, EdRc-30, EdRc-34, EdRc-41, EdRc-44, EdRc-49, EdRc-51, EdRc-53, EdRc-54, EdRc-55, EdRc-56, and EdRc-63</u>

Sites EdRc-6, EdRc-7, EdRc-10, EdRc-23, EdRc-27, EdRc-30, EdRc-34, EdRc-41, EdRc-44, EdRc-49, EdRc-51, EdRc-53, EdRc-54, EdRc-55, EdRc-56, and EdRc-63 are lithic scatters that include a subsurface component. Avoidance of these sites through Project redesign is the preferred management recommendation. If avoidance is not practicable, then mitigation measures will be required. Site mitigation would be determined in consultation with the Archaeology Branch and Aboriginal Groups, and may include systematic data recovery, construction monitoring, and/or site capping. Any alteration to these sites will require a Section 12 Site Alteration permit, issued by the Archaeology Branch.

<u>EdRc-5</u>

Archaeological site EdRc-5 is a lithic scatter recorded in 1988 that was completely disturbed by construction of the original Ajax haul road. It is recommended that this site be put forward to the Archaeology Branch for consideration of Legacy Status. The Archaeology Branch considers granting Legacy Status to an archaeological site when protection from the HCA is no longer necessary do the destruction of the site. If granted Legacy Site designation, EdRc-5 would require no further management or permits. If Legacy Status is not granted, then a Section 12 Site Alteration Permit will be sought for EdRc-5 to allow for continued use of the haul road over the site.

Table 11.18-1. Archaeological Sites within the Local Study Area

Borden Number	Antiquity	Site Type	Comments	Site Significance	Nearest Proposed Development	Distance to Development (m)	Permit Number
EdRc-5	Prehistoric	Lithic Scatter	This site consists of two grey chert flakes and small faunal fragments. Approximately 10 flakes observed on the surface were left in situ. After 1988, the site was destroyed during construction of the Mine Haul Road.	Low	Open Pit	0	1988-0028
EdRc-6	Prehistoric	Lithic Scatter	This site consists of a little scatter of one basalt and one green chert flake. Five chert flakes were also observed on the surface and left in situ. After 1988, the eastern portion of the site was impacted by construction of the existing Trans Mountain pipeline.	Low	Hydroline	35	1988-0028
EdRc-7	Prehistoric	Lithic Scatter	This site consists of two chert flakes and two basalt core fragments. All were observed on the surface and left in situ.	Low	Open Pit	0	1988-0028
EdRc-8	Prehistoric	Lithic Scatter	This site consists of four chert flakes, one of which was utilized. All were observed on the surface and left in situ. The site is now flooded due to damming on Peterson Creek.	Low	Hydroline	25	1988-0028
EdRc-9	Prehistoric	Lithic Scatter	This site consists of five chert flakes. All were observed on the surface and left in situ. The site is now flooded due to damming on Peterson Creek.	Low	Open Pit	78	1988-0028
EdRc-10	Prehistoric	Lithic Scatter	This site consists of material recovered in 1988 and 2013. Material recovered in 1988 consist of two basalt flakes, one chert flake, and a small calcined bone fragment. In addition, eight chert and basalt flakes were observed on the surface and left in situ. Additional material recovered in 2013 consists of three basalt flakes (two of which were collected from the surface). This site was also given Borden Number EdRc-18; this duplicate designation has now been legacied.	Low	South MRSF	0	1988-0028

(continued)

Table 11.18-1. Archaeological Sites within the Local Study Area (continued)

Borden Number	Antiquity	Site Type	Comments	Site Significance	Nearest Proposed Development	Distance to Development (m)	Permit Number
EdRc-19	Prehistoric	Lithic Scatter	This site consists of an Early Nesikep basalt, projectile point fragment, a basalt projectile point fragment (non-diagnostic), a basalt distal point fragment, a basalt distal point fragment, two basalt unformed unifaces, a chert unformed uniface, and debitage. This site is situated on the shore of Jacko Lake.	Medium-high	Peterson Creek Diversion	62	2002-0114
EdRc-21	Prehistoric	Lithic Scatter	The site consists of a quartzite core and two pieces of quartzite block shatter collected from a single surface find located on a steep slope east of site EdRc-25.	Low	Open Pit	0	2009-349
EdRc-22	Prehistoric	Lithic Scatter	This site consists of one basalt biface base fragment and one piece of basalt debitage.	Low	Peterson Creek Diversion	40	2009-349
EdRc-23	Prehistoric	Lithic Scatter	This site consists of one piece of basalt debitage.	Low	Haul Road	11	2009-349
EdRc-24	Prehistoric	Lithic Scatter	This site consists of a basalt biface distal fragment.	Low	Waterline	320	2011-0128
EdRc-25	Prehistoric	Petroform	Three semi-circular petroforms, constructed using cobbles, were identified along a series of gently sloping rocky outcrops.	High	Open Pit	0	2009-349
EdRc-26	Prehistoric	Lithic Scatter	This site consists of two pieces of basalt debitage and one chert flake.	Low	Site Entrance Gatehouse	423	2009-349
EdRc-27	Prehistoric	Lithic Scatter	This site consists of five pieces of basalt debitage.	Low	Haul Road and Peterson Creek Diversion	0	2009-349
EdRc-28	Prehistoric	Lithic Scatter	This site consists of four basalt flakes.	Low	Hydroline	60	2009-349
EdRc-30	Prehistoric	Lithic Scatter	This site consists of one basalt flake, one mudstone flake, one piece of chert debitage, and one piece of chalcedony debitage.	Low	East MRSF / Topsoil Stockpile	0	2009-349
EdRc-31	Prehistoric	Lithic Scatter	This site consists of one banded chert flake.	Low	Prefered Explosives Facility Access Road	75	2009-349

(continued)

Table 11.18-1. Archaeological Sites within the Local Study Area (continued)

Borden Number	Antiquity	Site Type	Comments	Site Significance	Nearest Proposed Development	Distance to Development (m)	Permit Number
EdRc-32	Prehistoric	Lithic Scatter	This site consists of three pieces of chert debitage, and a red-banded chert flake.	Low	Hydroline	67	2009-349
EdRc-34	Prehistoric	Lithic Scatter	This site consists of one basalt Shuswap Horizon projectile point, one basalt flake, and one chert flake.	Moderate	Hydroline / Fortis Line	21	2009-349
EdRc-35	Prehistoric	Lithic Scatter	This site consists of two banded chert flakes.	Low	Hydroline	260	2009-349
EdRc-36	Prehistoric	Lithic Scatter	This site contains one chert flake.	Low	Truckshop Platform	207	2009-349
EdRc-38	Prehistoric	Lithic Scatter	This site consists of one basalt flake.	Low	Existing Highway 5 Access Ramp	174	2009-349
EdRc-39	Prehistoric	Lithic Scatter	This site consists of one chert biface fragment, three retouched basalt flakes, four utilized basalt flakes, 59 pieces of basalt debitage, two pieces of chert debitage and one chalcedony flake. Ninety-one pieces of calcined bone were also recovered.	Moderate	Existing Access Road	195	2009-349
EdRc-40	Prehistoric	Lithic Scatter	This site consists of a basalt biface collected from the surface.	Low	Open Pit	0	2009-349
EdRc-41	Prehistoric	Lithic Scatter	This site consists of one basalt retouched flake and 14 basalt and three chert flakes.	Low	Waterline, Hydroline, Access Road, and Peterson Creek Diversion	0	2009-349
EdRc-42	Prehistoric	Lithic Scatter	The site consists of a single non-diagnostic basalt biface.	Low	Existing Access Road	86	2009-349
EdRc-43	Prehistoric	Lithic Scatter	The site consists of a single basalt flake.	Low	Existing Access Road	222	2009-349
EdRc-44	Prehistoric	Lithic Scatter	This site consists of a single utilized basalt flake.	Low	Hydroline	49	2009-349

(continued)

Table 11.18-1. Archaeological Sites within the Local Study Area (continued)

Borden Number	Antiquity	Site Type	Comments	Site Significance	Nearest Proposed Development	Distance to Development (m)	Permit Number
EdRc-45	Prehistoric	Lithic Scatter	The site consists of a basalt Plateau Horizon projectile point base, a non-diagnostic basalt biface fragment, two basalt scraper fragments, a retouched basalt flake, and debitage (all basalt with the exception of one chert flake).	Moderate	Existing Access Road	424	2009-349
EdRc-47	Prehistoric	Lithic Scatter	The site consists of a basalt flake.	Low	Peterson Creek Discharge	121	2009-349
EdRc-48	Prehistoric	Lithic Scatter	The site consists of a basalt non-diagnostic biface fragment.	Low	TSF/MRSF	0	2009-349
EdRc-49	Prehistoric	Lithic Scatter	This site consists of one bifacially formed tool and 21 pieces of basalt	Low	TSF	0	2009-349
EdRc-50	Prehistoric	Lithic Scatter	The site consists of an isolated lithic find located on the surface of a prominent bedrock ridge.	Low	Ore Stockpile	0	2014-0171
EdRc-51	Prehistoric	Lithic Scatter	The site consists a small subsurface lithic scatter (one pink quartzite flake and one white chert flake) located on a bench overlooking Goose Lake.	Low	TSF	0	2014-0171
EdRc-52	Prehistoric	Lithic Scatter	The site consists of an isolated lithic find (one dark grey basalt flake) located on the surface of a ridge of exposed bedrock.	Low	Open Pit	0	2014-0171
EdRc-53	Prehistoric	Lithic Scatter	The site consists of a single black basalt flake recovered from a shovel test on a low terrace overlooking a slough.	Low	TSF	0	2014-0171
EdRc-54	Prehistoric	Lithic Scatter	The site consists of one green chert flake collected from a shovel test at the edge of a terrace overlooking Peterson Creek to the north.	Low	Water Management Pond	0	2014-0171
EdRc-55	Prehistoric	Lithic Scatter	The site consists of two black basalt flakes, two rose quartzite flakes, and one beige tuff flake, all recovered from a single shovel test on a narrow ridge overlooking Peterson Creek to the east and south.	Low	Water Management Pond	0	2014-0171

(continued)

Table 11.18-1. Archaeological Sites within the Local Study Area (completed)

Borden Number	Antiquity	Site Type	Comments	Site Significance	Nearest Proposed Development	Distance to Development (m)	Permit Number
EdRc-56	Prehistoric	Lithic Scatter	The site consists of one red chert flake from a shovel test on a terrace above a dry gully to the south.	Low	South MRSF/ Reclamation Stockpile	0	2014-0171
EdRc-57	Prehistoric	Lithic Scatter	The site consists of one red chert flake, one orange chert core fragment, and one dark grey basalt flake recovered from three positive shovel tests on a low ridge overlooking a pond to the east and southeast.	Low	Existing Access Road	351	2014-0171
EdRc-58	Prehistoric	Lithic Scatter	The site consists of dark grey basalt end-scraper that was identified from a surface exposure on a terrace on the northern side of Peterson Creek.	Low	Peterson Creek Downstream	84	2014-0171
EdRc-59	Prehistoric	Lithic Scatter	The site consists of one cream-coloured tuff side-scraper recovered from the gravel roadbed at the junction of Sugarloaf Road and a New Gold Inc. mine site road.	Low	Waterline	0	2014-0171
EdRc-60	Prehistoric	Lithic Scatter	This site consists of a retouched red chert flake that was identified on a surface exposure.	Low	Hydroline	410	2014-0171
EdRc-61	Historic - European	Cemetery	The site is the location of St. Peter's Anglican Church and its associated cemetery, built in 1915 and dismantled in the late 1920s.	High	TSF	0	2014-0171
EdRc-62	Prehistoric	Faunal	The site consists of a modified right first incisor of a large ungulate, most likely elk, recovered from a shovel test on a gently sloping terrace immediately west of Humphrey Creek. Modifications to the tooth include a groove on the mesial surface at the cemento-enamel junction, where the crown meets the root, and the remnants of a drilled hole visible at the base of the broken root on the distal surface, perpendicular to the long axis of the tooth.	Moderate	Waterline	1.3	2014-0171
EdRc-63	Prehistoric	Lithic Scatter	This site consists of eight basalt flakes.	Low	TSF/MRSF	0	2014-0171

EdRc-8

Archaeological site EdRc-8 is a lithic scatter that is submerged due to the construction of a dam on Peterson Creek and, as such, it is likely candidate for Legacy Status. The Archaeology Branch considers granting Legacy Status to an archaeological site when protection from the HCA is no longer necessary due to the destruction of the site. If granted Legacy Site designation, EdRc-8 would require no further management or permits. If Legacy Status is not granted, then a Section 12 Site Alteration Permit will be sought for EdRc-8 to allow for potential disturbances to the site related to the construction of the Hydroline.

EdRc-21 and EdRc-22

Archaeological sites EdRc-21 located within the Open Pit and EdRc-22 located within 40 m of the Peterson Creek Diversion are low density lithic scatters recorded by Terra Archaeology (Morin 2014). As the artifacts from both sites were collected and Terra assessed that there was low potential for further investigation to yield significant additional information, pending approval from the Archaeology Branch, no further assessment or mitigation is recommended for EdRc-21 and EdRc-22. Any alteration to these sites will require Section 12 Site Alteration permits, issued by the Archaeology Branch.

EdRc-25

Archaeological site EdRc-25 consists of three semicircular petroforms within a series of rock outcrops north of Peterson Creek. Extensive subsurface testing (n = 688) and survey was conducted at the site by Terra Archaeology; however, no prehistoric cultural material was identified at the site (Morin 2014). Based on the available information the antiquity and function of site EdRc-25 cannot be confirmed (Morin 2014); however, the SSN Cultural Heritage Study describe these as hunting blind features with "extremely high interest and irreplaceable value" (Ignace 2014:135). Further the SSN Cultural Heritage Study states "if this complex cannot be avoided during construction of the proposed mine, a highly significant, unique and irreplaceable cultural resource, ideal as a demonstration and teaching aid in understanding the resourcefulness and ingenuity of the Stk'emlups people and their long term, intimate connection to their lands and the natural world, will be lost forever" (Ignace 2014:137).

As EdRc-25 is within the mine pit, avoidance of the site is not practicable. Additional investigation of this site is recommended, focusing on determining the antiquity and function of the site, understanding the cultural values associated with the site and how these could be related to possible mitigation options. Ultimately, a final mitigation strategy for this site will need to be determined through discussion between KAM, SSN and the Archaeology Branch. This may include reconstruction the hunting blind complex at another location accessible to the community.

EdRc-40, EdRc-48, EdRc-50, EdRc-52, and EdRc-59

Archaeological sites EdRc-40, EdRc-48, EdRc-50, EdRc-52 and EdRc-59 consist of single artifact finds from surface exposures. All were subsequently shovel tested with no further cultural material recovered. Based on these sites consisting of single isolated artifact finds from a surface context and the negative results of shovel testing, no further archaeological investigations are recommended.

Sites EdRc-48, EdRc-50, and EdRc-52 will require a Section 12 Site Alteration permit, issued by the Archaeology Branch, prior to any alteration.

EdRc-61

Archaeological site EdRc-61 is the former site of St. Peter's Anglican Church and associated cemetery. Avoidance of EdRc-61 through Project redesign is the preferred management recommendation. As avoidance is not practicable, mitigation measures determined in consultation with the Archaeology Branch, the Anglican Church, and potentially other affected stakeholders (e.g., next of kin) are recommended. The Anglican Church has contacted the next of kin of Beatrix May Smith-Osborne, the one individual known to be buried at this site, and they expressed their desire to have the burial to be located and moved if this site is to be disturbed.

EdRc-62

Archaeological site EdRc-62 consists of a single modified ungulate incisor recovered from a shovel test. Avoidance of the site through Project redesign is the preferred management recommendation. If avoidance is not practicable, then mitigation measures will be required. Site mitigation would be determined in consultation with the Archaeology Branch, and may include systematic data recovery, construction monitoring, and/or site capping. Any alteration to these sites will require a Section 12 Site Alteration permit, issued by the Archaeology Branch.

EdRc-9, EdRc-19, EdRc-24, EdRc-26, EdRc-28, EdRc-31, EdRc-32, EdRc-35, EdRc-36, EdRc-38, EdRc-39, EdRc-42, EdRc-43, EdRc-45, EdRc-47, EdRc-57, EdRc-58, and EdRc-60

These sites may be directly affected due to increased human presence within the LSA during Construction, Operation, and Decommissioning and Closure. These areas will be marked as "No Work Zones" on development maps. An Environment Department staff member will be present during construction activities near such sites and site boundaries will be flagged or fenced to limit any indirect impacts.

11.18.3.3 Revisions to Project Footprint during Construction, Operation, and Closure

Any revisions of the Project footprint will be reviewed by a professional archaeologist and if necessary additional AIAs conducted under HCA permit. Any sites discovered as a result of revisions to the Project footprint during Construction, Operation, and Decommissioning and Closure within 500 m of Project impacts will be subject to the same level of management and mitigation afforded to protected sites outlined in this plan. Reporting pertaining to chance find sites is described further in Sections 11.18.5.3 and 11.18.7.2.

11.18.4 Monitoring

Site monitoring and/or site flagging during Construction, Operation, and Decommissioning and Closure is identified in Section 11.18.4 of this Plan for protected heritage sites that are located within 500 m of any Project infrastructure (Figure 11.18-1). This section describes how and when site monitoring and site flagging will take place as well as the use of the Project's Heritage Chance Find Procedure for new site discoveries.

11.18.4.1 Site Monitoring and Flagging

If construction is occurring near protected archaeological sites that are within 150 m of the Project footprint the site will be flagged or temporarily fenced prior to construction to serve as a visible barrier. All sites within 500 m of the Project footprint will be clearly indicated on development maps in relation to the Project footprint components. An Environment Department staff member and archaeological monitor will watch for archaeological site impacts or situations where construction activities occur less than 50 m from a site. Should impacts be anticipated or found to occur less than 50 m from an archaeological site, the Project Archaeologist will be contacted to determine if mitigation measures, which may include systematic data recovery, are required.

<u>Construction Monitoring</u>

Protected heritage sites that are located between 150 m and 500 m of the Project footprint, and may be impacted by ongoing Project activities, will have archaeological monitors check on these sites on an annual basis to determine that they remain intact and unaffected by the Project. Should impacts be observed at archaeological sites, the Project Archaeologist and the Archaeology Branch will be contacted and notified of the impact. Post-impact mitigation plans will be developed in consultation with the Archaeology Branch and Aboriginal Groups on a case-by-case basis.

<u>Boundary Flagging/Fencing</u>

Where construction activities will take place in close proximity to protected heritage sites, within 150 m, a physical barrier may be established around a site, the boundaries flagged or fenced. Typically, site boundary flagging involves the use of rebar or wooden stakes with snow fencing or other visible barriers, running around the outside of the site boundary. Similarly, brightly coloured stakes installed at intervals around the boundaries of the site can be used if snow fencing or other visible barriers are impractical or constitute a barrier for livestock or wildlife. In either case, fencing will be visible above the anticipated snowline, particularly where sites are located adjacent to areas where construction will be undertaken when snow is still present.

It is best practice to have site boundaries marked for flagging/fencing by the environmental personnel, archaeological monitors, or an Archaeologist in order to limit impacts to the site and to avoid any sensitive areas that may be present. Flagging/fencing of archaeological site boundaries will take place prior to construction during snow-free conditions, where possible, and when the ground is not frozen. Archaeological sites in the region typically contain surface and subsurface scatters of artifacts; therefore installation of flagging/fencing is best conducted when the surface of the site is visible to prevent any unnecessary damage. Installation of flagging/fencing when the ground is not frozen is recommended for ease of installation where rebar or wooden stakes will be used.

Once a site has been flagged/fenced, it will be visited during and after construction activities to determine if impacts have occurred. Environment Department personnel or archaeological monitors will also check on and maintain these flagged/fenced boundaries if future construction or other development activities are planned nearby in the future.

11.18.4.2 Work Planning and Schedule

As outlined in Section 11.18.3, mitigation, monitoring, and management of protected heritage resources in the Project will be largely scheduled in relation to planned construction activities that will occur in proximity to sites.

Project activities that will take place within 0 to 50 m of protected heritage sites will require mitigation to take place prior to Project activities. Such mitigation would be conducted under a *Heritage Conservation Act* Heritage Inspection Permit and may involve detailed mapping, photography, and systematic data recovery. Reporting the results of mitigation would meet the submission date outlined in the permit application. Approval for work to proceed in the area will be given by the Archaeology Branch to allow for impacts within the site boundaries. See Section 11.18.7.1 for additional reporting details.

Project activities that will take place within 50 to 500 m of protected heritage sites may be subject to either site boundary fencing/flagging or monitoring. If site fencing/flagging is used, it will need to be installed during snow-free conditions when the ground is not frozen when possible, prior to construction activities. Site monitoring will be conducted during construction activities that are taking place in close proximity to archaeological sites. In addition, site monitoring/inspection will also be conducted following construction activities to determine that no impacts to the site occurred.

The Project's Heritage Chance Find Procedure will be used on an as-needed basis during the course of Construction, Operation, and Decommissioning and Closure. Should heritage materials be encountered, the procedure will be followed. See Section 11.18.5.3 for additional information.

11.18.5 Reporting

The reporting process for mitigation, monitoring and chance finds is summarized in Table 11.8-2 and detailed below.

Table 11.18-2. Reporting Summary

		Report Submitted to	
Report Type	**Report Frequency**	**Provincial Regulatory Agency**	**Federal Regulatory Agency**
Mitigation	Prior to Construction	Archaeology Branch MFLNRO	
Monitoring	As required	Archaeology Branch MFLNRO	
Chance Find	As required	Archaeology Branch MFLNRO	

11.18.5.1 Mitigation Reporting

For protected heritage sites that are within 0 to 50 m of Project impacts, mitigation will be conducted prior to construction (see Section 11.18.3). British Columbia Site Inventory Forms must be updated detailing the mitigation measures and submitted to the Archaeology Branch for inclusion in the Archaeology Branch's Archaeological Site Inventory database. Reporting detailing the results of mitigation measures will be included in a *Heritage Conservation Act* Heritage Inspection Permit, issued to the Project Archaeologist by the Archaeology Branch. The permit application will specify the delivery date of the report to the Archaeology Branch as well as Aboriginal Groups who will require a copy of the report for reference, and the repository that will curate any collected artifacts and all associated field notes, artifact catalogues, and reporting.

Reporting relating to mitigation will be completed and will meet the submission date outlined in the permit application. Approval to proceed in the area of the site is given by the Archaeology Branch, to allow for work to be conducted within the site boundaries. A report will be submitted to the Archaeology Branch and Aboriginal Groups outlining the work carried out within the site boundaries.

11.18.5.2 Monitoring Reporting

KAM, in collaboration with the Project Archaeologist, will coordinate monitoring and site inspection and the documentation of chance finds. KAM will maintain documentation regarding monitoring and any heritage sites that may be discovered during the course of Construction and Operation, and will report any chance finds or impacts to heritage sites to the Project Archaeologist who will report as appropriate to the Archaeology Branch and Aboriginal Groups (see Section 11.18.5).

Monitoring activities, outlined in Section 11.18.4, will be summarized in an Archaeological Site Monitoring Report to be provided to the Project Archaeologist who will report as appropriate to the Archaeology Branch.

11.18.5.3 Heritage Chance Find Procedure

KAM will arrange for site orientation and training of all employees and on-site personnel/contractors with regards to compliance with the *Heritage Conservation Act* (1996) and the use of the Project's Heritage Chance Find Procedure. Training and site orientation will be provided for all new employees during their induction. This training will focus on how to avoid known heritage sites (including protected archaeological, historic, and paleontological sites), the procedure in place for responding to newly identified sites as outlined in the Project's Heritage Chance Find Procedure, and how to report these sites or observed site impacts. Records of this training will be kept and maintained. Copies of the Project's Chance Find Procedure will be kept on-site for reference and on file by KAM. In general, if personnel suspect archaeological, historic, or paleontological materials or human remains have been discovered they will:

- Stop all work in the area to reduce/minimize impacts to the site;
- Leave the material in place and protect and/or mark the area around the site; do not disturb or collect any heritage material or human remains; and
- Report the discovery to their supervisor. The supervisor will inform the Environmental Manager and Mine Manager. The Mine Manager and Project Archaeologist will inform the Archaeology Branch and local Aboriginal organizations of the discovery.

11.19 Dark Sky Management and Monitoring Plan

11.19.1 Purpose

The purpose of the management and monitoring plan is to:

- monitor the effect of obtrusive light on the area surrounding the project;
- evaluate mitigation measures to enable the implementation of adaptive follow-up management programs as needed; and
- verify the predictions made during the environmental assessment.

Throughout engagement and consultations with the City of Kamloops and the Kamloops Astronomical Society (KAS) concerns regarding the potential for light from Project activities to affect the dark sky in both the nearby residential areas of Sahali, Pineview, Aberdeen, and Knutsford as well as the observatory operated by KAS south of the project near Stake Lake were well established. The effects assessment has identified that the residual effect from Sky Glow caused by the Project will have a not-significant (moderate) effect on the surrounding areas within the RSA.

11.19.2 Performance Objectives

The objective of this plan is to manage the lighting requirements for the construction and operation of the Project components in a manner that will eliminate spill light and glare on to neighbouring areas and limit the amount of sky glow while providing adequate lighting to assure safe working conditions at the Ajax Project and meet the OHS standard as mandated by Work BC.

The invasive character of spill light and glare can affect night rest of humans and behaviour of wildlife surrounding the Project. Glare can also lead to hazardous driving conditions for traffic travelling past Project sites. The illumination of the sky in the form of sky glow could affect astronomical observation at the observatory of KAS near Stake Lake.

11.19.3 Environmental Protection Measures

The measures to protect the environment from spill light, glare, and sky glow can be separated into three specific procedures: illumination management, shielding and directed lighting, and spectral control.

<u>Illumination Management</u>

A very effective means of mitigating obtrusive light effects is to only use lighting when required. This will be achieved by setting timers, placing motion sensors, and planning the work efficiently by concentrating activities during the spring and summer season when the number of daylight hours is at its peak. When nighttime work is required, timers and motion sensors will be used to limit the duration of illumination and portable light plants will be used to light only areas that are active during nighttime activities.

Historically the preference for typical industrial sites has been to use high intensity discharge lighting for outdoor purposes. This type of lighting guarantees a sufficient amount of illumination and the lamps last a long time, however, this type of lighting has a warm-up and cooling-down period that is needed for optimal performance and as a result the lights are rarely turned off. With the invention of light emitting diode (LED) lighting, the warm-up and cool-down periods are no longer necessary and lights can be dimmed when lower illumination levels are sufficient. To mitigate obtrusive light, LED lighting will be preferentially used for illumination on site.

Shielding and Directed Lighting

To prevent light from spilling over property boundaries, light will be directed and/or shielded to target areas. This will be achieved for stationary sources by using fixtures that cut off the illuminated light and have a more concentrated beam. Along linear features, when fixtures direct the light more efficiently less lumen are required. LED lighting can be shaped to the specific feature requiring illumination, reducing the spill light generated by conventional lighting systems, which illuminate in a circular shape. Shielding, achieved by developing natural or artificial barriers around the project area, will be used where appropriate. Light Plants (non-stationary sources) will be utilized in areas where the location of nighttime activities is variable (i.e. active waste rock management facilities). Non-stationary sources can be used in these instances to direct light in active areas only and minimize effects to any residences within proximity to the Project.

Light fixtures will be placed above target areas at a height that creates a near vertical light beam in order to simulate the light from the sun which gives a more natural working environment with fewer shadows. This positioning is not only important to optimize the visual aspect for workers but also to reduce the potential glare for the workers, drivers or other visitors to the area.

Spectral Control

Native flora and fauna are often sensitive and responsive to light in the short wavelength range (less than 500 nm), where ultraviolet light plays an important role for navigation, foraging, and mate selection (Bruce-White and Shardlow, 2011). Additionally at these shorter wavelengths, atmospheric scattering is increased causing negative effects upon astronomical observations. The use of 500 nm filtered LED fixtures will make it possible to control the colour of the light and limit the effect of spill light at the local scale and the effect of sky glow at the regional scale.

11.19.3.1 Design Criteria

The Occupational Health and Safety Regulations dictate under Section 4.65 that a minimum level of lighting is required to guarantee work can be performed safely and travellers can pass through a target area without any hazards or obstructions (Work Safe BC, 2008). The following BC requirements will be met:

- 22 lux (2 fc or 22 lumen/m^2) in areas of low activity, such as parking lots, building exteriors, outside areas, and basement areas housing machinery, but which are not regular task areas;
- 54 lux (5 fc or 54 lumen / m^2) in areas of high activity, such as frequently used walkways and building access and egress points.

11.19.3.2 Construction

The majority of the Construction activities will occur during daylight hours. Efforts will be made to limit the amount of lighting used when working in low light conditions, while maintaining safe working conditions. There will be times where work extends into the evenings and occasionally work may occur through the night, and in these low light situations there will be a requirement to illuminate the work areas sufficiently to perform the work safely and efficiently. The lighting management plan for the Construction phase will consist of:

- Mobile light installation, which will be shielded and aimed at the target areas to prevent light spilling beyond the Project boundaries;
- Monitoring of key locations around the Project by measuring the amount of light spilling beyond the Project boundaries and the effect of Project lighting on the Dark Sky.
- Regular consultation and two-way communication with neighbours and the Community Liaison Group (see Section 11.29).

Also, plans for the long-term operational lighting will take place as the Project site is developed, including the lighting type and placement of lights.

11.19.3.3 Operation

During Operation the prevention of light disturbance will be supported by an enhanced lighting plan that includes illumination management, shielding and directed lighting options, as well as spectral control. The following will be included in the developed lighting plan:

- install light sources only when necessary and use the smallest possible light source required to ensure safety for the target area;
- use full cut-off solid state LED lighting systems that are shielded and aimed at the target area;
- use spectral control options such as narrow band amber LED to limit the Rayleigh scattering and associated light pollution where possible; and
- employ adaptive management lighting options such as dimming and extinguishing (on/off) to ensure lights can be turned off when they are not needed and provide emergency lighting when required.

11.19.3.4 Decommissioning and Closure

During the Decommissioning and Closure phase, most activities will be carried out during daylight hours and lights on site will be dimmed or completely turned off. Lighting will be limited to the minimum amount required.

11.19.3.5 Post Closure

During the Post-Closure phase there will be no lighting used as all activities will take place during daylight hours. Illumination levels will be brought back to baseline conditions and any Project residual effects from sky glow will be eliminated.

11.19.4 Monitoring

Sky darkness will continue to be monitored at the original 19 baseline sampling locations through the life of the Project (Table 11.19-1 and Figure 11.19-1). Four monitoring locations have been added to create a better spatial coverage of observations and be able to create a better model. It will also increase the ability to address concerns regarding recreational activities at Greenstone Mountain Provincial Park and on Chuwhels Mountain.

Table 11.19-1. Sky Darkness Monitoring Locations

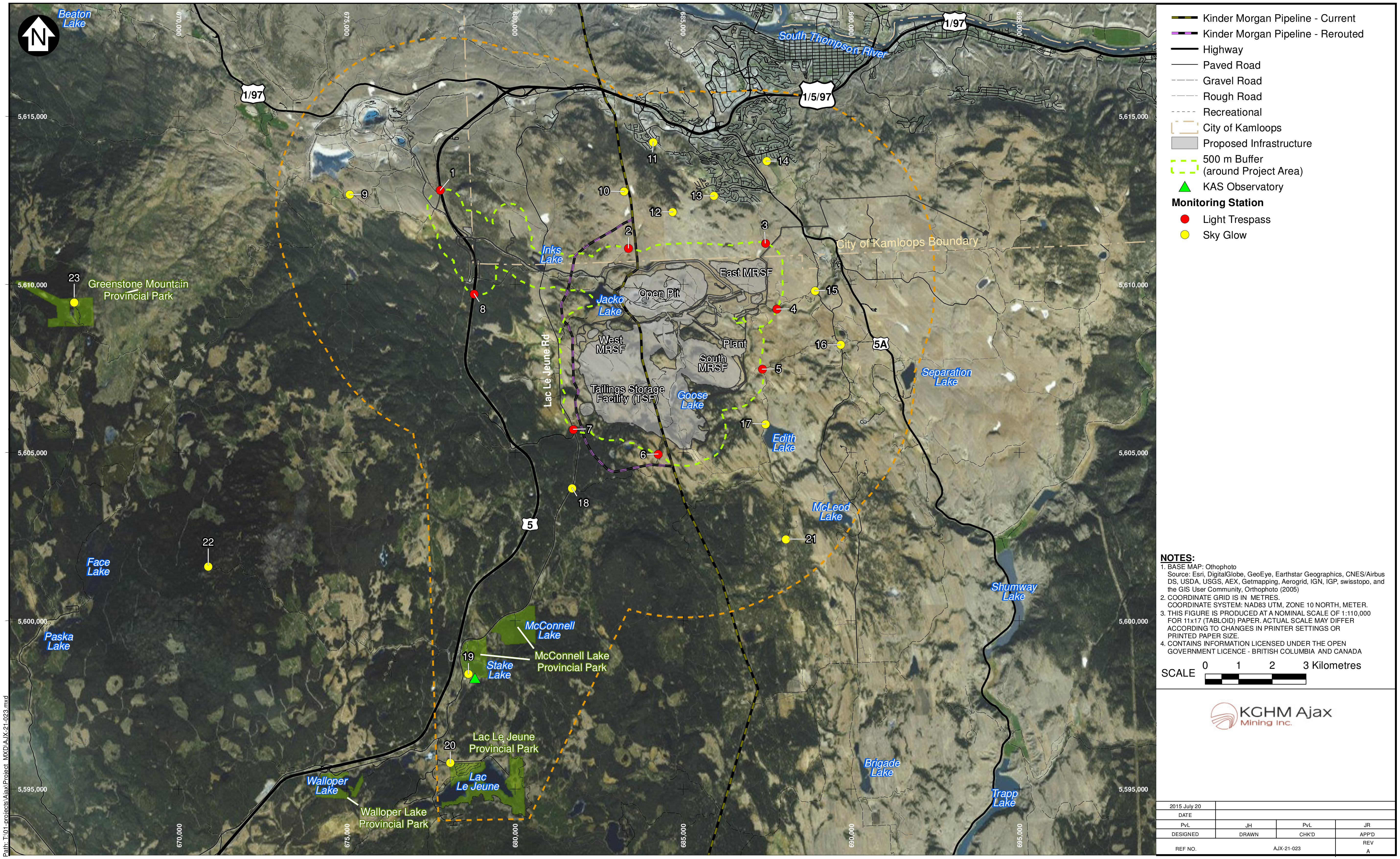
ID	Easting	Northing	ID	Easting	Northing
1	687486	5613665	13	684665	5612000
2	685912	5612632	14	685001	5611736
3	684102	5614222	15	678410	5611393
4	680434	5610403	16	680434	5610403
5	678608	5598433	17	689683	5608208
6	681695	5603940	18	675084	5612670
7	684700	5605929	19	687451	5605855
8	688918	5609811	20	678069	5595786
9	685680	5609366	21	688051	5602424
10	683426	5610902	22	670866	5601616
11	683239	5612758	23	666877	5609460
12	684683	5612151			

Three measurements (mag/arcsec^2) will be taken at each site at least twice a year, once in the summer and once in the winter. The frequency of measurement may be decreased over time based on the monitoring results. Readings will be collected within three days of a new moon, at the zenith using a Sky Quality Meter (SQM) made by Unihedron, Grimsby, Ontario, Canada (or equivalent).

Additional measurements will take place during the winter months at the Stake Lake Observatory to determine the effect of the Project on KAS and identify the effect of lighting along the ski trails.

Sky darkness will be compared annually to baseline conditions to determine changes resulting from project illumination. If changes in sky darkness are observed, then adaptive management lighting options will be assessed based on magnitude and duration of the activities as well as in response to concerns raised by local residents.

Figure 11.19-1
Sky Glow and Light Trespass Monitoring Locations



11.19.5 Reporting

Sky darkness will be reviewed annually to determine any changes in sky illumination. If the results suggest a decrease in sky darkness or illumination concerns are raised by the public, including KAS observers, then further mitigation measures will be assessed and discussed through consultation and two-way communications with neighbours and the Community Liaison Group. If necessary, improvements will be implemented through adaptive management to minimize spill light, glare, or sky glow. A dark sky data report will be produced annually and made available to the city of Kamloops, KAS and any stakeholder interested in the results (Table 11.19-2).

Table 11.19-2. Dark Sky Reporting Summary

		Report Submitted to	
Report Type	Report Frequency	Provincial Regulatory Agency	Federal Regulatory Agency
Dark Sky Data Report	Annually	Not required	Not required

11.20 TRANSPORTATION MANAGEMENT PLAN

Development, operation and closure/reclamation of the Project will generate substantial volumes of traffic. Measures to minimize traffic impact on existing networks will be required, as well as a safe and reliable means of delivering personnel, materials and equipment to the mine site, and hauling concentrate from the mine to Vancouver.

Over its lifecycle, the Project will use two access plans to connect the mine site with Kamloops and Vancouver via Highway 5. In general, the principal operational access between the mine and Highway 5 (Primary Access Plan) will be via the existing Old Afton Mine Haul Road (known hereinafter as the Ajax Mine Access Road) and an upgraded Inks Lake Interchange connecting it to Highway 5 which will be located approximately 500 m north of the existing Inks Lake Interchange (to be decommissioned). In order to improve access for both construction and mining, the Ajax Mine Access Road (AMAR) will be upgraded as required and a new intersection constructed where it crosses Lac Le Jeune Road (LLJR). Upon completion of improvements, the upgraded interchange and AMAR will become public roadway, providing a permanent connection between Highway 5 and LLJR. The primary access plan is shown in Figure 11.20-1.

During construction of the primary access routes, a temporary access plan will be in place as shown in Figure 11.20-2. During this phase, Kamloops-based passenger traffic will use LLJR to travel to/from the mine site via the Copperhead interchange. Heavy vehicles will be required to use Walloper Way Interchange on Highway 5 to access LLJR. This interchange is 31 km south of the Project. Once permanent access routes are complete, all mine traffic (including heavy vehicles) will be routed through the upgraded interchange and prohibited from using LLJR.

11.20.1 Purpose

The purpose of the Transportation Management Plan (TMP) is to ensure that the main access routes into the mine site are designed, operated and maintained in such a manner that:

- safety of all road users is maximized;
- disruption and delay to existing road users is minimized; and
- adverse effects on the environment, wildlife, and existing infrastructure are minimized.

The TMP contributes to a systematized framework of environmental management by co-ordinating and facilitating safe, orderly, compliant, and environmentally and socially responsible traffic operations.

Consistent with the ISO 14000 series of environmental management standards, the TMP is based on the principle of continual improvement via an iterative process of planning, implementing, checking, and acting. Adaptive management of the TMP is typically applied in the following manner:

- Planning – establishing objectives and defined processes that accord with the project charter and conditions of the Environmental Certificate;
- Implementing – following the defined processes (or actions);

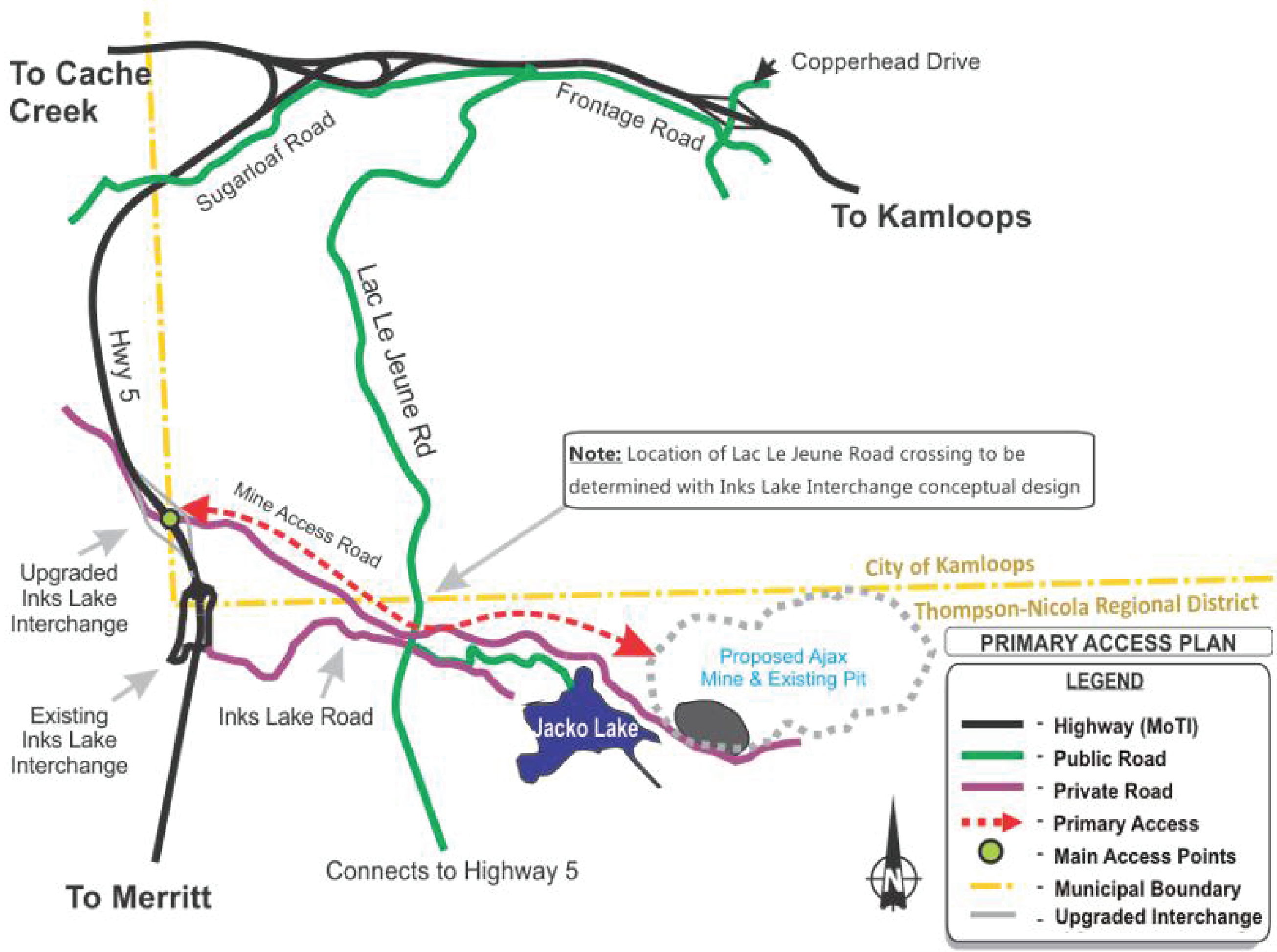
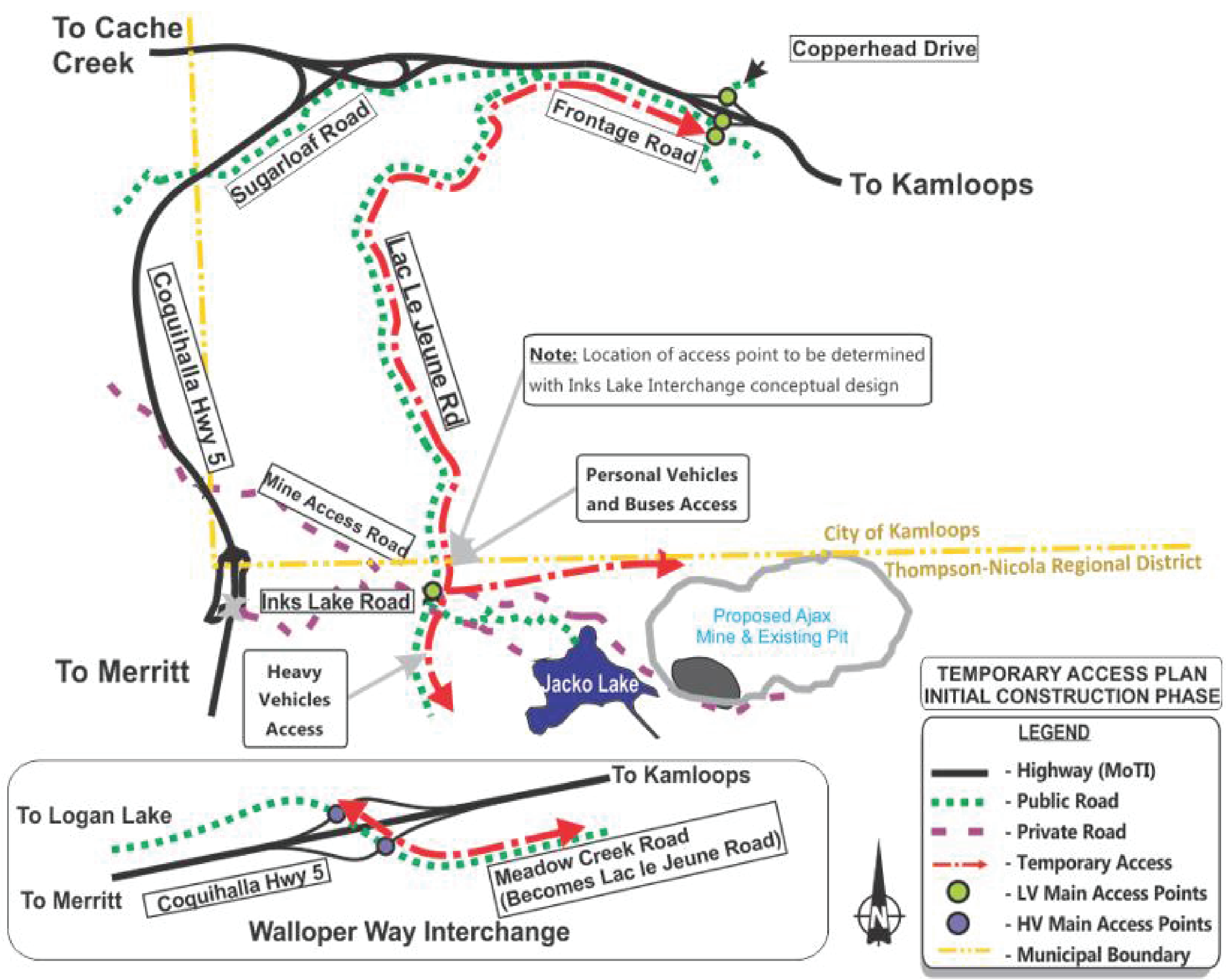

To Cache Creek
Sugarloaf Road
Frontage Road
Copperhead Drive
To Kamloops
Hwy 5
Lac Le Jeune Rd
Note: Location of Lac Le Jeune Road crossing to be determined with Inks Lake Interchange conceptual design
Mine Access Road
Upgraded Inks Lake Interchange
Existing Inks Lake Interchange
Inks Lake Road
City of Kamloops
Thompson-Nicola Regional District
Proposed Ajax Mine & Existing Pit
Jacko Lake
To Merritt
Connects to Highway 5
N
PRIMARY ACCESS PLAN
LEGEND
- Highway (MoTI)
- Public Road
- Private Road
- Primary Access
- Main Access Points
- Municipal Boundary
- Upgraded Interchange

Figure 11.20-2
Temporary Access Plan



- Checking – monitoring processes and conditions and reporting against the objectives; and
- Acting – taking action, if necessary, to achieve improvement in the project's traffic performance and compliance with objectives.

This TMP considers traffic generation throughout the entire lifecycle of the mine and sets out guidelines and procedures for implementing the traffic mitigation measures recommended in the Traffic Impact Assessment (TIA). It also sets out the approach to be taken for monitoring and responding to potential residual effects after application of planned mitigation.

11.20.2 Performance Objectives

This TMP is designed to achieve the following performance objectives:

- upgrade, operate and maintain the mine access roads so that they are safe for designated uses;
- implement demand management practices that minimize the volume and impact of commuter traffic generated by the mine;
- ensure that all authorized road users follow stipulated routes and procedures;
- comply with the *Mines Act* by controlling access to the mine site; and
- minimize adverse effects on water resources and other habitats by complying with guidance for the operation, maintenance, and deactivation of the Project and access roads.

11.20.3 Environmental Protection Measures

Successful implementation of the identified actions to avoid, control, and/or mitigate environmental effects (environmental protection measures) is critical to managing traffic disruption and ensuring continued safe and efficient operation of the surrounding street networks.

The following measures to manage traffic and minimize environmental impact are included:

- industry-recognized design criteria and construction management practices for access improvement works (including compliance with other Environmental Management and Monitoring Plans);
- commuting trip demand reduction through: car or vanpooling, bus staging, and staggering of shifts;
- heavy vehicle routing, including implementation of two-way radio communication and control processes to manage traffic movement as required;
- on and off-site parking management for commuting staff; and
- spill containment and sediment control practices.

In addition to the primary environmental protection measures listed above, a number of supporting actions are proposed to supplement the implementation and management of travel demand and behaviour. These supporting actions are important to the overall effectiveness of the environmental protection measures:

- employment contract incentives for participation in initiatives to reduce travel demand;
- workplace travel planning;
- community information, reporting, and feedback programs.

11.20.3.1 Design Criteria

The Project includes the improvement of existing roads as well as the construction of new access roads, intersections and highway interchanges that will connect the mine to Highway 5. The access roads will be used year round during all phases of the Project by commuting staff and contractors, and to deliver and remove supplies and materials, and ship concentrates to Vancouver. The supplies will include diesel fuel, mill consumables, mining consumables, ANFO (ammonium nitrate/fuel oil), and sundry equipment and supplies.

The Project Site access road will be upgraded, operated, and maintained in accordance with current standards and permits issued by the British Columbia Ministry of Transportation and Infrastructure (BC MOTI) under the *Canada Transportation Act* (1996). The objectives are to ensure that: 1) the access roads are designed and maintained in a manner that assures the safety of road users and minimizes adverse effects on the travelling public, the environment and wildlife; and 2) they are used in a manner that avoids adverse worker and public health and safety effects and minimizes environmental effects.

11.20.3.2 Construction General

Access Control

Prior to Construction, a sign (and turning facility) will be posted at the public road demarcation point to inform motorists and AMAR users that the road is no longer public and they are entering mine property. A gatehouse will be installed on the AMAR to control and record the access of the public, mine workforce and contractors to restricted working areas.

Additional gates and turning facilities will be installed on Goose Lake Road at the limits of the proposed road closure, in order to comply with *Mines Act* requirements for restricting public access to the active mine area.

Access control is also required at Jacko Lake to manage public safety during blasting operations (refer to Access Management Plan, Section 11.21).

Spill Contingency

Traffic accessing the project site will include trucks hauling fuel and other hazardous materials during construction and subsequent mine operations. Traffic exiting the site will include trucks hauling concentrates during mine operations. Protocols for transport and handling of hazardous substances are included in the Hazardous Waste Management Plan (Section 11.10). Spills of these materials may have adverse environmental effects if not addressed quickly and efficiently. The Project's Spill Contingency Plan (Section 11.16) will address accidental spills and road users (KAM personnel as well as contractors) are expected to be knowledgeable in relevant spill-response techniques and protocols. Spill kits should be available on vehicles transporting dangerous goods or hazardous materials, and mobile spill response kits will be available at the mine plant site. Mine exit vehicle inspections and wheel washing facilities will prevent the transport and deposition of mine sediments on the public road network.

As far as the protection of wildlife and wildlife habitat is concerned, relevant measures referred to in best practice guidelines will be applied, such as curtailing sediment-release from nearby roadworks and preventing deleterious substances from entering streams (Erosion and Sediment Control Plan, Section 11.2).

<u>Road Use Minimization</u>

Minimization of private vehicle commuting trips amongst KAM employees is an important mitigation action and will take place via the following interventions:

- **Construction:**
  - Providing bus staging in Kamloops for 85% of construction workers.
  - Facilitate carpooling during the Construction phase to ensure that at minimum 15% of employees travelling by personal vehicle will travel as a passenger.
  - Staggering of shift start and end times during operations to reduce travel in adjacent street peak hours by at least 40%.
- **Operation:**
  - Facilitate carpooling during the Operation phase to ensure that at least 15% of employees travel as passengers in private vehicles.
  - Staggering of shift start and end times during operations to reduce travel in adjacent street peak hours by at least 40%.

Prior to Construction, KAM will identify appropriate off-site staging and parking locations and follow due process to secure and comply with appropriate permits for establishment and operation. At this time, the three potential bus staging locations have been identified:

- northeast corner of the upgraded Inks Lake Interchange;
- 485 Mt Paul Centre Way (in Tk'emlúps te Secwepemc land); and
- southeast corner of the Shuswap Road E and Highway 5 intersection (also in Tk'emlúps te Secwepemc land).

In addition, KAM will support the achievement of the above through a workplace travel planning initiative, carried out as per Transport Canada's Workplace Travel Plan Guidance for Canadian Employers.

11.20.3.3 Construction

During the first six months of mine Construction, while the Inks Lake Interchange modifications are being built and the AMAR is upgraded, commuter traffic will access the mine site via LLJR from the

Copperhead Interchange (see Figure 11.20-2). Heavy traffic and oversized loads will require an alternative access due to the weak pavement and sub-optimal alignment of LLJR between Kamloops and the AMAR intersection. All heavy traffic will be routed via LLJR from the south through the Walloper Way interchange (Highway 5). Appropriate signage on the Project site and access roads will also be installed.

On-site parking and associated facilities will be required for 50 private vehicles as well as bus drop off/pick-up capacity for 270 staff (6 buses) per hour.

During the remainder of the Construction period, the Inks Lake Road Interchange will be open and all traffic to and from the Project site will be re-routed through this interchange and along the AMAR (see Figure 11.20-1).

On-site parking and associated facilities will be required for 230 private vehicles as well as bus drop-off/pick-up capacity for up to 1,170 staff (26 buses) per day. Busing will remain the primary site personnel transportation mode for site access throughout the construction phase.

11.20.3.4 Operation

During the Operation phase, all traffic will access and egress the mine site via the upgraded Inks Lake Interchange and AMAR. Access control will be as described above (i.e., the main access control gatehouse on the AMAR at the mine site, and the additional gates on Goose Lake Road) will become permanent features and maintained throughout Operation. Similarly, the sediment transport and spill response protection measures described for the Construction phase above will be maintained and rigorously applied during the Operations phase of the Project. Appropriate signage on the mine site and access roads will also be maintained.

Project related traffic will not be permitted to use LLJR to access the Highway, and will be outlined in all employment and supply contracts. This will avoid adverse effect on existing difficult traffic conditions at the Copperhead and Pacific Way interchanges as well as sections of LLJR with substandard alignment and weak pavement.

On-site parking and associated facilities will be required for 180 private vehicles.

11.20.3.5 Decommissioning and Closure

Access control to the Project site by means of gates on the main access road and Goose Lake Road as described for the Construction and Operation phases above will be maintained as required during the Decommissioning and Closure phase. Traffic during this phase will be similar in nature to Construction phase traffic in that it will comprise the transportation of large pieces of equipment and bulk materials, in this case for resale, recycling or disposal off-site.

However, the number of vehicle trips will diminish considerably since concentrate will no longer be hauled off site, there will be fewer employees and delivery of operating consumables will no longer be required. The Project's Spill Prevention and Response Plan and Sediment Control Plan will also remain in force while Decommissioning and Closure activities are taking place.

The Decommissioning and Closure phase will see the demolition and removal of the gatehouse facility, and the decommissioning and rehabilitation of most of the mine site roads. The AMAR will remain intact as public road between Highway 5 and LLJR and private road beyond to provide access to the site Post-Closure. A lockable gate across the AMAR will provide demarcation between public and private road.

11.20.3.6 Post-Closure

Access control to the closed mine site will be maintained into the Post-Closure phase, but only until an acceptable level of closure and rehabilitation has been reached and the presence of personnel diminishes to an infrequent level when the access control will return to the level required for Sugarloaf Ranch operations. For more information on ranching activities during Post-Closure, please refer to the Reclamation and Closure Plan (Section 3.17). For more information regarding Sugarloaf Ranch access during Post-Closure, please refer to the Access Management Plan (Section 11.21).

11.20.4 Monitoring

Monitoring will be implemented to track the effectiveness of the proposed environmental protection measures for traffic and access to the mine site. These will include:

- **Incident Monitoring:**
  - Ongoing road safety, wildlife collision and spillage incident tracking to determine trends and identify areas requiring further mitigation.
  - Ongoing tracking of public complaints to identify areas requiring further mitigation.
  - Ongoing tracking of unauthorized use of access roads.
- **Planned Monitoring:**
  - Daily patrols of LLJR during operation of the temporary access plan (Phase 1 of Construction) by a designated employee during travel to/from the Project site.
  - Quarterly documented conditions assessment monitoring of LLJR during operation of the temporary access plan (Phase 1 of Construction).
  - Quarterly monitoring of staff travel behaviours and trends to determine achievement of target bus and carpooling rates.
  - Quarterly monitoring of other key effects identified in the EA such as: traffic noise and vibration at various human and wildlife receptor locations; and sediment release and contamination of various water courses and receiving environments (refer to Section 11.2 Erosion and Sediment Control Plan).

11.20.4.1 Work Planning and Schedule

The performance objectives and measures related to access management will be relayed to all KAM personnel that have a direct or indirect influence on such management during site orientation and job training. Communication of such training will be recorded.

A notional monitoring schedule for traffic and access management would consist of regular monitoring and inspections of access roads and routes at defined intervals and automated e-mail notification of issues as and when received through on-line or call-in forums. Scheduled engagement forums with key stakeholders (BC MOTI, RCMP, etc.) will also be planned. Table 11.20-1 summarizes the proposed schedule of monitoring activities associated with the TMP.

Table 11.20-1. Schedule of Transportation Management Plan Monitoring Activities

Monitoring Activity	Project Phase	Frequency	Season
Incident Reporting: • Road safety • Wildlife collisions • Spills • Public complaints	Throughout the life of the mine	As incidents occur	Year-round
LLJR Daily Patrols	Construction	Daily until the Primary Access Plan is functional	Year-round
LLJR Road Condition Assessment	Construction	Quarterly until the Primary Access Plan is functional	Year-round
Staff Travel Behaviours	Throughout the life of the mine	Quarterly during construction and first year of operation, then annually	Year-round
Traffic Noise and Vibration	Throughout the life of the mine	Quarterly during construction and first year of operation, then annually	Year-round

11.20.5 Reporting

Three main reporting types will include:

- internal significant incidence reporting;
- internal quarterly reports; and
- external annual reporting.

Internal significant incidence reporting will occur when serious incidents take place and need to be reviewed and rectified immediately (e.g., spills, road collisions, disregard of specified travel routes, etc.). Internal quarterly reports will summarize transportation related incidence reports, quarterly LLJR condition assessment results, and quarterly staff behaviour monitoring. External annual reports will summarize the quarterly reports and will be submitted to BC MOTI for review.

In general, quarterly and annual reports will include:

- evaluation of the effectiveness of the TMP;
- description of the data collected and analyses that were performed in the period as well as QA/QC procedures;
- monitoring results and interpretation;

- identification of any emerging negative environmental trends likely attributable to Project traffic;
- recommended revisions to the TMP to address emerging negative trends, or to adjust monitoring programs, if required; and
- assessment of the effectiveness of additional mitigation measures taken to eliminate or reduce emerging negative trends.

All reports will be reviewed internally by the responsible line manager, the Environment Manager, Process Plant Manager, Health and Safety Manager and the Mine Manager, in order to identify necessary improvements in the monitoring system.

The Health and Safety Manager and Environment Manager will be responsible for the monitoring and reporting on access management related incidents and mitigation measures as per their areas of responsibility. Appropriately qualified personnel will be employed throughout the life of the Project to supervise, direct, monitor, and implement the line management actions required by this Transportation Management Plan. Where required, reports will be forwarded to relevant government agencies as stipulated by regulations and licences.

11.21 ACCESS MANAGEMENT PLAN

11.21.1 Purpose

The purpose of the Access Management Plan is to ensure that KGHM Ajax Mining Inc (KAM) manages and maintains access to the Project Site to ensure the health and safety of KAM workers, contractors, the public and special interest groups, as well as addressing safe and effective management of access to Jacko Lake.

Successful implementation of the Plan will facilitate a superior level of security and safety for KAM workers, employees, visitors, and the community as well protection of the environment.

A safe and reliable means of delivering personnel, materials and equipment to and from the Project Site will be required to support the Project. In general the Access Management Plan will address access control to and from the Project.

11.21.2 Performance Objectives

This Access Management Plan is designed to achieve the following performance objectives:

- upgrade the Inks Lake Interchange, Ajax Mine Access Road (AMAR) and Lac Le Jeune Road crossing to maximize safety for road users and ensure that environmental effects associated with site access are minimized;
- post speed limits and other road safety signage in order minimize wildlife mortality and enhance traffic safety;
- comply with Health, Safety and Reclamation code for Mines in British Columbia 2008, requirements by controlling access to the Project site;
- control access to Jacko Lake during blasting events;
- incorporate an external communication plan to provide community and special interest groups updates to Project activities that could impact recreational use in the Project area;
- maintain a process by which special interest groups can access non-operational areas outside the mine footprint.

11.21.3 Environmental Protection Measures

11.21.3.1 *Design Criteria*

The Project Site access road and associated infrastructure in relation to Inks Lake Interchange and the Lac Le Jeune Road crossing will be upgraded with user safety and environmental stability in mind. During all phases of the Project, this infrastructure will be used to provide access for workers and contractors to the Project site and to deliver and remove supplies and materials from the Project site, including concentrate shipments. The supplies will include diesel fuel, mill consumables, mining consumables, and sundry equipment and materials. The AMAR and associated infrastructure will also be used by the Public to access Lac Le Jeune Road and Jacko Lake from Highway 5.

All upgrades and maintenance to mine access and security, including upgrades to transportation infrastructure and perimeter fencing, will be conducted in accordance to applicable guidelines and regulations:

- Health, Safety and Reclamation Code for Mines in British Columbia 2008;
- Occupational Health and Safety Regulations of British Columbia;
- *Transportation Act* and Statutes;
- *Environmental Management Act*;
- *Agricultural Land Commission Act* and associated Regulations and Policies;
- *Land Act* and associated Regulations and Policies.

In addition to regulatory requirements, any activities associated with all phases of the project will be subject to internal policies to be outlined in the following documents:

- KAM HSSE Manual Vol 6;
- KAM Drug and Alcohol Policy;
- KAM Traffic Management Plan;
- KAM Security Management Plan;
- Fisheries and Aquatic Life Monitoring Plan (Section 11.25); and
- Spill Contingency Plan (Section 11.16).

11.21.3.2 *Construction*

Two phases of access have been identified: early construction (initial access; zero to six months) and Primary access (six months onward; Figure 11.21-1).

During ramp up to Construction, access to the Project site will be via the Lac Le Jeune Road. Lac Le Jeune Road is a public road and all posted signage, speed limits, and activity on this roadway, including upgrades to the Lac Le Jeune overpass and accommodation of large vehicles or oversize loads, shall be in accordance with provincial and federal standards for public roadways as laid out in the applicable transportation acts and statutes and applicable permit requirements. During early Construction, the existing overpass will be removed and replaced with a new overpass to safely accommodate increased traffic volume.

During peak Construction, Project access will transition from the Initial Access Plan to the Primary Access plan on completion of the Inks Lake interchange and upgrades to the Mine Access Road. In the Primary Access Plan access to the Project will occur via Highway 5 (Coquihalla Highway) to Inks Lake interchange. Inks Lake interchange will provide connection to the Mine Access Road and the Project site. A temporary construction parking area will be constructed in conjunction with the interchange upgrades (Figure 11.21-2). The majority of traffic to the Project site during construction will be managed by park and ride bussing from this location to the site. An additional access point via Goose Lake Road will be used during emergency only.

Figure 11.21-1
Project Access Roads, Security Points and Perimeter Fencing

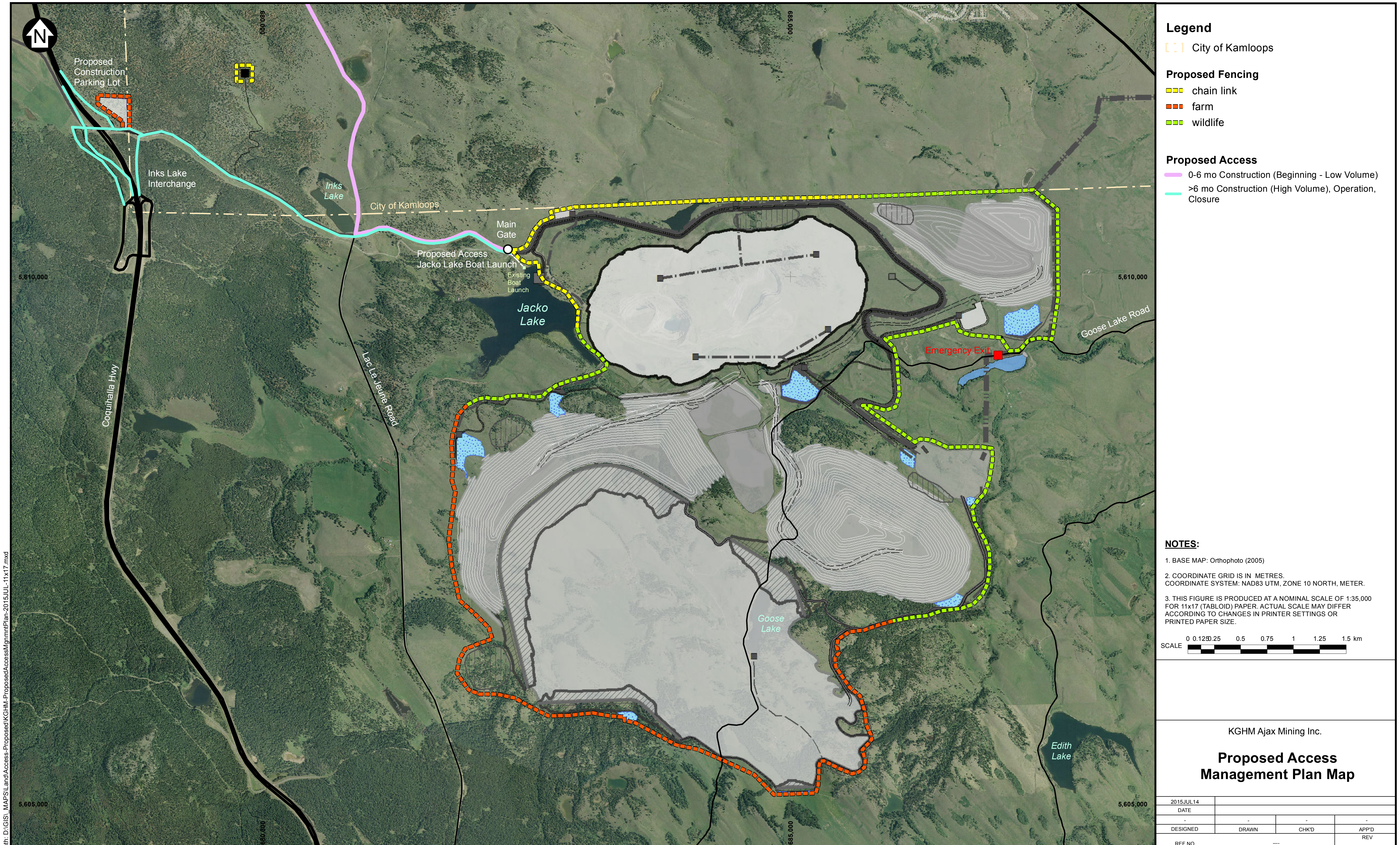


Figure 11.21-2
Safety Buffers for Blasting (Jacko Lake)

A combination of chain link and wildlife fencing will be constructed to establish security lines around the Project operations, with appropriate access points to the site (see Figure 11.23-1). A gatehouse installed near the entrance to the Project will facilitate the control of access and provide record of personnel to the site, as required by the *Mines Act*, Health, Safety and Reclamation Code for Mines in British Columbia 2008.

Traffic along the main Project access road will include trucks hauling fuel and other hazardous materials. Spills of these materials may have adverse environmental effects if not dealt with quickly and efficiently. The Project's Spill Contingency Plan (Section 11.16) and the Project required Transportation Carrier's Spill Response Plan will address accidental spills. KAM road users are expected to be knowledgeable in relevant spill-response techniques and protocols. Spill kits are required on all vehicles/equipment, and mobile spill response kits will be available.

Protection of fish and fish habitat and relevant measures referred to in the *Fish-stream Crossing Guidebook* (BC FLNRO, BC MOE, and DFO 2012) as well as the Fisheries and Aquatic Life Monitoring Plan (Section 11.25) will be applied, such as curtailing sediment-release from nearby roadwork's and preventing deleterious substances from entering streams.

11.21.3.3 *Operation*

Access control, as described above for access and perimeter security, will be maintained throughout the Operations phase of the Project. Similarly, the spill response and environmental protection measures described for the Construction phase will be maintained and rigorously applied during the Operations phase of the Project.

The delivery and shipment of materials, fuels, supplies, concentrate and movement of personnel will be conducted using the Primary Access Plan. Lac Le Jeune Road will not be used to access the Project beyond early Construction. Shift start and end times will be staggered to facilitate smooth movement through the main gate and allow for the smooth application of procedures required to access the Project site.

11.21.3.4 *Decommissioning and Closure*

During the Decommissioning and Closure phase, fence lines and access to the Project site via the Mine Access Road and the main Gatehouse will be maintained as required. Traffic throughout the Decommissioning and Closure phase will be similar to that for Construction in that it will comprise the transportation of large pieces of equipment and bulk materials leaving the Project site for resale, recycling or disposal off-site. The number of vehicles will diminish considerably since concentrate will no longer be shipped.

During Decommissioning and Closure, patrols of the perimeter, the property, as well as maintenance, monitoring, water management, effluent treatment, and fire watch will be maintained as per the Health, Safety and Reclamation Code for Mines in British Columbia 2008. The Project's Spill Response Plan will also remain in force while closure activities are taking place and the fuel storage facilities will be operated in accordance with the *Liquid Fuels Handling Act.*

This phase will see the decommissioning and rehabilitation of most of the mine site roads. The Mine

Access Road will remain a public road between the Inks Lake Interchange and Jacko Lake and will continue to provide restricted access to the site Post-Closure.

11.21.3.5 *Post-Closure*

Access management for the closed mine site will be maintained into the Post-Closure phase, but only until an acceptable level of closure and rehabilitation has been reached and the presence of personnel diminishes to an infrequent level. The envisaged Post-Closure landscape for the site includes reconfigured fence lines around open pit areas to ensure public safety and accommodate ranching practices.

11.21.3.6 *Jacko Lake*

Jacko Lake is a popular fishing and recreation area used by the public between April and October. As such, access management will consider two scenarios: blasting events and non-blasting events. For public safety the lake and surrounding area must be cleared to a distance determined by blast size, geotechnical assessments, and regulatory requirements. Figure 11.21-2 provides annual progression of safety zone radius associated with blasting events. Controlled access to Jacko Lake is anticipated to be required between Construction and up to year 13 of Operations. After year 13 it is anticipated that blasting events within the proposed pit will be deep enough or far enough away from Jacko Lake to remove the requirement for regularly controlled access.

In advance of the proposed mining activities, KAM will inform and educate the public and other stakeholders regarding proposed activities that might affect access to Jacko Lake, as well as the risks associated with relevant mining activities, statutory and/or regulatory authorities and limits that guide the Access Management Plan, timing of proposed activities, and additional ways people can learn about these issues.

Notification and communication to the public prior to blasting events will include:

- signage to be erected at the access gate, boat launch/picnic area, and roadway;
- KAM website;
- social media;
- handheld radio KAM frequency;
- direct emails and/or SMS text to registered individuals, parties and stakeholders.

Onshore and offshore clearance of Jacko Lake to a safe distance outside of the established safety zone will be maintained until blasting has ended and the “all clear” has been given. A safe area will be established where fishermen can remain on the lake or onshore until the “all clear” is given. Effective communication with the public regarding blasting times and associated restrictions will aid in the timely completion of clearance to “safe zones”. This process will ensure public and operational safety while maximizing recreational use of the lake.

KAM understands that Jacko Lake is important to many people. Through proactive communication, education and consultation followed by timely, updated information about construction and mining activities, it will be possible for all to continue to enjoy meaningful, safe experiences at Jacko Lake.

11.21.3.7 *Special Interest Groups*

KAM recognizes that at different times special interest groups such as Ranchers and Aboriginal Groups may require access to areas adjacent the Project footprint. A process will be developed to grant special interest groups the opportunity to access areas located on private lands for pursuit of their specific interests. Access will be considered on a case by case basis taking into consideration the safety of all KAM employees, contractors and special interest groups.

11.21.4 Monitoring

The performance objectives related to Access Management will be communicated by the Project Safety Department to all Project personnel during site orientation and/or job training. Completion of all required training by KAM personnel and contractors will be recorded for auditing purposes regarding conformance for training requirements

Project activities will be monitored through all phases of the Project to determine whether measures provided in the Access Management Plan are effective and to provide active management where improvements to the plan are required based on actual experience and results.

Monitoring programs will include review of:

- information provided by Security Gatehouse access records;
- Health, Safety and Environmental incident review related to site access;
- public inquiries and complaints relating to traffic management, Jacko Lake access or access considered for special interest groups; and
- routine inspection reports of security fencing and checkpoints, work sites and routine equipment and building inspections.

11.21.4.1 *Work Planning and Schedule*

Table 11.21-1 summarizes the proposed schedule of monitoring activities associated with the Access Management Plan.

Table 11.21-1. Schedule of Monitoring Activities Associated with the Access Management Plan

Monitoring Activity	Project Phase	Frequency	Season
Review of Security Gatehouse Access	All Phases	Monthly	Year Round
Incident Report Review	All Phases	Monthly and Annually	Year Round
Review of Public Inquiries and Complaints	All Phases	Monthly and Annually	Year Round
Routine Inspection Reports	All Phases	Weekly during construction, Monthly and Annually during all phases	Year Round

11.21.5 Reporting

Reporting of monitoring activities will be conducted by the Project Safety Department in a structured manner such that Access related incidents and mitigation measures can be accurately tracked and actioned.

Reports will be reviewed internally by the Project Safety Department, as necessary, in order to identify improvements to access management. Where required, reports will be forwarded to relevant government agencies as stipulated by applicable regulations and licences.

The Project Safety Department will be responsible for the monitoring and reporting on access management related incidents and mitigation measures as per their areas of responsibility. Appropriately qualified and authorized personnel will be employed throughout the life of the Project to supervise, direct, monitor, and implement the actions required by this Access Management Plan.

Table 11.21-2. Summary Table

		Report Submitted to	
Report Type	Report Frequency	Provincial Regulatory Agency	Federal Regulatory Agency
Incident Reporting	As required by applicable Regulations	Ministry of Energy and Mines (MEM)	RCMP

11.22 NOISE AND VIBRATION MANAGEMENT PLAN

11.22.1 Purpose

A noise and vibration management plan is an important component of the Project due to the proximity to the City of Kamloops, as noise and vibration are concerns to the nearby population, wildlife, and aquatic life. The purposes and scope of the management plan are summarized as follows:

- to monitor noise and vibration emissions to the atmosphere by Project activities;
- to ensure compliance with regulatory requirements or other guidelines;
- to track environmental performance and evaluate mitigation measures to enable the implementation of adaptive follow-up programs as needed; and/or
- to verify the predictions made during the environmental assessment (EA).

11.22.2 Performance Objectives

Performance objectives for noise and vibration effects are described below:

- blast-related ground vibration and air blast overpressure effects below the Ontario Ministry of Environment and Climate Change vibration guideline (currently no quantitative limit for blast vibration effects in the province of BC) for structural damage at residential receptors closest to the Project;
- blast-related ground vibration and air blast overpressure effects below the Australian and New Zealand Environment Council (ANZECC) "Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration" for annoyance threshold at receptors closest to the Project;
- ground vibration and air blast overpressure effects below the best available guideline (Wright and Hopky 1998) which prescribes quantitative vibration limits for aquatic life during blast activities;
- non-blast related ground vibration effects below the City of Toronto construction vibration limit ByLaw 514-2008 (City of Toronto 2008);
- noise effects below the BC OGC, Health Canada, and WHO noise guidelines at residential receptors closest to the Project;
- progressively reduce blast related vibration effect and noise emission from Project related activities; and
- reduce complaints from City of Kamloops communities and residential receptors closest to the Project.

The objectives are summarized in Table 11.22-1.

Table 11.22-1. Noise and Vibration Performance Objectives

VC	Guideline	Description	Location
Noise	BC Oil and Gas Commission noise control Best Practices Guideline (BCOGC 2009)	• Nighttime Permissible Sound Level (PSL) range from 40 dBA to 51 dBA, receptor dependant • Daytime PSL range from 50 dBA to 61 dBA	Residential receptors
	Health Canada (2010)	Change in percent highly annoyance (%HA) less than 6.5%	• residential receptors; • daycares; • schools; • hospitals; • places of worship; • nursing home; • Aboriginal Group communities
	World Health Organization (WHO) Night Noise Guidelines for Europe (2009)	42 dBA (outside) during the nighttime period	Residential receptors
Vibration	The Ontario Ministry of Environment and Climate Change – Guidelines on Information Required for the Assessment of Blasting Noise and Vibration (1985) (MOECC 1985)	Blast related vibration effect • Ground vibration level of 10 mm/s Peak Particle Velocity (PPV) • Air blast overpressure level of 120 dBL	Residential receptors
	Australian and New Zealand Environment Council (ANZECC) - Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration	Blast related vibration effect • Ground vibration level of 5 mm/s Peak Particle Velocity (PPV) • Air blast overpressure level of 115 dBL	Residential receptors and Traditional Land Use receptors
	Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright, D. G., and G. E. Hopky. 1998)	Blast related vibration effect • Ground vibration level of 13 mm/s PPV • Air blast overpressure level of 194 dBL	Jacko Lake fish habitat area
	City of Toronto Construction Vibration Limit ByLaw 514-2008 (City of Toronto 2008)	Ground vibration effect from other non-blast related activities • Ground vibration level of 8 mm/s PPV	Residential receptors

11.22.3 Environmental Protection Measures

Environmental protection measures include actions to avoid, control, and mitigate noise and vibration effects during different Project phases. The following sections describe these measures.

11.22.3.1 Design Criteria

Project design criteria that reduce noise emissions include the following:

- conveyor from crusher to plant will be covered to reduce noise emission;
- coarse ore stockpile enclosure will provide noise attenuation for equipment activities;
- heavy equipment such as mills, crusher, compressors, pumps, and motors will be located inside buildings;

- design roads to minimize haul distances;
- use large trucks for ore and mine rock transport to minimize the number of trips required between the source and destination;
- ensure that the mobile equipment is equipped with the manufacturer-recommended exhaust mufflers; and
- locate plant facilities further from the City of Kamloops boundary.

Project design criteria that reduce vibration effects include the following:

- blast designs were based on the threshold at the closest location (i.e. Jacko Lake) while other receptors are located much further away;
- blast designs were developed to reduce annoyance effects from blast-induced air blast overpressure;
- maximum explosives mass per time delay for the different blast zones (Z1, Z2, and Z3) decreases substantially from 1,020 Kg to 68 Kg as the blasts approach Jacko Lake;
- use of lower explosives per delay in Z3 enables the blast effect to be in compliance with the aquatic life vibration guideline (Wright and Hopky 1998) at Jacko Lake;
- hole diameter sizes, number of decks, and stemming configurations are designed for different zones;
- only one hole/delay will be fired on the blast;
- minimum time delay between holes in all blasts will not be less than 8 milliseconds (ms); and
- row time delays will be incremented from the front of the blast towards the back with 100 to 300 ms.

11.22.3.2 Construction

Protection measures for noise effect during Construction include the following:

- keep all operating equipment building doors and windows closed;
- limit the use of vehicle horns during each shovel and haul truck loading cycle, within required safety protocols;
- operate vehicles within the posted maximum speed limits to reduce noise emission;
- use multi-passenger vehicles to transport construction crews to and from job sites to reduce overall traffic noise emission;
- conduct piling activities only during the daytime period;
- select best achievable technology (technology that can achieve lower noise emissions and that has been shown to be economically feasible through commercial application) for construction equipment;

- maintain vehicles in good operating condition to meet emission standards (especially with exhaust silencers/mufflers);
- reduce vehicle idling and minimize rapid starts and stops; and
- regularly maintain all machinery and equipment to ensure that noise emissions are within range set by manufacturer when available.

Training and instruction on the Noise and Vibration Management Plan will be provided to applicable employees and contractors (i.e. equipment operators). Records will be maintained for those who are tasked with the implementation of the Noise and Vibration Management Plan.

In addition, a process will be implemented to address noise or vibration complaints from the community in a timely manner. The Noise Complaint Investigation Form Part 1 and Part 2 in the BCOGC noise guideline provide the frame work for noise compliant investigation. The Noise Complaint Investigation Form will be incorporated as part of the noise complaints process. In a complaint investigation, sound level meters would be strategically positioned to monitor events of the Project's construction activities in order to quantify the contributions from individual noise sources or events at receptor locations.

11.22.3.3 Operation

The same protection measures for noise effect during the Construction phase are applicable during the Operation phase.

Protection measures for vibration effect during the Operation phase include the following:

- apply proper field, planning and engineering controls during blast activities as summarized in the Noise and Vibration Technical Data Report (Appendix D Blast Review, Conclusions and Recommendations Section 8.0. in Appendix 10.4-A);
- manage and revise the controllable blast design parameters (i.e. confinement, charge length and diameter), charge decoupling, direction of initiation, and total shot duration) on an ongoing basis during the Operation phase;
- correlate blast design parameter with monitoring data to determine best practice in reducing blast effect;
- test blast data from the monitoring will also be used for predictive linear regression analysis as the blast locations move around the pit;
- when operations start, test blasts or smaller blasts will be used to incrementally "scale up" the blast until vibration effects are fully understood, KAM will scale up to full size blasts;
- use the on-site and other existing weather stations in Kamloops to monitor unfavourable atmospheric conditions (i.e. high velocity directional winds towards Kamloops, coupled with low lying inversions), blasts procedures will be modified to reduce vibration effect during these weather conditions; and
- use electronic detonators for blasting and purchase explosives from a reputable supplier.

Similar to the Construction phase, training and instruction of the Noise and Vibration Management Plan will be provided for the applicable employees (i.e. equipment operators). Records will be maintained for the employees who are tasked with the implementation of the Noise and Vibration Management Plan.

In addition, a process will be implemented to address noise or vibration complaints from the community in a timely manner. Complaints will be addressed through a community contact phone number as well as through the community liaison group that will be formed. The Noise Complaint Investigation Form Part 1 and Part 2 in the BCOGC noise guideline provide the frame work for noise compliant investigation. The Noise Complaint Investigation Form will be incorporated as part of the noise complaints process. In a complaint investigation, sound level meters would be strategically positioned to monitor events of the Project's operating activities in order to quantify the contributions from individual noise sources or events at receptor locations. During the Operation phase, a comprehensive sound level survey can be conducted to confirm whether the Project is in compliance.

11.22.3.4 Decommissioning and Closure

The protection measures described for the Construction phase are applicable during the Decommissioning and Closure phase.

11.22.3.5 Post Closure

There is no environmental protection measure for noise and vibration effects during the Post Closure phase.

11.22.4 Monitoring

A noise monitoring program will be implemented at multiple locations to measure the noise level during different Project phases (i.e. Construction, Operation, and Decommissioning and Closure). Similarly, a vibration monitoring program will be implemented at multiple locations to measure the ground vibration and air blast overpressure effect during blast activities from the mine pit. The proposed locations for noise and vibration monitoring are summarized in Table 11.22-2.

Table 11.22-2. Proposed Noise and Vibration Monitoring Locations

VC	Description	Proposed Monitoring Locations [a]	UTM East (m)	UTM North (m)	Monitoring Parameters
Noise	N1 - Rural residence	Noise receptor #1	677081	5611958	Noise levels
		Noise receptor #8	681197	5607480	
		Noise receptor #9	687390	5606458	
		Noise receptor #12	684290	5604072	
		Noise receptor #22	688644	5610892	
	N2 - City Development Boundary	Noise receptor #18	686880	5611577	
	N3 - Traditional Land Use Area	TLU#9	682931	5609762	

VC	Description	Proposed Monitoring Locations [a]	UTM East (m)	UTM North (m)	Monitoring Parameters
Vibration	S1, S2, S3	Linear array from pit edge towards Aberdeen	684043 [b] 685018 [b] 686073 [b]	5610167 [b] 5611283 [b] 5612501 [b]	Ground vibration and overpressure levels
	S4 – Jacko Lake Area	Vibration receptor #1b	682982	5609349	
	S5 and S6 - Rural residence	Vibration receptor #4 Vibration receptor #10	687108 680726	5608805 5608936	

Note:
[a] proposed locations are consistent with baseline receptor locations and are pending accessibility in some cases
[b] preliminary monitoring location, exact location will change as blast locations move around the pit

Three general noise monitoring areas (N1, N2, and N3) that include individual monitoring stations are proposed. N1 is a rural residence area located closest to the Project boundary. N2 is a location closest to the city development boundary (Aberdeen neighborhood). N3 is a traditional land use location in the Jacko Lake area. Proposed locations are preliminary and pending access and detailed Project design and planning that may influence the exact locations of monitoring stations. Noise monitoring will measure sound pressure level and perform audio recording continuously. The results will be used for the following purposes:

- comparison to noise limits presented in Table 11.22-1 above;
- comparison to prediction results in the EA; and
- correlate noise level to different Project related activities to determine best practice in reducing noise effect.

Vibration monitoring is proposed once the full scale production blasts are started. Six seismograph stations are will verify predictions and that levels are below guidelines. Seismographs will be arranged in a linear array from the pit edge towards the Aberdeen neighborhood. The proposed locations may change as the blast locations move around the pit. The fourth permanent seismograph (S4) will be located near the southeast arm of Jacko Lake to verify that all blasts, close to and approaching the lake, comply with the vibration thresholds for aquatic life protection. Seismographs S5 and S6 will be portable to monitor vibrations levels toward residences to the east and west of the blasting areas. Vibration monitoring will be undertaken during blasting operations or until it is clear that vibration from blasting will be below threshold levels (Table 11.22-1).The monitoring stations will trigger ground vibration and air blast overpressure measurement once a pre-determined trigger level (i.e. regulatory guideline limits as presented in Table 11.22-1) is exceeded. The results will be used for the following purposes:

- comparison to vibration limits established in Table 11.22-1 above;
- correlate blast design parameter with monitoring data to determine best practice in reducing blast effect, particularly for the "scaling up" of test blast or smaller blast to full blast during the earlier phase of operation; and
- verification of prediction results (i.e. predictive linear regression analysis) as the blast locations move around the pit.

If the monitoring results indicate that noise or vibration effects exceed the threshold, site activities or blasts design will be adjusted to mitigation any exceedance.

In addition to noise and vibration monitoring, monitoring of atmospheric conditions (i.e. inversion and temperature, wind speed and direction) will be implemented to better understand unfavourable condition for blast activities. The current on site weather station in combination with other meteorological weather stations will be used to monitor the weather conditions in advance for blast planning purposes.

11.22.4.1 Work Planning and Schedule

The noise monitoring will occur continuously during the Construction, Operation, and Decommissioning and Closure phases. The vibration monitoring will occur on a daily basis during the full-scale blast operation for the Operation phase in the mine pit.

11.22.5 Reporting

There are no provincial or federal reporting requirements for noise and vibration effect. However monitoring results will be made available to regulatory agencies or via a Project specific website if and as required. The frequency of reporting will be determined through consultation with the community and regulators as required during the permitting process. An annual report will be completed to summarize the EMP (Environmental Management Plan) which will include noise and vibration monitoring results. The annual report will be made available to the community via website or upon request (i.e. Community Liaison Group) for information purposes. The report will present the following information:

- evaluation of the effectiveness of the EMP;
- description of record keeping of monitoring data and analyses (e.g., a description of the analyses that were performed, detection limits used, and QA/QC procedures);
- monitoring results and interpretation;
- discuss potential issues related to noise and vibration effects;
- describe proposed revisions to the EMP to address emerging negative trends, or to adjust monitoring programs, if required; and
- verify the accuracy of the predicted noise and vibration levels.

11.22.5.1 Complaint Resolution

Noise and vibration complaints will be recorded and evaluated to determine if blasting procedures require modification. KAM will respond respectfully to all complaints and implement all feasible and reasonable measures to address the issue. A complaint management process will be developed to respond and document the particulars of the complaint. Complaint details will be recorded and will include feedback provided to complainant, resolution of complaint, contact information of KAM individual addressing the complaint and time taken for responses and/or resolution.

11.23 SURFACE WATER QUALITY MANAGEMENT AND MONITORING PLAN

11.23.1 Purpose

The purpose of the Surface Water Quality Management and Monitoring Plan (SWQMMP) is to describe the rationale, framework, strategy, and scope of the plan to be implemented during the Construction, Operation, Decommissioning and Closure, and Post Closure phases of the Project. The focus of the SWQMMP is on minimizing Project effects on surface water quality, regulatory compliance, monitoring the effectiveness of mitigation measures, and verifying the predictions completed as part of the effects assessment presented in this Application. The SWQMMP is intended to meet the stipulated regulatory requirements under applicable provincial permits and federal regulations (e.g., Environmental Management Act [EMA; 2003]).The SWQMMP is aimed at addressing the following goals:

- provide feedback into the ongoing monitoring for performance of mine design (water management structures and systems) with respect to mitigation for surface water quality effects;
- assess the effectiveness of mitigation measures and mine water management in the protection of water quality in the receiving environment;
- identify and promptly address areas where maintenance, upgrades, modifications, or additional mitigation measures are necessary;
- compare measured parameter concentrations against predicted parameter concentrations for the Project; and
- protect water-related resources (livestock, irrigation, wildlife, human health, recreation and aquatic life) and avoid harmful impacts on all potential receptors.

The SWQMMP adopts the spatial and temporal boundaries presented in this Application/EIS focusing on the surface water receiving environment in Jacko Lake, and Peterson Creek upstream and downstream of Jacko Lake.

The SWQMMP provides a conceptual level outline of the monitoring study design that is anticipated to meet requirements for internal water quality management and of applicable permits. The SWQMMP provides a conceptual level outline of the reporting requirements and is designed to complement the proposed mitigation and management measures presented in the Application/EIS.

11.23.2 Performance Objectives

The performance objective of the SWQMMP is to avoid, minimize or control adverse effects on the surface water receiving environment, by meeting the following:

- Implementing a surface water quality monitoring program that meets the requirements of all applicable permits for the Project, and that follows the standards contained in the guideline documents below to ensure proper study design, sampling methods, analyses, and Quality Assurance / Quality Control (QA/QC) procedures are carried out:

- Guidelines for Designing and Implementing a Water Quality Monitoring Program in British Columbia. BC Ministry of Environment, Lands and Parks, Wildlife Branch. Resource Inventory Committee. 1998.
- British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-emission, Water, Wastewater, Soil, Sediment and Biological Samples. 2003 Edition. BC Ministry of Water, Land and Air Protection.
- Protocols Manual for Water Quality Sampling in Canada. Canadian Council of Minister of the Environment. 2011.
- Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators. Prepared by the Ministry of Environment. October 9, 2012 (MoE 2012).

- Provide timely feedback on water quality with respect to assessing the performance of the water management for the Project and the numerous management plans (listed below) that through their implementation assist in the protection of surface water quality.
- Provide timely input to the other management and monitoring plans that rely on surface water quality monitoring results.

Along with the SWQMMP, adverse effects on water quality in the receiving environment will be managed and monitored through the implementation of the following EMPs:

- Erosion and Sediment Control Plan (Section 11.2);
- Metal Leaching/Acid Rock Drainage (ML/ARD) Management Plan (Section 11.5);
- Air Quality Management Plan (Section 11.6); and
- Water Management and Hydrometric Monitoring Plan (Section 11.7);
- Explosives Management Plan (Section 11.11);
- Spill Contingency Plan (Section 11.16);
- Groundwater Quality Management and Monitoring Plan (Section 11.24);
- Fisheries and Aquatic Life Monitoring Plan (Section 11.25);
- Wildlife and Vegetation Monitoring Plan (Section 11.29).

11.23.3 Environmental Protection Measures

The Project has the potential to interact with components of the surface water receiving environment through a number of pathways, such as erosion and sedimentation, and seepage and runoff from mine facilities. The pathways of interactions between the Project and the surface water receiving environment are summarized in Table 6.3-3 in Section 6.3. The primary source of mitigation measures for water quality is the Water Management and Hydrometric Monitoring Plan (Section 11.7) and the protection measures specific in that plan that mitigate against water quality effects are summarized in the following sub-sections, organized by mine phases.

11.23.3.1 Design Criteria

KAM is committed to developing the Project to meet or exceed applicable legal/regulatory requirements in a manner consistent with industry best practice. This includes proactively implementing proper environmental protection measures so that specific needs and interests of the VCs are accounted for during Project planning and implementation. The Project was designed to minimize interactions with the aquatic environment by ensuring appropriate setback distances from riparian areas are maintained, natural drainage networks will be maintained or restored as much as feasible, and stream crossings will be designed to avoid/minimize impacts.

The SWQMMP is designed to limit generation of contact water (i.e., water that comes into contact with and may pick up a geochemical load from a Project facility) and to prevent sediment laden runoff from leaving the site. Key aspects of the water management plan are:

- fresh water transfers (water pumped from Kamloops Lake);
- surface water diversions (e.g., collection ditches);
- site water transfers (e.g., spillways, water pumped from one location to another);
- tailings slurry (i.e., tailings solids and water);
- water management ponds at the Tailings Storage Facility (TSF) embankments and at the Mine Rock Storage Facilities (MRSFs);
- Peterson Creek Downstream Pond (PCDP); and
- Central Pond.

Mitigation and management measures for avoiding and minimizing the transport of sediments into the aquatic environment, as described in the Sediment and Erosion Control Plan (Section 11.4), will be implemented during appropriate Project phases. The potential for the introduction of nitrogenous nutrients from explosives will be minimized by the application of best management practices for the use, transport, and storage of explosives (Explosives Management Plan, Section 11.11). Much of the water management infrastructure, such as diversion channels for contact and non-contact water, will be installed during the Construction phase (Site Water Management and Hydrometric Monitoring Plan, Section 11.7). This water management infrastructure will mitigate potential effects from changes in the quantity and quality of water in the receiving environment.

The identification and storage of potential sources of metal leaching/acid rock drainage (ML/ARD) will contribute to the mitigation and management of changes in water quality due to the increases in the concentrations of metals and other parameters in the receiving environment. Implementation of the ML/ARD Management Plan (Sections 11.5) will begin prior to Construction phase activities and will continue through the life of the Project.

Potential effects from accidents and malfunctions will be managed by the implementation of best management practices and mitigation measures for the handling and use of explosives, hazardous materials, waste, and fuel (Explosives Management Plan (Section 11.11), Hazardous Materials Management Plan (Section 11.10), Spill Contingency Plan (Section 11.16)).

11.23.3.2 Construction

Construction of the Project has been divided in three phases, and will include the following development activities:

- Phase 1: development of access and haul roads, seepage dams, collection ponds, TSF initial starter embankment, reclamation stockpiles, ore stockpile, plant site, crusher, truck shop, and Peterson Creek diversion outlet footprints.
- Phase 2: pre-stripping of the pits, explosives magazine and batch plant, Central Pond, the West and South MRSFs foundation works, the TSF starter area and starter embankment, the Peterson Creek diversion system, and two diversion ditches associated with the East MRSF.
- Phase 3: construction of the haul road and East MRSF foundation preparation.

Water management activities that will take place during this phase include:

- Open Pit dewatering: direct groundwater inflows and stormwater runoff to the Open Pit will be managed by dewatering the pit, thus preventing surface water interactions with the receiving environment.
- Decommissioning of the existing Jacko Lake dam: this dam will be removed using either a “wet” approach, which refers to discharging Jacko Lake water between the locations of the new and old dams, or a “dry” approach, which refers to installing a temporary dam upstream of the old dam while construction works are performed for the new dam.
- Peterson Creek Downstream Pond (PCDP): civil works required for water impoundment at this location will be performed during construction, for components such as creek diversion, embankments, basin excavation, impoundment, and spillways.
- TSF: water management ponds, diversion ditches and French drains will be used for water management during construction to either store water within the TSF or divert water, while the TSF pond confined by an initial starter dam will store water required by the mill.

11.23.3.3 Operation

The Operation phase will include the active mining and ore processing period. This period includes the following water management activities:

- maintenance and operation of the Peterson Creek diversion system (PCDS) and PCDP;
- pumping of the runoff to the plant site pond to the process water tank;
- collection and recirculation of contact water from the Open Pit, MRSFs, embankments, and ore stockpiles at the various water management ponds around the mine site;
- reclamation of TSF water for process water requirements; and
- supply of make-up fresh water from Kamloops Lake.

Additional water management activities in mine facilities include:

- MRSFs: runoff and seepage from the TSF, WMRSF, and TSF North Embankment will be managed in the North Embankment Pond 1 and North Embankment Pond 2. Runoff and seepage from the southern portion of the SMRSF will be managed in the SMRSF Pond and to the north in the Central Pond and Open Pit. Runoff and seepage from the EMRSF will be managed in the EMRSF Pond, to the south and the Open Pit (seepage) to the west. Water intercepted in the North Embankment Pond 1 and 2 and the EMRSF will be pumped to the Central Pond and then directed to the mill for process during Operation and water intercepted at the SMRSF Pond will be routed to the Plant Site Pond.
- TSF: the embankments for this facility, which are constructed of non-potentially acid generating (NPAG) mine rock, will be expanded in stages, while runoff from undisturbed areas will be routed to and collected in the TSF pond, reclaimed tailings supernatant will be pumped back to the mill, and seepage and runoff collected in the South and Southeast embankment ponds will be pumped back to the TSF pond.
- Open Pit: water from various sources that reaches the pit, and is not absorbed by broken rock hauled out of the pit, will be contained by a large collection system of ditches, pipes, sumps, pumps, and booster pumps, and will be directed to the Central Pond.

11.23.3.4 Decommissioning and Closure

Reclamation and closure initiatives have the objective of transforming the mine site into an integrated component of the surrounding ecosystem after completion of active mining. Environmental protection measures established during the Construction and Operation phases will be applied during decommissioning and reclamation activities in the Decommissioning and Closure phase. Erosion and sediment control measures will be important during the reclamation of infrastructure and the decommissioning of the water management infrastructure (Erosion and Sediment Control Plan, Section 11.4). The following water management activities will occur during this phase:

- removal of culverts and water crossings and restoring of natural drainage;
- re-establishment of the Peterson Creek channel between Jacko Lake and the PCDP, while maintaining and operating the PCDS to maintain downstream flows from Jacko Lake;
- retaining of PCDP with no structural changes intended;
- modification of the Southeast Jacko Lake Dam to facilitate Closure design;
- purging, dismantling, and disposal of pipelines in an approved facility;
- pumping of water in the TSF pond to the Open Pit to initiate pit filling and allow for reclamation of the TSF;
- site grading and reclamation of the TSF, along with construction of a spillway, to allow for surface runoff to be diverted to the Humphrey Creek drainage;
- decommissioning of the Central Pond, although a pond feature may still be maintained as part of the Post Closure landscape;

- site grading and reclamation of the MRSFs;
- continued operation of the Kamloops Lake fresh water pipeline to provide a clean source of water for closure activities, including dust control and demolition of site infrastructure;
- routing contact runoff to the Open Pit during infrastructure removal; and
- reclamation of the MSRFs and continued operation of their associated water management ponds (pumping to Open Pit) until water quality objectives are met.

11.23.3.5 Post Closure

The following is a list of the state of the water management features in the Post Closure phase:

- Kamloops Lake fresh water pipeline is decommissioned;
- Peterson Creek closure channel is functional;
- PCDS is decommissioned;
- Southeast Jacko Lake Dam functions in a similar fashion to the existing Jacko Lake Dam;
- PCDP is retained in perpetuity;
- TSF reclamation is complete with surface flows discharging into Humphrey Creek;
- MRSFs reclamation is complete with surface runoff from these facilities suitable for release to the environment;
- modified downstream ponds associated with the EMRSF, SMRSF, and North Embankment are retained in perpetuity; and
- the Open Pit continues to fill passively until reaching a relatively static surface elevation.

11.23.4 Monitoring

Surface water quality monitoring is a key component of the environmental protection strategy for the Project and as such the SWQMMP relies on monitoring to ensure the mitigation and management measures are adequate, perform as predicted in the effects assessment, and provide information for adaptive management if unanticipated effects are discovered. Surface water quality monitoring will be the responsibility of the Project's Mine Environmental Supervisor, with delegation of duties to Project personnel. As required, individuals that complete the monitoring and data interpretation will be suitably qualified professionals. These individuals will report on the findings of the water quality monitoring and will assist in investigations into potential sources if unexpected water quality results are reported. Reporting requirements will meet all requirements specific to regulatory permits, approvals, and authorizations.

11.23.4.1 Surface Water Quality Data Collection and Analysis Methods

The water quality program and sampling protocols will be similar to the baseline program, which were implemented following the general requirements of the following documents:

- Guidelines for Designing and Implementing a Water Quality Monitoring Program in British Columbia. BC Ministry of Environment, Lands and Parks, Wildlife Branch. Resource Inventory Committee. 1998.
- British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-emission, Water, Wastewater, Soil, Sediment and Biological Samples. 2003 Edition. BC Ministry of Water, Land and Air Protection.
- Protocols Manual for Water Quality Sampling in Canada. Canadian Council of Minister of the Environment. 2011.
- Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators. Prepared by the Ministry of Environment. October 9, 2012 (MOE 2012).

General surface water quality monitoring will be implemented with a focus on assessing for changes in surface water quality compared to baseline and predicted concentrations, generic water quality guidelines, and site-specific water quality benchmarks. The key objectives of these activities are to:

- provide feedback into the ongoing monitoring for performance of mine design (water management structures and systems) with respect to mitigation for surface water quality effects;
- identify and promptly address areas where maintenance, upgrades, modifications, or additional mitigation measures are necessary;
- measure and monitor actual water quality on site (intake, recycling, discharge), in the receiving environment and at upstream reference locations; and
- protect water-related resources (livestock, irrigation, wildlife, human health, recreation and aquatic life) and avoid harmful impacts on all potential receptors.

This will be accomplished through regular surface water quality monitoring in the background and receiving environments and in the mine site facility reservoirs.

11.23.4.2 Surface Water Quality Monitoring

The SWQMMP will aim to prevent changes in surface water quality that may negatively impact all relevant receptors, including aquatic life, wildlife, and human water use (drinking water, agricultural, and recreational water use); however, the main focus is on the protection of aquatic life, for which guidelines are generally most stringent. The final SWQMMP monitoring program will be developed jointly with the Fish and Aquatic Life Monitoring Plan (Section 11.25) to reduce redundancy. The SWQMMP monitoring program will aim to follow and fulfill the guidelines and requirements specific to all permits. KAM's strategy for the draft SWQMMP will be to work cooperatively with the regulatory agencies to develop the framework for a "living document" that will be updated throughout the Project lifecycle.

The spatial scope of the monitoring program will include Jacko Lake, Peterson Creek upstream and downstream of Jacko Lake, Edith Lake, and Humphrey Creek, upstream and downstream of the Project. Monitoring locations will be consistent with the baseline sampling sites and those sites selected specifically for the Fish and Aquatic Life Monitoring Plan and permit compliance.

The monitoring program will include appropriate reference sites to control for natural variation and regional trends. The monitoring program will also include on-site water quality monitoring in the water management ponds and the TSF.

The monitoring program will rely on baseline data presented in the Application/EIS and any additional data collected prior to the onset of Construction activities for the established reference sites and the downstream monitoring sites. These data will be used for comparison to receiving water data collected over the course of the mine development. Some of the parameters will require thresholds to be met, above which additional monitoring and/or mitigation strategies may be triggered.

The parameters to be monitored include the following:

- In Situ – temperature, dissolved oxygen, conductivity, specific conductance, redox potential, and turbidity;
- Physical Tests – hardness, pH, specific conductivity (SpC), total dissolved solids (TDS), total suspended solids (TSS), and turbidity;
- Dissolved Anions – alkalinity (bicarbonate, carbonate, and hydroxide), bromide, chloride, fluoride, and sulphate;
- Nutrients – ammonium nitrogen, nitrate, nitrite, dissolved orthophosphate, and total and dissolved phosphate;
- Total and Dissolved Metals - analyzed at low levels to meet the B.C. Water Quality Guidelines (BCWQG) and the Canadian Environmental Quality Guidelines (CEQG) criteria values; and
- Organics – total organic carbon (TOC).

Water quality monitoring data (field notes, photographs, original laboratory files) will be managed in the environmental management system (EMS) for the Project.

11.23.4.3 Work Planning and Schedule

The surface water quality monitoring schedule will be adjusted as required to meet the required sampling frequencies outlined in any permits issued for the Project. The monitoring sites and mine phase monitoring schedule outlined in Table 11.23-1 is the minimum surface water quality program expected and is currently being achieved through the baseline monitoring program. Sampling events generally occur monthly, with lake samples collected twice through ice in the winter, and only when conditions are safe. The sampling schedule is anticipated to be reduced over time in Post Closure as receiving water targets are achieved and as dictated by the permits.

Table 11.23-1. Surface Water Sampling Locations

Site ID	Easting	Northing	Site Description	Baseline	Construction	Operation	Decommissioning and Closure	Post Closure
PC02	689229	5611248	Peterson Creek, adjacent to the Princeton-Kamloops Highway and downstream of interception of all expected seepage pathways	✓	✓	✓	✓	✓
PC02.3	688485	5609232	Peterson Creek down-gradient of all project facilities	✓	✓	✓	✓	✓
PC02.5	687573	5609285	Peterson Creek down-gradient of the EMRSF	✓				✓
PCDP			Peterson Creek Downstream Pond spillway		✓	✓	✓	✓
PC03	685692	5609339	Peterson Creek, down-gradient of all historical mine features	✓				✓
PC08	683266	5609146	Peterson Creek, at the outlet of Jacko Lake	✓				✓
PC10	681607	5609088	Peterson Creek upstream reference site, upstream of Jacko Lake	✓	✓	✓	✓	✓
PC-EF-04	688617	5614344	Peterson Creek, upstream of Bridal Veil Falls	✓	✓	✓	✓	✓
JACL-D/M/S	682481	5609804	Jacko Lake – deepest location – sampled at shallow, middle and deep depths	✓	✓	✓	✓	✓
EDITH-01D/ M/S	687588	5605722	Edith Lake - deepest location – sampled at shallow, middle and deep depths	✓	✓	✓	✓	✓
HUMPH02	686943	5607938	Humphrey Creek, upstream of a small tributary outside of the Project footprint	✓	✓	✓	✓	✓
HUMPH-08	686907	5607159	Humphrey Creek, down-gradient of the confluence with a tributary within the Project footprint	✓	✓	✓	✓	✓
HUMPH-10	687540	5605977	Humphrey Creek at the outflow of Edith Lake	✓	✓	✓	✓	✓
TSF (Reclaim Line)			TSF sampled off the reclaim line		✓	✓		
North Embankment Pond 1					✓	✓	✓	✓
North Embankment Pond 2					✓	✓	✓	✓
SMRSF Pond					✓	✓	✓	✓

Site ID	Easting	Northing	Site Description	Baseline	Construction	Operation	Decommissioning and Closure	Post Closure
EMRSF Pond					✓	✓	✓	✓
Central Pond					✓	✓		

NOTES:
1. GPS coordinates are in UTM wgs84 zone 10 U.
2. Coordinates for mine facility water sample locations to be provided once constructed.
3. Check mark indicates the mine phases that these sites will be monitored in.
4. UTM coordinates are provided for existing sites that are included in the baseline monitoring program, but are not available for project facility sites, which have not yet been established.

11.23.4.4 Action Triggers

Receiving water quality will be compared against predicted concentrations as well as guidelines and water quality benchmarks specific to the Project conditions on a timely basis following receipt of results from a laboratory. Action triggers will be developed which are specific to monitoring results that exceed generic water quality guidelines specific to the downstream users, provided that the parameter doesn't already exceed these guidelines under baseline conditions, and for parameters that already exceed generic guidelines under baseline conditions the trigger would be the exceedance of the water quality benchmark specific to that parameter. Water quality benchmarks and science based environmental benchmarks are being presented for approval for a sub-set of parameters (e.g., sulphate, chloride, copper, molybdenum, and selenium) that either exceed guidelines in baseline conditions or that are predicted to exceed the generic water quality guidelines but are understood to be protective under the site specific conditions. Exceedances of the guidelines and benchmarks may require reporting to and feedback from responsible governing agencies (e.g., Ministry of Environment) prior to undertaking advanced mitigation measures. Actions that may result from exceedances of triggers could include detailed assessment of the water quality upstream and downstream of the location where the exceedance was measured, increased sampling frequency upstream and downstream of the site where the exceedances was measured, and potential improvements to mitigation measures through feedback into the SWQMMP.

The guidelines relevant to the surface water quality data for the Project are as follows:

- British Columbia Ministry of Environment Approved and Working Water Quality Guidelines (BCWQG) (BC MOE 2015a and BC MOE 2015b):
  - Drinking Water Supply (BCWQG-DW)
  - Fresh Water Aquatic Life (BCWQG-Aq)
    - Maximum (BCWQG-Max)
    - 30 Day Average (BCWQG-30 D)
  - Livestock Water Supply (BCWQG-Livestock)

  - Irrigation (BCWQG-Irrigation)
  - Wildlife (BCWQG-Wildlife)
  - Recreation (BCWQG-Rec)

- Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines (CEQG) (CCME 2015):
  - Water Quality Guidelines for the Protection of Aquatic Life (Freshwater) (CEQG-PAL)
  - Water Quality Guidelines for the Protection of Agriculture (Livestock) (CEQG-Livestock)
  - Water Quality Guidelines for the Protection of Agriculture (Irrigation) (CEQG-Irrigation)
- Health Canada (2012):
  - Guidelines for Canadian Drinking Water Quality (HC-DW), and
  - Guidelines for Canadian Recreational Water Quality (HC-Rec).

The water quality benchmarks and science based environmental benchmarks specific to the Project will be provided once approved.

11.23.5 Reporting

Reporting for the SWQMMP are expected indirectly through input to the various reporting requirements for the Fish and Aquatic Life Monitoring Plan (Section 11.25) and specific permits; however, the primary reporting requirements are for internal purposes as feedback into the assessment of the performance of mine design (water management structures and systems) with respect to mitigation for surface water quality effects. The internal reporting schedule is anticipated to be monthly, or more frequent as required, and will include surface water quality sample results, detailed summaries of on-going quality assurance and quality control sample results and corrective actions required (if any), detailed reports on any deviations from standard data collection protocols, and details regarding investigations into potential source delineation for unexpected changes in receiving water concentrations. Reporting on the results of the SWQMMP will be the responsibility of the Project's Mine Environmental Manager, with delegation of duties to Project personnel. As required, individuals that complete the reporting will be suitably qualified professionals.

Reporting for the SWQMMP is expected in association with the *Mines Act* and *Environmental Management Act* permits and is assumed to be on an annual basis for the duration of Construction, Operation, and Decommissioning and Closure, but will be dictated by the permit. Reporting frequency in the Post Closure phase may be less frequent and will be stipulated in the permits. External reporting on a more frequent basis may be required in accordance with permits if set triggers are exceeded.

11.24 Groundwater Quality Management and Monitoring Plan

11.24.1 Purpose

The purpose of the Groundwater Quality Management and Monitoring Plan (GWQMMP) is to describe the rationale, framework, strategy, and scope of the plan to be implemented during the Construction, Operation, Decommissioning and Closure, and Post Closure phases of the Project. The project will be required to implement a groundwater quality monitoring program to meet the requirements of the AIR/EIS Guidelines for the Project. The focus of the GWQMMP is on regulatory compliance, monitoring the effectiveness of mitigation measures, and verifying the predictions completed as part of the effects assessment presented in this Application/EIS. The GWQMMP is intended to meet the stipulated regulatory requirements under applicable provincial permits and federal regulations. The GWQMMP is aimed at addressing the following goals:

- protect water-related resources (livestock, irrigation, wildlife, human health, recreation and aquatic life) and avoid harmful impacts on potential receptors;
- compare measured parameter concentrations against baseline and predicted parameter concentrations for the Project;
- provide feedback into the ongoing monitoring for performance of mine design (water management structures and systems) with respect to mitigation for groundwater quality effects; and
- identify and promptly address areas where maintenance, upgrades, modifications, or additional mitigation measures are necessary, through adaptive management.

The GWQMMP adopts the spatial and temporal boundaries presented in this Application/EIS focusing on the groundwater resources down-gradient of Project facilities in the Peterson Creek watershed.

The GWQMMP provides a conceptual level outline of the monitoring study and reporting requirements and is designed to complement the proposed mitigation and management measures presented in the Application/EIS. The intent of this document is to describe the relevant aspects of the monitoring study design that are anticipated to meet requirements for internal groundwater quality management and of applicable permits. All Project activities will be subject to the conditions described in the permits, which will include detailed descriptions of the requirements for monitoring and reporting.

11.24.2 Performance Objectives

The performance objective of the GWQMMP is to avoid, minimize or control adverse effects on the groundwater receiving environment and to meet the anticipated *Environmental Management Act* permit requirements for groundwater monitoring, by meeting the following:

- Implementing a groundwater quality monitoring program that meets the requirements of all applicable permits for the Project, and that follows the standards contained in the guideline documents below to ensure proper study design, sampling methods, analyses, and Quality Assurance / Quality Control (QA/QC) procedures are carried out:

 - Guidelines for Designing and Implementing a Water Quality Monitoring Program in British Columbia. BC Ministry of Environment, Lands and Parks, Wildlife Branch. Resource Inventory Committee. 1998.
 - British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-emission, Water, Wastewater, Soil, Sediment and Biological Samples. 2003 Edition. BC Ministry of Water, Land and Air Protection.
 - Protocols Manual for Water Quality Sampling in Canada. Canadian Council of Minister of the Environment. 2011.
 - Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators. Prepared by the Ministry of Environment. October 9, 2012 (MoE 2012).

- Provide timely feedback on groundwater quality with respect to assessing the performance of the water management for the Project and the numerous management plans (listed below) that through their implementation assist in the protection of groundwater quality.
- Provide timely input to the other management and monitoring plans that rely on groundwater quality monitoring results.

Along with the GWQMMP, adverse effects on water quality in the receiving environment will be managed and monitored through the implementation of the following EMPs:

- Erosion and Sediment Control Plan (Section 11.2);
- Metal Leaching/Acid Rock Drainage (ML/ARD) Management Plan (Section 11.5);
- Air Quality Management Plan (Section 11.6);
- Water Management and Hydrometric Monitoring Plan (Section 11.7);
- Explosives Management Plan (Section 11.11);
- Spill Contingency Plan (Section 11.16);
- Surface Water Quality Management and Monitoring Plan (Section 11.23);
- Fisheries and Aquatic Life Monitoring Plan (Section 11.25); and
- Wildlife and Vegetation Monitoring Plan (Section 11.27).

11.24.3 Environmental Protection Measures

The Project has the potential to interact with the groundwater receiving environment through seepage and runoff from mine facilities. The pathways of interactions between the Project and the groundwater receiving environment are summarized in Table 6.5-3 in Section 6.5. The primary source of mitigation measures for groundwater quality is the Water Management and Hydrometric Monitoring Plan (Section 11.7) and the protection measures specific in that plan that mitigate against water quality effects are summarized in the following sub-sections, organized by mine phases.

11.24.3.1 Design Criteria

KAM is committed to developing the Project to meet or exceed applicable legal/regulatory requirements in a manner consistent with industry best practice. This includes proactively implementing proper environmental protection measures so that specific needs and interests of the VCs are accounted for during Project planning and implementation.

The GWQMMP is designed to limit generation of contact water (i.e., water that comes into contact with and may pick up a geochemical load from a Project facility) and to prevent sediment laden runoff from leaving the site. Key aspects of the GWQMMP are:

- fresh water transfers (water pumped from Kamloops Lake);
- surface water diversions (e.g., collection ditches);
- site water transfers (e.g., spillways, water pumped from one location to another);
- tailings slurry (i.e., tailings solids and water);
- water management ponds (WMPs) at the Tailings Storage Facility (TSF) embankments and at the Mine Rock Storage Facilities (MRSFs);
- Peterson Creek Downstream Pond (PCDP); and
- Central Pond.

The potential for the introduction of nitrogenous nutrients from explosives will be minimized by the application of best management practices for the use, transport, and storage of explosives (Explosives Handling Plan, Section 11.11). Much of the water management infrastructure, such as diversion channels for contact and non-contact water, will be installed during the Construction phase (Site Water Management and Hydrometric Monitoring Plan, Section 11.7). This water management infrastructure will mitigate potential effects from changes in the quantity and quality of water in the receiving environment.

The identification, segregation, and storage of potential sources of metal leaching/acid rock drainage (ML/ARD) will contribute to the mitigation and management of changes in water quality due to the increases in the concentrations of metals and other parameters in the receiving environment. Implementation of the ML/ARD Management Plan (Section 11.5) will begin prior to Construction phase activities and will continue through the life of the Project.

Potential effects from accidents and malfunctions will be managed by the implementation of best management practices and mitigation measures for the handling and use of explosives, hazardous materials, waste, and fuel (Explosives Handling Plan (Section 11.11), Hazardous Materials Management Plan (Section 11.10), Spill Contingency Plan (Section 11.16)).

11.24.3.2 Construction

Construction of the Project is divided in three phases, and will include the following development activities:

- Phase 1: development of access and haul roads, seepage dams, collection ponds, TSF initial starter embankment, reclamation stockpiles, ore stockpile, plant site, crusher, truck shop, and Peterson Creek diversion outlet footprints.
- Phase 2: pre-stripping of the pits, explosives magazine and batch plant, Central Pond, the West and South MRSFs foundation works, the TSF starter area and starter embankment, the Peterson Creek diversion system, and two diversion ditches associated with the East MRSF.
- Phase 3: construction of the haul road and East MRSF foundation preparation.

Water management activities that will take place during this phase include:

- Open Pit dewatering: water management for this activity will be limited mainly to dewatering direct groundwater inflows and stormwater runoff to the Open Pit.
- Decommissioning of the existing Jacko Lake dam: this dam will be removed using either a "wet" approach, which refers to discharging Jacko Lake water between the locations of the new and old dams, or a "dry" approach, which refers to installing a temporary dam upstream of the old dam while construction works are performed for the new dam.
- Peterson Creek Downstream Pond (PCDP): civil works required for water impoundment at this location will be performed during construction, for components such as creek diversion, embankments, basin excavation, impoundment, and spillways.
- TSF: water management ponds, diversion ditches and French drains will be used for water management during construction to either store water within the TSF or divert water, while the TSF pond confined by an initial starter dam will store water required by the mill up to three months.

11.24.3.3 Operation

The Operation phase will include the active mining and ore processing period. This period includes the following water management activities:

- maintenance and operation of the Peterson Creek diversion system (PCDS) and PCDP;
- pumping of the runoff to the plant site pond to the process water tank;
- collection and recirculation of contact water from the Open Pit, MRSFs, embankments, and ore stockpiles at the various water management ponds around the mine site;
- reclaim of TSF water for process water requirements; and
- supply of make-up fresh water from Kamloops Lake.

Additional water management activities in mine facilities include:

- MRSFs: runoff and seepage from the TSF, WMRSF, and TSF North Embankment will be managed in the North Embankment Pond 1 and North Embankment Pond 2. Runoff and seepage from the southern portion of the SMRSF will be managed in the SMRSF Pond and to the north in the Central Pond and Open Pit. Runoff and seepage from the EMRSF will be managed in the EMRSF Pond, to the south and the Open Pit (seepage) to the west. Water intercepted in the North Embankment Pond 1 and 2 and the EMRSF will be pumped to the Central Pond and then directed to the mill for process during Operation and water intercepted at the SMRSF Pond will be routed to the Plant Site Pond.

- TSF: the embankments for this facility, which are constructed of non-potentially acid generating (NPAG) mine rock, will be expanded in stages. Seepage and runoff collected in the South and Southeast embankment ponds will be pumped back to the TSF pond. Runoff from undisturbed areas within the final footprint of the TSF will be routed to and collected in the TSF pond. Reclaimed tailings supernatant will be pumped back to the mill.
- Open Pit: water from various sources that reaches the pit, and is not absorbed by broken rock hauled out of the pit, will be contained by a large collection system of ditches, pipes, sumps, pumps, and booster pumps, and will be directed to the Central Pond.

11.24.3.4 Decommissioning and Closure

Reclamation and closure initiatives have the objective of transforming the mine site into an integrated component of the surrounding ecosystem after completion of active mining. Environmental protection measures established during the Construction and Operation phases will be applied during decommissioning and reclamation activities in the Decommissioning and Closure phase. Erosion and sediment control measures will be important during the reclamation of infrastructure and the decommissioning of the water management infrastructure (Erosion and Sediment Control Plan, Section 11.2). The following water management activities will occur during this phase:

- removal of culverts and water crossings and restoring of natural drainage;
- re-establishment of the Peterson Creek channel between Jacko Lake and the PCDP, while maintaining and operating the PCDS to maintain downstream flows from Jacko Lake;
- retaining of PCDP with no structural changes intended;
- modification of the Southeast Jacko Lake Dam (JLD3) to reduce the operational crest elevation;
- purging, dismantling, and disposal of pipelines in an approved facility;
- pumping of water in the TSF pond to the Open Pit to initiate pit filling and allow for reclamation of the TSF;
- site grading and reclamation of the TSF, along with construction of a spillway, to allow for surface runoff to be diverted to the Humphrey Creek drainage;
- decommissioning of the Central Pond, although a pond feature may still be maintained as part of the Post Closure landscape;
- site grading and reclamation of the MRSFs;
- continued operation of the Kamloops Lake fresh water pipeline to provide a clean source of water for closure activities, including dust control and demolition of site infrastructure;

- routing contact runoff to the Open Pit during infrastructure removal; and
- reclamation of the MSRFs and continued operation of their associated water management ponds (pumping to Open Pit) until water quality objectives are met.

11.24.3.5 Post Closure

The following is a list of the state of the water management features in the Post Closure phase:

- Kamloops Lake fresh water pipeline is decommissioned;
- Peterson Creek closure channel is functional;
- PCDS is decommissioned;
- Southeast Jacko Lake Dam (JLD3) functions in a similar fashion to the existing Jacko Lake Dam;
- PCDP is retained in perpetuity;
- TSF reclamation is complete with surface flows discharging into Humphrey Creek;
- MRSFs reclamation is complete with surface runoff from these facilities suitable for release to the environment;
- modified downstream ponds associated with the EMRSF, SMRSF, and North Embankment are retained in perpetuity; and
- the Open Pit continues to fill passively until reaching a relatively static surface elevation.

11.24.4 Monitoring

Groundwater quality monitoring is a key component of the environmental protection strategy for the Project and as such the GWQMMP relies on monitoring to ensure the mitigation and management measures are adequate, perform as predicted in the effects assessment, and provide information for adaptive management if unanticipated effects are discovered. Groundwater quality monitoring will be the responsibility of the Project's Mine Environmental Supervisor, with delegation of duties to Project personnel. As required, individuals that complete the monitoring and data interpretation will be suitably qualified professionals. These individuals will report on the findings of the water quality monitoring and will assist in investigations into potential sources if unexpected water quality results are reported. Reporting requirements will meet all requirements specific to regulatory permits, approvals, and authorizations.

11.24.4.1 Groundwater Quality Data Collection and Analysis Methods

The groundwater quality program and sampling protocols will be similar to the baseline program, which were implemented following the general requirements of the following documents:

- British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-emission, Water, Wastewater, Soil, Sediment and Biological Samples. 2003 Edition. BC Ministry of Water, Land and Air Protection.

- Low-Flow (Minimum Drawdown) Ground-Water Sampling Procedures. 1996. United States Environmental Protection Agency. EPA/540/S-95/504 (Puls, W. and Barcelona, M. 1996).
- Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators. Prepared by the Ministry of Environment. October 9, 2012 (MOE 2012).

General groundwater quality monitoring will be implemented with a focus on assessing for changes in groundwater quality compared to baseline and predicted concentrations, and generic water quality guidelines. The key objectives of these activities are to:

- provide feedback into the ongoing monitoring for performance of mine design (water management structures and systems) with respect to mitigation for surface water quality effects;
- identify and promptly address areas where maintenance, upgrades, modifications, or additional mitigation measures are necessary;
- measure and monitor groundwater quality and levels up-gradient (background/reference) and down-gradient of Project facilities and further down-gradient near potential receptors (e.g., domestic water supply wells in the Peterson Creek aquifer); and
- protect water-related resources (livestock, irrigation, wildlife, human health, and aquatic life) and avoid harmful impacts on all potential receptors.

This will be accomplished through regular groundwater quality monitoring.

11.24.4.2 Groundwater Quality Monitoring

The final GWQMMP monitoring program will be developed through consultation with regulatory agencies and the monitoring program will aim to follow and fulfill the guidelines and requirements specific to all permits. KAM's strategy for the draft GWQMMP will be to work cooperatively with the regulatory agencies to develop the framework for a "living document" that will be updated throughout the Project lifecycle.

The spatial scope of the monitoring program will include the Peterson Creek watershed and the proposed monitoring locations are consistent with the baseline monitoring locations, excluding those monitoring wells that may be under the footprint of a facility. The monitoring program will include appropriate reference sites to control for natural variation and regional trends. The Surface Water Quality Management and Monitoring Plan (Section 11.23) accounts for on-site water quality monitoring in the water management ponds and the TSF, which will be important information for interpreting groundwater quality results if trends in groundwater parameter concentrations become apparent.

The monitoring program will rely on baseline data presented in the Application/EIS and any additional data collected prior to the onset of construction activities for the established reference sites and the down-gradient monitoring sites. These data will be used for comparison to monitoring data collected over the course of the mine development. Some of the parameters will require thresholds to be met, above which additional monitoring and/or mitigation strategies may be triggered.

The parameters to be monitored include the following:

- *In Situ* – water level, temperature, dissolved oxygen, conductivity, specific conductance, redox potential, and turbidity;
- Physical Tests – hardness, pH, specific conductivity (SpC), total dissolved solids (TDS), total suspended solids (TSS), and turbidity;
- Dissolved Anions – alkalinity (bicarbonate, carbonate, and hydroxide), bromide, chloride, fluoride, and sulphate;
- Nutrients – ammonium nitrogen, nitrate, nitrite, dissolved orthophosphate, and total and dissolved phosphate;
- Dissolved Metals - analyzed at low levels to meet the B.C. Water Quality Guidelines (BCWQG) and the Canadian Environmental Quality Guidelines (CEQG) criteria values; and
- Organics – total organic carbon (TOC).

Water quality monitoring data (field notes, photographs, original laboratory files) will be managed in the environmental management system (EMS) for the Project.

11.24.4.3 Work Planning and Schedule

The groundwater quality monitoring schedule will be adjusted as required to comply with the sampling frequencies outlined in any permits issued for the Project. The monitoring sites and mine phase monitoring schedule outlined in Table 11.24-1 is the minimum groundwater quality program expected and is currently being achieved through the baseline monitoring program. The sampling frequency is seasonal (roughly quarterly), with four sampling events conducted per year through Construction, Operation, and Decommissioning and Closure. Sampling frequency targets with respect to high and low groundwater elevations follow guidance recommended in the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (MOE 2012); sampling within ±2 weeks of the highest and lowest groundwater levels. Water levels are proposed to be monitored with quarterly manual measurements in association with the groundwater sampling program and with dataloggers to measure continuous water levels in all monitoring wells. The sampling frequency is anticipated to be reduced over time in Post Closure as groundwater quality targets are achieved and/or as dictated by the permits.

11.24.4.4 Action Triggers

Groundwater quality monitoring results will be reviewed on a timely basis upon receipt from the laboratory. Groundwater quality results will be compared against baseline ranges for each monitoring well as well as generic water quality guidelines. For most parameters, action triggers will be developed for monitoring results that exceed generic water quality guidelines specific to the downstream users. If the parameter in question exceeds the generic water quality guideline under baseline conditions the trigger would be the exceedance of the maximum reference concentration for that specific parameter for that specific monitoring location. The maximum reference concentrations will be based on statistical analysis of the cumulative monitoring results that are collected prior to construction activities and will be reviewed with permitting agencies prior to finalization.

Table 11.24-1. Groundwater Sampling Locations

Nearest Facility [4]	Site ID	Quarterly Sampling and Manual Water Level Measurements: Construction	Operation	Decommissioning and Closure	Post Closure	Water Level Only [5]	Coordinates [1]: Easting	Northing	Elevation (masl)	Completion Zone [2]: From (mbgs)	To (mbgs)	Screened/Monitored Stratigraphy	Rationale Based on Proximity to Facility [3, 4]
Background	MW11-01S					●	679,734	5,612,460	928	19.4	22.4	Glacial Till	Background groundwater levels
Background	MW11-09S					●	679,860	5,609,079	910	11.5	14.5	Nicola Volcanics	Background groundwater levels
Background	MW11-09D					●	679,861	5,609,076	910	28.4	29.9	Nicola Volcanics	Background groundwater levels
Inks Lake	MW11-02	●	●	●	●		680,492	5,610,459	855	38.7	41.7	Nicola Volcanics	Near Inks Lake
Background	MW11-07S					●	681,750	5,612,894	941	5.8	7.3	Iron Mask Hybrid	Background groundwater levels
Background	MW11-07D					●	681,751	5,612,893	941	47.9	Z	Iron Mask Hybrid	Background groundwater levels
Open Pit	MW11-04S	●	●	●	●		682,619	5,610,367	899	17.6	20.6	Iron Mask Hybrid	Proximity to Open Pit and Jacko Lake
Open Pit	MW11-06S	●	●	●	●		683,404	5,612,239	943	8.3	9.8	Fluvial/Glaciofluvial	Background groundwater quality and levels north of Open Pit
Open Pit	MW11-06D					●	683,405	5,612,236	943	42.3	45.3	Iron Mask Hybrid	Vicinity of old MRSF option
Background	MW11-08D	●	●	●	●		681,391	5,609,123	897	31.3	32.8	Nicola Volcanics	Up-gradient of proposed project - reference location.
TSF	BGC14-003D	●	●	●	●		683,544	5,608,858	897	28.4	31.4	Nicola Volcanics	Down-gradient of TSF and WMRSF; seepage and runoff
TSF	BGC14-003I	●	●	●	●		683,544	5,608,858	897	16.8	19.8	Fluvial/Glaciofluvial	Down-gradient of TSF and WMRSF; seepage and runoff
TSF	BGC14-003S	●	●	●	●		683,544	5,608,858	897	9.8	11.3	Glacial Till	Down-gradient of TSF and WMRSF; seepage and runoff
TSF	BGC14-012D [6]	●	●	●	●		681,950	5,608,373	924	20.4	26.2	Nicola Volcanics	Down-gradient of TSF and WMRSF; seepage and runoff
TSF	BGC14-012S [6]	●	●	●	●		681,950	5,608,373	924	2.7	3.4	Colluvium	Down-gradient of TSF and WMRSF; seepage and runoff
TSF	BGC14-002D	●	●	●	●		682,756	5,608,900	925	16.8	22.9	Nicola Volcanics	Down-gradient of TSF and WMRSF; ELFZ foot wall
TSF	BGC14-002S	●	●	●	●		682,756	5,608,900	925	9.1	15.2	Glacial Till	Down-gradient of TSF and WMRSF; ELFZ foot wall
TSF	BGC14-001D	●	●	●	●		682,286	5,608,796	936	18.0	24.1	Nicola Volcanics	Down-gradient of TSF and WMRSF; ELFZ foot wall
TSF	BGC14-001S					●	682,286	5,608,796	936	4.0	5.5	Nicola Volcanics	Down-gradient of TSF and WMRSF; ELFZ foot wall
TSF	BGC14-010	●	●	●	●		681,730	5,607,514	979	46.0	58.2	Nicola Volcanics	Down-gradient of TSF and WMRSF; seepage and runoff
TSF	BGC14-011D	●	●	●	●		682,796	5,605,945	1029	23.5	29.6	Nicola Volcanics	Southwest end of TSF; Potential groundwater divide location.
TSF	BGC14-011S	●	●	●	●		682,796	5,605,945	1029	15.2	18.3	Nicola Volcanics	Southwest end of TSF; Potential groundwater divide location.
TSF	BGC14-016	●	●	●	●		685,348	5,607,041	1039	23.5	29.6	Nicola Volcanics	Down-gradient of TSF and up-gradient of SMRSF
TSF	BGC14-017D	●	●	●	●		685,515	5,605,954	1040	23.5	29.6	Nicola Volcanics	Southeast end of TSF
TSF	BGC14-017S	●	●	●	●		685,515	5,605,954	1040	3.0	4.6	Glacial Till	Southeast end of TSF
Open Pit	KAX-14-107S	●	●				683,223	5,609,202	896	29.9	38.0	Lacustrine	Jacko Lake-Open Pit Hydrogeological Connectivity
Open Pit	KAX-14-108S	●	●				683,140	5,609,428	901	32.3	35.4	Glacial Till	Jacko Lake-Open Pit Hydrogeological Connectivity
Open Pit	KAX-14-114S	●	●				683,210	5,609,277	896	22.0	31.1	Glacial Till or Fluvial/Glaciolacustrine	Jacko Lake-Open Pit Hydrogeological Connectivity

		Quarterly Sampling and Manual Water Level Measurements					Coordinates [1]			Completion Zone [2]			
Nearest Facility [4]	**Site ID**	**Construction**	**Operation**	**Decommissioning and Closure**	**Post Closure**	**Water Level Only [5]**	**Easting**	**Northing**	**Elevation (masl)**	**From (mbgs)**	**To (mbgs)**	**Screened/Monitored Stratigraphy**	**Rationale Based on Proximity to Facility [3, 4]**
Open Pit	KAX-14-128D	●	●				683,315	5,609,490	904	71.7	90.0	Nicola Volcanics	Jacko Lake-Open Pit Hydrogeological Connectivity
Open Pit	MW12-01	●					684,638	5,609,892		36.0	38.5	Waste rock backfill	Geochemistry of groundwater in historic waste rock
Open Pit	MW12-02	●					684,637	5,609,894		15.1	16.8	Waste rock backfill	Geochemistry of groundwater in historic waste rock
SMRSF	BGC14-009	●	●	●	●		686,799	5,608,647	919	47.9	54.0	Iron Mask Hybrid	Down-gradient of SMRSF; seepage and runoff
SMRSF	BGC14-013	●	●	●	●		686,466	5,606,777	987	27.4	30.5	Nicola Volcanics	Down-gradient of SMRSF; seepage and runoff
SMRSF	BGC14-014D	●	●	●	●		686,672	5,607,810	986	23.5	29.6	Nicola Volcanics	Down-gradient of SMRSF; seepage and runoff
SMRSF	BGC14-014S					●	686,672	5,607,810	986	12.8	18.9	Till/Undivided deposits or Fluvial/Glaciofluvial	Down-gradient of SMRSF; seepage and runoff
SMRSF	BGC14-015D	●	●	●	●		686,773	5,606,920	977	23.5	29.6	Nicola Volcanics	Down-gradient of SMRSF; seepage and runoff
SMRSF	BGC14-015S	●	●	●	●		686,773	5,606,920	977	8.2	11.3	Glacial Till	Down-gradient of SMRSF; seepage and runoff
SMRSF	MW12-04	●	●				684,327	5,609,146		32.0	35.5	Glacial Till	Geochemistry of groundwater in historic waste rock
SMRSF	BGC14-007D					●	685,324	5,608,722	924	26.5	29.6	Nicola Volcanics	Down-gradient of SMRSF; Peterson Creek aquifer
SMRSF	BGC14-007S					●	685,324	5,608,722	924	14.3	17.4	Fluvial/Glaciofluvial or Till	Down-gradient of SMRSF; Peterson Creek aquifer
SMRSF	BGC14-008D					●	686,107	5,608,923	877	26.5	29.6	Iron Mask Hybrid	Down-gradient of SMRSF; Peterson Creek aquifer
SMRSF	BGC14-008S					●	686,107	5,608,923	877	4.6	6.1	Fluvial/Glaciofluvial	Down-gradient of SMRSF; Peterson Creek aquifer
EMRSF	BGC14-004					●	687,746	5,609,526	869	72.2	78.3	Iron Mask Hybrid	Down-gradient of EMRSF; Sugarloaf Bedrock aquifer
EMRSF	BGC14-005 [6]	●	●	●	●		687,161	5,609,519	878	47.2	50.5	Iron Mask Hybrid	Vertical hydraulic gradients between Peterson Creek Aquifer and underlying Sugarload Hill Bedrock Aquifer
EMRSF	BGC14-006D [6]	●	●	●	●		687,288	5,610,779	940	20.4	26.5	Iron Mask Hybrid	EMRSF seepage and runoff and interactions with Aberdeen
EMRSF	MW11-05D [6]	●	●	●	●		686,723	5,610,692	961	25.6	28.6	Iron Mask Hybrid	Vertical hydraulic gradients and seepage from EMRSF
EMRSF	MW11-05S [6]	●	●	●	●		686,723	5,610,689	961	12.7	14.2	Iron Mask Hybrid	Vertical hydraulic gradients and seepage from EMRSF
EMRSF	MW11-10D	●	●	●	●		687,494	5,609,466	887	76.2	79.2	Fluvial/Glaciofluvial	Vertical hydraulic gradients and seepage from EMRSF

Notes:

1. *GPS coordinates are in UTM WGS84 zone 10 U. Ground surface elevations estimated from LIDAR.*
2. *Completion zone is top and bottom of well screens.*
3. *Rationale based on proximity to proposed facility: up-gradient monitoring locations to assess interactions with project facilities; down-gradient monitoring locations to assess potential seepage pathways.*
4. *Edith lake fault zone – ELFZ; tailings storage facility - TSF, west mine rock storage facility - WMRSF, south mine rock storage facility - SMRSF, east mine rock storage facility – EMRSF.*
5. *Water level only, no water quality sampling proposed.*
6. *New monitoring well may need to be installed if facility footprint is on top of the existing well.*

Trigger actions will be developed in consultation with permitting agencies and may include increased monitoring frequency (monthly) if a single trigger exceedance is noted and follow-up investigations if the maximum reference trigger is exceeded over multiple monitoring periods (indication of upward trends). Follow-up investigation plans will be developed in consultation with appropriate oversight from permitting agencies. Outcomes of investigations may result in feedback into potential improvements to mitigation measures in the GWQMMP or may result in the conclusion that changes are not explicit to the groundwater down-gradient of the Project, due to similar trends observed in reference or up-gradient monitoring locations. Potential mitigation measures will not be listed at this time as mitigation for groundwater quality effects are dependent on site specific conditions and could vary for any location in the RSA.

The guidelines that have been assumed to be relevant to the groundwater quality data for the Project are as follows:

- British Columbia Ministry of Environment Approved and Working Water Quality Guidelines (BCWQG) (BC MOE 2015a and BC MOE 2015b):
  - Drinking Water Supply (BCWQG-DW)
  - Fresh Water Aquatic Life (BCWQG-Aq)
    - Maximum (BCWQG-Max)
    - 30 Day Average (BCWQG-30 D)
  - Livestock Water Supply (BCWQG-Livestock)
  - Irrigation (BCWQG-Irrigation)
  - Recreation (BCWQG-Rec)
- Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines (CEQG) (CCME 2015):
  - Water Quality Guidelines for the Protection of Aquatic Life (Freshwater) (CEQG-PAL)
  - Water Quality Guidelines for the Protection of Agriculture (Livestock) (CEQG-Livestock)
  - Water Quality Guidelines for the Protection of Agriculture (Irrigation) (CEQG-Irrigation)
- Health Canada (2012):
  - Guidelines for Canadian Drinking Water Quality (HC-DW)
  - Guidelines for Recreational Water Quality (HC-Rec)

Triggers for groundwater levels will be developed based on the water level record for each monitoring well that will be developed prior to construction activities that may alter groundwater levels in the vicinity of a monitoring well. Groundwater quality mitigation measures have the potential to affect unavoidable changes in groundwater levels down-gradient of the Project. Effects on groundwater levels (quantity) are expected and will be monitored but no additional mitigation measures are proposed.

11.24.5 Reporting

The internal reporting schedule is anticipated to be quarterly, or more frequently as required, and will include groundwater quality sample results and updated water level plots, detailed summaries of on-going quality assurance and quality control sample results and corrective actions required (if any), detailed reports on any deviations from standard data collection protocols, and details regarding investigations into potential source delineation for unexpected changes in groundwater concentrations. Reporting on the results of the GWQMMP will be the responsibility of the Project's Mine Environmental Supervisor, with delegation of duties to Project personnel. As required, individuals that complete the reporting will be suitably qualified professionals.

Reporting for the GWQMMP is expected in association with the *Mines Act* and *Environmental Management Act* permits and is assumed to be on an annual basis for the duration of Construction, Operation, and Decommissioning and Closure, but will be dictated by the permit. Reporting frequency in the Post Closure phase may be less frequent and will be stipulated in the permits. External reporting on a more frequent basis may be required in accordance with permits if set triggers are exceeded. All external reports will be publicly available, as developed through communication plans.

11.25 Fisheries and Aquatic Life Monitoring Plan

11.25.1 Purpose

The purpose of Fisheries and Aquatic Life Monitoring Plan (FALMP) is to describe the rationale, framework, strategy, and scope of the plan to be implemented during the Construction and Operations, Decommissioning and Closure, and Post Closure phases of the Project. The FALMP is intended to meet the stipulated regulatory requirements under applicable provincial permits and federal regulations including the following:

- Canada *Fisheries Act* (R.S.C., 1985, c. F-14), Section 35 (1), Section 36(3).
- Canada *Species at Risk Act* (S.C. 2002, c. 29)
- BC *Water Act* (RSBC 1996)
- BC *Water Protection Act* (RSBC 1996)
- BC *Fish Protection Act* (SBC 1997), and
- BC *Environmental Management Act* (SBC 2003).

The FALMP focuses on ensuring regulatory compliance, implementation of mitigation measures, monitoring the effectiveness of mitigation measures, and verifying the predictions completed as part of the effects assessment of the following potential effects:

- Loss of habitat in Peterson Creek related to the Open Pit and the mine rock storage facilities;
- Loss of habitat and altered fish distribution and abundance in Peterson Creek downstream of the Project resulting from reduced flow;
- Impact of mining dust and vibrations on fish in Jacko Lake;
- Loss of habitat in northeast arm of Jacko Lake related to Open Pit development;
- Loss of habitat in Jacko Lake as a result of seepage or drainage of lake water into the adjacent open pit;
- Loss of habitat in Kamloops Lake as a result of water intake upgrades;
- Direct and indirect mortality of fish in Kamloops Lake resulting from water withdrawal (through either entrainment or impingement); and
- Water temperature variation in Kamloops Lake, Peterson Creek and/or Jacko Lake;
- Direct mortality or sub-lethal effects to fish as a result of altered water quality in Kamloops Lake, Peterson Creek and/or Jacko Lake (increased metals loading, decreased dissolved oxygen concentration, etc.) or blasting activities;
- Altered productive capacity (periphyton, aquatic macrophytes, plankton community, benthic invertebrates) resulting from changes in water quality in Kamloops Lake, Peterson Creek and/or Jacko Lake (nutrients, temperature, suspended solids).

The FALMP adopts the spatial and temporal boundaries presented in this Application/EIS focusing on managing and monitoring:

- Direct effects to the aquatic receiving environment in Cherry Creek, Jacko Lake and Peterson Creek upstream and downstream of Jacko Lake; and
- Indirect effects to the aquatic receiving environment in Peterson Creek watershed to the confluence with the South Thompson River.

The FALMP provides a conceptual level outline of the following:

- Construction phase monitoring that is required to ensure that appropriate mitigation measures are in place and to ensure that work activities conform to applicable standards, guidelines, and regulations.
- Monitoring requirements that are anticipated to be conditions of the authorizations issued under Section 35 (1) of the Canada *Fisheries Act*, including the monitoring of the success of the proposed habitat offsetting plan.
- Aquatic Effects Monitoring (AEM) program for the use of adaptive management that is intended to conform with industry standards, guidelines, and regulations, even though the project is not anticipated to trigger any of the requirements under the *Metal Mining Effluent Regulation* (MMER; SOR/2002-222).
- Reporting requirements for the FALMP.

The FALMP is designed to complement the proposed mitigation and management measures presented in the Application/EIS. The Construction phase monitoring, monitoring for *Fisheries Act* authorization compliance and Aquatic Effects Monitoring will be developed to track effectiveness and act as a trigger for adaptive management in the event of project-related major changes in: downstream surface water quality and quantity; and fish, fish populations, and/or aquatic life.

11.25.2 Performance Objectives

The performance objective of the FALMP is to avoid, minimize or control adverse effects on the fish and aquatic life present in the receiving environment, through development and implementation of the following:

- Mitigation measures and plan for implementation, including methods, timing, and assigning responsibilities;
- Construction phase monitoring program that will ensure that appropriate mitigation measures are in place and to ensure that work activities conform to applicable standards, guidelines, and regulations;
- Monitoring program that will meet the requirements that are conditions of the authorizations issued under Section 35 (1) of the Canada *Fisheries Act*, including the monitoring of the success of the proposed habitat offsetting plan;

- Aquatic effects monitoring program for adaptive management that will meet BC *Environmental Management Act* (EMA) Effluent Permit discharge requirements even though the Project is not expected to have a direct discharge to the surface water receiving environment, and that follows the standards contained in the guideline documents below to ensure proper study design, sampling methods, analyses, and Quality Assurance / Quality Control (QA/QC) procedures are carried out:
  - British Columbia Field Sampling Manual (Clark 2003);
  - Water and Air Baseline Monitoring Guidance Document for Mine Proponents (BC MOE 2012);
  - Fish Collection Methods and Standards (BC 1997);
  - Environmental Code of Practice for Metal Mines (Environment Canada 2012a);
- Monitoring program that will confirm the conclusions of the effects assessment, including the anticipated effectiveness of mitigation measures;
- Monitoring program to determine the response of fish and aquatic life present in the aquatic environment to potential effects, which will allow for early detection of emerging issues related to project activities; and
- Monitoring program results to adaptively manage adverse effects on the fish and aquatic life present in the aquatic environment, as needed.

Along with the FALMP, adverse effects on the fish and aquatic life present in the aquatic receiving environment will be managed through the implementation of the following Environmental Management Plans:

- Erosion and Sediment Control Plan (Section 11.2);
- Metal Leaching and Acid Rock Drainage (ML/ARD) Management Plan (Section 11.5);
- Air Quality Monitoring and Dust Control Plan (Section 11.6);
- Water Management and Hydrometric Monitoring Plan (Section 11.7);
- Explosives Management Plan (Section 11.11);
- Spill Contingency Plan (Section 11.16).
- Surface Water Quality Management and Monitoring Plan (Section 11.23); and
- Groundwater Quality Management and Monitoring Plan (Section 11.24).

11.25.3 Environmental Protection Measures

The Project has the potential to interact with components of the aquatic environment including fish and aquatic life through a number of pathways, as described in Section 6.7 Assessment of Potential Fish and Fish Habitat Effects. The pathways of interactions between the Project and the aquatic environment are summarized in Table 6.7.4-1. Protection measures specific to fish and aquatic life are described in the subsections below.

Implementation of the environmental protection measures will be the responsibility of the Project's Environmental Manager, with delegation of duties to Project personnel as required. Individuals that institute the protection measures will be qualified professionals that have been identified by KGHM Ajax Mining Inc. (KAM) and provided with the required training to effectively perform this duty.

11.25.3.1 Design Criteria

KAM is committed to developing the Project to meet or exceed applicable legal/regulatory requirements in a manner consistent with industry best practice. Where relocation or redesign have not been possible to avoid potential effects on fish or fish habitat, mitigation measures for reducing the potential risks associated with instream works will be employed. This will consist of proactively implementing proper environmental protection measures so that specific needs and interests of fish and aquatic life are preserved. Where possible, the Project has been designed to minimize interactions with the aquatic environment by ensuring appropriate setback distances from riparian areas are maintained, natural drainage networks are maintained or restored as much as feasible, and stream crossings are designed to avoid/minimize impacts.

As a best practice, KAM intends for all instream work to adhere to the general least risk work windows for fish in the Thompson Region, which are designed to protect the fish species known to occur in a stream. For the Project the general least risk work window for rainbow trout shows that instream work is constrained outside of the July 22 to October 31 period for early spawners and the August 7 to October 15 period for late spawners. The specific least risk work window for coho, chinook, pink, and sockeye salmon and rainbow/steelhead trout is July 22 to August 15 in the Thompson River; although no least risk work windows are specified for Kamloops Lake the period is considered to be the same as for the Thompson River. Work can occur outside of the least risk window if all structures and construction works do not encroach below the high water mark and measures are taken to prevent the delivery of sediments into the waterbody. In the event that instream work would be required to occur outside of the least risk work windows, KAM would seek an alteration from federal and provincial authorities prior to commencing the work.

11.25.3.2 Effect-Specific Protection Measures

Habitat Loss

In order to avoid causing serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery, the Project attempts to avoid or mitigate serious harm to fish associated with the Open Pit and the Peterson Creek Diversion by first minimizing the impacted area and then proposing habitat offsetting measures for the unavoidable impacts resulting in a loss of fish habitat.

Instream Works

Implementation of the following industry standard best practices will be used to reduce fish mortality that could result from Project activities within Jacko Lake, Peterson Creek, and/or Kamloops Lake:

- A fish and amphibian salvage will be completed before the start of works where a wetted channel or waterbody will be isolated or dewatered;

- All in-water work areas will be isolated by temporarily diverting, enclosing, or pumping the water around the worksite, with the point of discharge immediately downstream of the worksite to minimize disturbance to downstream populations and habitats;
- All equipment and machinery will be in good operating condition and free of leaks, excess oil, and grease;
- Whenever possible, machinery will be operated on land above the high water mark, on ice, or from a floating barge to minimize disturbance to the banks and bed of the waterbody;
- No equipment refuelling or servicing will be undertaken within 50 m of any watercourse or surface water drainage;
- All hydraulic machinery entering a stream or waterbody will use hydraulic fluids that are non-toxic to aquatic life and that are readily or inherently biodegradable;
- Any sediments, debris, concrete, concrete fines, wash or contact water associated with any concrete works will not be deposited, directly or indirectly, into or about any watercourse. A CO_2 tank with regulator, hose and gas diffuser will be readily available during concrete work to neutralize pH levels in the event of a spill;
- Material such as rock, riprap, or other materials placed on the banks or within the active channel will be inert and free of silt, overburden, debris, or other deleterious substances;
- Excavated material and debris will be removed from the site or placed in a stable area above the high-water mark as far as possible from the waterbody;
- Vegetation clearing for access to the site and work area will be minimized to the extent possible. Following any work within a waterbody or riparian area, any adjacent shoreline or banks disturbed by the work will be stabilized through re-vegetation with native species suitable for the site; and
- Any water that contacts uncured or partly cured concrete will be contained and monitored until the pH is between 6.5 and 8.0 pH units and the turbidity is less than 25 nephelometric turbidity units (NTUs) measured to an accuracy of +/- 2 NTUs.

Increased Fishing Pressure from Workers

It is estimated that increased fishing pressure resulting from introduction of the workforce could represent an additional 17 anglers during the Construction phase and 10 anglers during the Operation phase. In order to minimize any potential effect on the fish population in Jacko Lake from the increased fishing pressure, KAM will adopt and enforce a policy for employees prohibiting fishing during working hours and requiring all anglers to access Jacko Lake by means of the publicly available access points.

Blasting

Blasting design will follow the recommendations included in the *Ajax Mine Blast Review, Conclusions and Recommendations* (Chiappetta, 2014), that are intended to prevent harm to fish. Additional information regarding blasting specifics are included in the Explosives Management Plan (Section 11.11) and the Noise and Vibration Management Plan (Section 11.22).

In addition, KAM has incorporated the following guidelines from Fisheries and Oceans Canada as "Measures to Avoid Causing Harm to Fish and Fish Habitat":

- Isolate the work site to exclude fish from within the area that could be directly affected by blasting.
- Remove any fish trapped within the isolated area prior to initiating blasting.
- Minimize blast charge weights used and subdivide each charge into a series of smaller charges in blast holes with a minimum 25 millisecond delay between charge detonations.
- Back-fill blast holes to grade or to streambed/water interface to confine the blast.
- Place blasting mats over top of holes and/or use top-stemming to minimize scattering of blast debris around the area.
- Prohibit the use of ammonium nitrate based explosives in or near water.
- Remove all blasting debris and other associated equipment/products from the blast area.

<u>Sheet Pile Dam Installation</u>

The northeast dyke will be installed to separate fish near the northeast arm of Jacko Lake from blasting near the edge of the Open Pit (Klohn Crippen Berger 2015). Activities required for installation of the dyke will follow the mitigation measures outlined for instream works.

To mitigate against mortality of fish in Jacko Lake associated with installation of the sheet pile dam for the northeast dyke, installation procedures will be designed to comply with the National Oceanic and Atmospheric Administration (NOAA) interim criteria for the onset of physical injury to fish. These criteria are:

- Sound Pressure Level: 206 decibels (dB) re: 1 microPascal (µPa) (meaning the SPL in dB at the instant of maximum absolute pressure referenced to 1 µPa)
- Sound Exposure Level: 187 dB re: 1 µPa2·sec SEL for fish 2 grams or larger or 183 dB re: 1 µPa2·sec SEL for smaller fish of all strikes generally occurring within a single day

To meet the above guidelines, pile driving will be undertaken using a number of best management practices and mitigation measures. As an example, if necessary to meet guidelines and subsurface conditions allow, vibratory sheet pile installation may be completed rather than impact hammer installation. . Vibratory sheet pile drivers can result in less noise with shorter installation time, less disturbance to the surroundings, and reduced damages to the driven sheet pile compared to impact driven sheet piles. If sound pressures exceeding these criteria are measured or a fish mortality is evident, a bubble curtain will be deployed over the full length of the wetted pile to reduce the sound levels.

<u>Entrainment or Impingement</u>

To prevent mortality of fish in Jacko Lake and Kamloops Lake associated with entrainment or impingement on fresh water intakes, screens will be installed and design of the intakes will adhere to the advice outlined in Fisheries and Oceans Canada (2013), including but not limited to:

- Screens will be located in areas and depths of water with low concentrations of fish throughout the year;
- Screens will be located away from natural or artificial structures that may attract fish;
- The screen face will be oriented in the same direction as the flow;
- Screens will be located a minimum of 300 mm above the bottom of the watercourse to prevent entrainment of sediment and benthic aquatic organisms;
- Structural support will be provided to the screen panels to prevent sagging and collapse of the screen;
- Large cylindrical and box-type screens will have a manifold installed in them to ensure even water velocity distribution across the screen surface, with the ends of the structure made out of solid materials and the end of the manifold capped;
- Intakes will be designed to allow removal, inspection, and cleaning of screens; pumps will be shut down when fish screens are removed for inspection and cleaning;
- Regular maintenance and repair of all cleaning apparatus, seals, and screens will be carried out to prevent debris-fouling.

In addition, the intakes will be designed to distribute the approach velocity (the velocity component perpendicular to the screen face) uniformly across the face of the screen; the approach velocity will be determined based on the size and swimming mode of fish present in the vicinity (Fisheries and Oceans Canada 1995).

<u>Fish Stranding/Isolation</u>

Stranding and isolation of fish in creeks is typically associated with rapid reduction in flows. Flow regulation from the Peterson Creek Downstream Pond to meet the requirements of existing water licences will be managed by the provincial water bailiff. The Project will not affect the rate of release, therefore no effect on Fish and Fish Habitat as a result of stranding downstream in Peterson Creek is anticipated and no mitigation measures are required.

Any Project components that will be constructed within the wetted areas of creeks or lakes (e.g., the Sheet Pile Dam, Peterson Creek downstream pond Dam, Kamloops Lake Water Intake) will be conducted in the dry, either by scheduling the work for low flow periods or by isolating (e.g. using coffer dams) and dewatering the work area. Fish salvage will be conducted in any work areas that will be dewatered.

<u>Changes in Water Temperature and Dissolved Oxygen</u>

Assuming that the Peterson Creek Diversion intake is located at a comparable depth to the existing lake outflow gate and that the diversion will operate at a constant flow of 0.08 m^3/s (see Section 11.7 - Water Management Plan for more details) from May through September, no mitigation measures are proposed, as the estimated differences between the waterline and creek are within the range of natural variability and measurement error. Similarly, the absolute difference in temperature between Jacko Lake and the Peterson Creek Downstream Pond is estimated to range from 0.1°C to

1.3°C between May and November, which is within the range of natural variability and measurement error. No additional mitigation measures are proposed as the location and design of the intake and outflow gate are anticipated to effectively mitigate this potential impact.

Changes in Primary Productivity

Changes in primary productivity (i.e., periphyton, aquatic macrophytes, plankton community, etc.), could potentially result from an altered thermal regime from reduced flows and/or from nutrient additions from blasting residues entering a water body. These potential effects will be mitigated as described above, but the AEM monitoring program described in Section 11.25.4.3 will specifically aim to identify changes in primary production resulting from these activities and be used to direct adaptive management measures as required.

11.25.3.3 General Protection Measures during Construction and Operation

Mitigation and management measures for avoiding and minimizing the transport of sediments into the aquatic environment, as described in the Erosion and Sediment Control Plan (Section 11.2) will be implemented during Construction and Operation phases. This will start with temporary erosion and sediment control measures until permanent water management infrastructure are required. The goals are to prevent erosion and stop the movement of sediment that is generated. The key protection measures include minimizing the disturbance area, progressive reclamation of disturbed area through grading, and shaping and stabilization with a suitable seed mixture, establishing grooves, coir logs, straw wattles, or modified brush /rock layers installed along the slope contour based on slope inclination.

The water management infrastructure identified in the Surface Water Quality Management and Monitoring Plan (Section 11.23), Water Management and Hydrometric Monitoring Plan (Section 11.7), and Erosion and Sediment Control Plan (Section 11.2) such as dams, collection ditches, ponds, and pits including sumps, pumps, pipelines and drains will be utilized for control of contact and non-contact water. The water management infrastructure will mitigate potential effects from changes in the quantity and quality of water in the receiving environment that have the potential to have subsequent effects on fish and aquatic life.

The Water Management and Hydrometric Monitoring Plan identifies the proposed Construction and Operations phase mitigation and management required to protect and preserve fish and aquatic life that may potentially be affected by changes in water quantity.

The identification, blending, and storage of potential sources of metal leaching/acid rock drainage (ML/ARD) will contribute to the mitigation and management of changes in surface water and groundwater quality that have the potential to have subsequent effects on fish and aquatic life. The key design criteria incorporated into the ML/ARD Management Plan (Section 11.5) that will aid in protecting fish and fish habitat include:

- MRSFs – Blended PAG and NPAG mine rock to prevent ARD, progressively covered during operation and closure to minimize neutral metal leaching.
- TSF Embankments – Constructed only of NPAG mine rock to prevent ARD.

- Tailings – Low-sulphur NPAG tailings deposited as a thickened slurry that will form a homogeneous, non-segregated tailings mass. The TSF will be covered at closure to limit infiltration and neutral metal leaching.
- Ore Stockpiles – Maintain neutral drainage during operations and removal prior to closure.

Implementation of the ML/ARD Management Plan will begin prior to Construction phase activities and will continue through the life of the Project.

The potential for the introduction of nitrogen rich compounds from explosives into the aquatic receiving environment will be minimized by the application of best management practices for the use, transport, and storage of explosives (Explosives Management Plan, Section 11.11).

Mitigation and management measures for avoiding and minimizing the transport of airborne contaminants into the aquatic environment are described in the Air Quality Management Plan (Section 11.6), which will be implemented during construction and operation phases. The following design considerations and environmental protection measures have been adopted to minimize fugitive dust that could adversely affect fish and fish habitat:

- Conveyor from crusher to plant and the primary crusher area will be covered with an arch cover to reduce dust generation;
- Construct a cover over the coarse ore and fine ore stockpiles;
- Install dust collectors (baghouses) for the coarse ore reclaim area, cone crusher area, high pressure grinding roller area;
- Minimize the height from which materials are dropped;
- Where practical, orient the exposed stockpiles to minimize wind exposure;
- Minimize the height of stockpiles where compatible with operational requirements;
- Watering haul road surfaces as appropriate to maintain the optimum 4% moisture ratio for suppression of fugitive dust;
- Roadways will be properly graded, compacted and maintained to reduce the silt content for the surface material;
- Construct roads with coarse gravel and aggregate materials;
- Grade snow into the top surface of unpaved roads during winter to suppress dust emissions;
- Operate vehicles within the posted maximum speed limits to minimize fugitive dust emissions; and
- Where applicable use of water or a dust suppression agent on exposed surfaces prone to wind erosion (e.g., surfaces of mine rock storage facilities, TSF dams, Overburden Stockpile, Reclamation Stockpile, Topsoil Stockpile, etc.).

Potential effects from accidental spills will be prevented, minimized and managed through the implementation of best management practices and mitigation measures for the handling and use of explosives, hazardous materials, waste, and fuel (Explosives Management, Hazardous Waste Management, and Spill Contingency Plans).

11.25.3.4 Decommissioning and Closure

Applicable measures established for the protection and preservation of fish and aquatic life during the Construction and Operations phases will continue to be applied during the Decommissioning and Closure phase. As the Project proceeds, results from the AEM will be used to identify whether additional environmental protection measures are warranted to protect and preserve fish and aquatic life.

11.25.3.5 Post Closure

Site reclamation and restoration activities will be completed in the Decommissioning and Closure Phase and will remain operational in the Post Closure phase. The proposed reclamation and restoration activities will be conducted in a manner that protects and preserves fish and fish habitat and mitigates indirect effects from surface water quality, groundwater quality and other potential pathways of effect. It is proposed that all reclamation and restoration activities undertaken will comply or conform to applicable regulatory and/or permit conditions put in place to preserve and protect fish and fish habitat beyond the life of the mine.

11.25.4 Monitoring

11.25.4.1 Construction Phase Monitoring

KAM will appoint an Environmental Monitor, who is a suitably qualified professional, who will be responsible for monitoring the implementation and performance of construction phase environmental protection measures designed to protect fish and fish habitat. The Environmental Monitor will be present to monitor activities in and around water to ensure the following:

- Environmental protection measures are consistent with the requirements specified in the Project's environmental management plans. Where the protection measures are inadequate, the Environmental Monitor, in consultation with the Environmental Manager, will have the authority to modify or halt any construction and/or commence and direct work to meet the specified requirements;
- Sampling and analysis of runoff water quality and water quality (physical and chemical) in the receiving environment to determine its compliance with permit requirements and applicable standards and guidelines including:
  - British Columbia Ministry of Environment Approved and Working Water Quality Guidelines (BCWQG) (BC MOE 2015a and BC MOE 2015b):
    - Fresh Water Aquatic Life (BCWQG-Aq)
      - Maximum (BCWQG-Max)
      - 30 Day Average (BCWQG-30 D)

- Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines (CEQG) (CCME 2015):
  - Water Quality Guidelines for the Protection of Aquatic Life (Freshwater) (CEQG-PAL)

  Where the water quality results are not in conformance, the Environmental Monitor, in consultation with the Environmental Manager, will have the authority to modify or halt any construction and/or commence and direct work to meet the water quality objectives;

- Recommended water flow requirements are met in Peterson Creek. This will require the interpretation of flow and hydraulic measurements from monitoring at established transect sites to assess whether the predicted changes in flow meet the recommended flow threshold for BC streams identified in Appendix 6.7-2. Where the water quantity results indicate that the flow is inadequate, the Environmental Monitor will inform the Environmental Manager to engage the provincial government to manage releases from the Peterson Creek Downstream Pond to meet instream flow needs (as long as water levels in Jacko Lake are not below the conservation level identified by FLNRO).
- During blasting and sheet pile driving works, the Environmental Monitor will conduct visual observation of the lake for abnormal fish behavior, injury or mortality and measure sound pressure level and sound exposure level in the water column with a hydrophone to ensure that the respective thresholds are not exceeded.

11.25.4.2 Monitoring Required under Fisheries Act *Authorizations*

KAM will appoint an Environmental Monitor, who is a suitably qualified professional, who will be responsible for monitoring the works for compliance with the Section 35 (1) authorizations issued under the *Fisheries Act*. The monitoring requirements will be specified as conditions under the *Fisheries Act* authorizations, which typically include items such as ensuring the required environmental protection measures are in place and in working order, measuring the affected habitat area, monitoring water quality, making visual observations regarding fish and fish habitat, and evaluating the post-construction effectiveness of the habitat offsetting works (vegetation, hydrological conditions, and fish and fish habitat).

11.25.4.3 Aquatic Effects Monitoring

Aquatic effects monitoring is a key component of the environmental protection strategy for the Project and as such the FALMP relies on monitoring to ensure the mitigation and management measures are adequate, perform as predicted in the effects assessment, and provide information for adaptive management of unanticipated effects. Aquatic monitoring will be the responsibility of the Project's Environmental Manager, with delegation of duties to Project personnel. As required, individuals that complete the monitoring will be suitably qualified professionals.

The spatial scope of the monitoring program will include Cherry Creek, Jacko Lake and Peterson Creek upstream and downstream of Jacko Lake. At least one location in each of the watercourses and/or waterbodies will be used as a monitoring location. Where monitoring locations are required, they will be consistent with the baseline sampling sites. The environmental effects monitoring program will include appropriate reference sites (one lake and one stream) to account for natural variation and regional trends.

The monitoring plan will be developed jointly with the Surface Water Quality Monitoring and Management Plan (SWQMMP) to reduce redundancy and enhance synergy. Fish, sediment quality, primary producers (periphyton, phytoplankton), and benthic invertebrates will be sampled at the same monitoring locations established for the SWQMMP. For the AEM, KAM will conduct accidental release/spill sampling and characterization (if achievable), water quality monitoring, water level and flow measurements, acute toxicity testing, sub-lethal toxicity testing, biological monitoring (fish population and benthic invertebrate communities), sediment quality, fish tissue metal and biological endpoints in sentinel species, and physical site characterization. These components of the AEM will generally be modelled on the guidance provided in the *Metal Mining Technical Guidance for Environmental Effects Monitoring* (Environment Canada 2012b), the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents* (BC MOE 2012), the *Fish Collection Methods and Standards* (BC 1997), and the *British Columbia Field Sampling Manual* (Clark 2003).

The monitoring program will rely on baseline data for the established reference sites (lakes and streams) presented in the Application/EIS and compare these data to those collected during the development of the Project.

The AEM program will utilize a before-after-control-impact (BACI) comparison of environmental indicators (i.e., water quality, fish population, benthic invertebrate community, and fish tissue), consistent with the Metal Mining Technical Guidance for Environmental Effects Monitoring (Environment Canada 2012b). The BACI analyses will aim to incorporate the required statistical assumptions and provide transparent and reproducible results. Statistical hypothesis testing will be validated through a posteriori power analysis.

The monitoring schedule for each environmental indicator (i.e., water quality, fish population, benthic invertebrate community, and fish tissue) will aim to be consistent with the required sampling frequencies outlined in the MMER (to be used as a guideline as no discharge authorization will be required under the MMER) and BC EMA Permit, by following the guidance provided in the *Metal Mining Technical Guidance for Environmental Effects Monitoring* (Environment Canada 2012b), the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents* (BC MOE 2012), the *Fish Collection Methods and Standards* (BC 1997), and the *British Columbia Field Sampling Manual* (Clark 2003).

Baseline monitoring (Before) has started and Post-baseline (After) monitoring will begin during the Construction phase and will continue throughout Operations, Decommissioning and Closure, and Post Closure phases.

11.25.5 Reporting

Reporting will be a mandatory requirement of the Construction phase monitoring and conditions of the authorizations issued under Section 35 (1) of the Canada *Fisheries Act,* and will be voluntary for the aquatic effects monitoring. The required reporting will be submitted to the applicable regulatory agencies as defined in the permits and/or authorizations, while reporting will voluntarily be made available to regulatory agencies or community groups through CSR (Corporate Social Responsibility) reporting or other annual reporting mechanisms.

Reporting on the results of the FALMP will be the responsibility of the Project's Environmental Manager, with delegation of duties to Project personnel. As required as part of a permit or authorization condition, individuals that complete the reporting will be suitably qualified professionals. A summary of the aquatic monitoring program reporting is provided in Table 11.25-1.

Table 11.25-1. Reporting Summary Table

Report Type	Report Frequency	Report Submitted to	
		Provincial Regulatory Agency	Federal Regulatory Agency
Non-Compliance/ Spill Event Reporting (Mandatory)	As Required	√ (Ministry of Environment)	√ (Fisheries and Oceans)
Construction Phase Monitoring Reporting (Mandatory)	Monthly (Typically)	√ (Ministry of Environment)	√ (Fisheries and Oceans)
Monitoring Reporting Required as a Condition Under Section 35(1) *Fisheries Act* Authorizations (Mandatory)	As Specified in the *Fisheries Act* Authorizations		√ (Fisheries and Oceans)
AEM Effluent and Water Quality Monitoring Reporting (Potentially Required/Voluntary)	Annually	√ (Ministry of Environment)	
AEM Biological Effects Monitoring Reporting (Potentially Required/Voluntary)	First year of operations and then following a 72-Month Cycle	√ (Ministry of Environment)	

11.25.5.1 Non-compliance/Spill Event Reporting

In the rare event of a non-compliance/spill event, the report prepared under the Spill Contingency Plan (Section 11.16) will be forwarded to appropriate regulatory agencies in accordance with applicable permits and legislation.

11.25.5.2 Construction Phase Monitoring Reporting

The Construction Phase Monitoring Reports will:

- Describe the status of the aquatic environment and any observed trends resulting from the development of the Project.
- Describe Project activities and mitigation measures in place, and a discussion of their effectiveness during the monitoring interval, raw monitoring data, a description of the monitoring, and evaluations/conclusions of/from Project effects on fish and fish habitat.
- Be submitted monthly throughout the Construction phase of the Project.

11.25.5.3 Monitoring Reports Required as a Condition under Section 35(1) Fisheries Act Authorizations

The Monitoring Reports required as a condition under Section 35(1) *Fisheries Act* authorizations will:

- Describe the status of the aquatic environment and any observed trends resulting from the development of the Project.
- Describe Project activities and mitigation measures in place, and a discussion of their effectiveness during the monitoring interval, raw monitoring data, a description of the monitoring, and evaluations/conclusions of/from Project effects on fish and fish habitat.
- Evaluate the post-construction effectiveness of the habitat offsetting works (vegetation, hydrological conditions, and fish and fish habitat).
- Be submitted as defined in the Section 35(1) *Fisheries Act* authorizations.

11.25.5.4 AEM Effluent and Water Quality Monitoring Program Reporting

The annual AEM Effluent and Water Quality Monitoring Report will:

- Describe the status of the aquatic environment and any observed trends resulting from the development of the Project.
- Describe Project activities and mitigation measures in place, and a discussion of their effectiveness during the monitoring interval, raw monitoring data for all monitoring locations including reference sites, a description of the monitoring, and evaluations/ conclusions of/from Project effects on water quality.
- Be shared voluntarily by KAM with interested stakeholders.

11.25.5.5 AEM Biological Effects Monitoring Reporting

The AEM Biological Effects Monitoring Report will:

- Provide a site characterization with the following information:
  - a description of the reference and exposure areas where the biological monitoring studies will be conducted that includes information on the geological, hydrological, limnological, chemical and biological features of those areas;
  - the type of production process used by the mine, and the environmental protection practices in place at the mine;
  - a summary of any federal, provincial or other laws applicable to the mine in respect of environmental monitoring;
  - a description of any anthropogenic, natural or other factors that are not related to the waters under study and that may reasonably be expected to contribute to any observed effect; and
  - any additional information relevant to the site characterization.

- Describe the fish population and fish tissue studies including:
  - the fish species selected (rainbow trout only in this case), taking into account the abundance of the species most exposed to effluent;
  - the sampling areas selected;
  - the sample size selected;
  - the field and laboratory methodologies selected; and
  - results and interpretation of the analyses.
- Describe the benthic invertebrate community studies including:
  - the sampling areas selected, taking into account the benthic invertebrate diversity and the area most exposed to effluent;
  - the sample size selected;
  - the sampling season selected;
  - the field and laboratory methodologies selected; and
  - results and interpretation of the analyses.
- Be shared voluntarily by KAM with interested stakeholders.

11.26 Landscape Design and Restoration Plan

11.26.1 Purpose

This plan describes the Conceptual Landscape Restoration and Reclamation Plan (CLRRP) for the Ajax Project (the Project). The focus of this plan is to provide a high level framework. The principles discussed will ensure that mine reclamation results in geologically stable landforms with low rates of soil erosion, maintains acceptable water quality standards, mitigates aesthetic and environmental impacts, restores ecological functions, and meets end land use objectives.

The plan identifies conceptual strategies to achieve landscape capability and productivity objectives, with the final goal of establishing self-sustaining vegetation communities that will foster the development of functional Post-Closure ecosystem units consistent with the Valued Components (VC) identified for the Project. The CLRRP includes direction for future reclamation planning and implementation for habitat elements such as woody debris, wildlife trees, boulder piles, and species composition and density targets. It is generally not prescriptive in terms of how these targets will be met, such as providing initial planting densities and areas; rather, it provides end goals for future reclamation planning.

11.26.2 Conceptual Framework

The CLRRP is based on the concept of ecological replacement (Cooke and Johnson 2002) where pre- and post-mining landscapes will have similar functional characteristics. However, they will not necessarily be the same in terms of site series composition as variables such as soil moisture regime, soil nutrient regime, and soil structure will be different from pre-mine conditions.

To mitigate effects on SSN occupancy of the land, KAM will work with the SSN to document past, present, and future land uses in the areas surrounding the Project and in the larger traditional territory. This will aim to support SSN involvement in future land use planning for consideration in the Reclamation Plan.

KAM will also provide support, as appropriate, to the SSN to participate in accessing, harvesting, and/or documenting plants or other resources of cultural value prior and during Project execution. KAM will work to identify and describe rare or valued plant communities within the Project footprint. As appropriate, KAM will work the SSN to collect seeds, plants, and soil samples to inform future reclamation plans. KAM will also work with the SSN to investigate the need for future studies on biodiversity trends in the region to determine the possible role of the Project or other industrial activities in future conditions as they relate to harvested species.

The end land use and capability objectives are the focus of the plan and are derived from pre-development site condition assessments. The objectives include agriculture, wildlife, and recreation values. Recreation values will be met by restoring landforms and wildlife habitat; further detail on agriculture objectives and wildlife objectives are provided in Section 11.26.2.1.

The focus of reclamation planning and implementation is on the use of ecologically based strategies, including:

- the creation of post-mine ecological units with similar function to those present in the pre-mine landscape, with emphasis on agricultural and wildlife habitat values;
- post-mine ecological units based on post-mine landforms (elevation, slope, aspect, and solar radiation class); soil moisture and soil nutrient regimes; available soil quantity and quality; and appropriate pre-mine vegetation communities; and
- the selection of reclamation plant species based on succession patterns within the targeted ecological units, as well as plant morphological and competitive characteristics and adaptations to the anticipated post-mine site conditions.

It is important to note that reclamation of the post-mining landscape will re-establish basic ecological processes (e.g., biochemical functions) and relatively simple structural diversity and plant communities that will support wildlife populations. The processes, structure, and plant communities established through reclamation will create conditions for the re-establishment of native species over the long-term. The objective for all reclamation treatments is to establish a diverse landscape with habitats that will persist and continue to develop over time, based on natural successional pathways, into more complex communities.

11.26.2.1 End Land Use Objectives

Agriculture

The proposed mine development is located within the Agricultural Land Reserve (ALR). Pursuant to Section 20(3) of the *Agricultural Land Commission (ALC) Act* (2002), KGHM Ajax Mining Inc. (KAM) is seeking authorization for temporary non-farm use in the ALR. Under the conditions of temporary non-farm use, lands within the ALR must be returned to equivalent pre-disturbance agricultural capability. Post-reclamation, the mine will support equivalent grazing capacity, when compared to the pre-disturbance condition. Access control measures will be implemented and some mine roads may be repurposed to allow access to land parcels and to support ranching activities after mine closure.

Wildlife

Wildlife habitat objectives will be managed through the creation of key wildlife habitat features within the predominantly agricultural grassland landscape. Habitat areas will include sensitive aspen/wild rose complexes for browse and security cover, shrub dominated ravines, rock outcrops and wetland/riparian complexes. Livestock will be excluded from these areas with fencing and strategic placement of natural barriers constructed of woody debris. Where possible, pockets of existing vegetation will be preserved to maintain remnant populations of native species that will increase the speed with which reclaimed areas are recolonized and natural successional pathways can be re-established. An effort will be made to re-establish key habitat types required to support sensitive species and traditional use species that currently live in Project vicinity.

<u>Recreation</u>

Recreation objectives will be met by re-establishment of vegetation communities that support the agriculture and wildlife objectives and restore aesthetic values.

11.26.2.2 Pre- and Post-mine Ecosystems

The CLRRP is based on:

- the soil salvage, handling and replacement strategies (Section 3.17 Closure and Reclamation; Section 11.3 Soil Salvage and Handling Plan);
- the identified primary end land use objective of agriculture and wildlife habitat;
- pre-mine Terrestrial Ecosystem Mapping (TEM; Terrestrial Baseline, Appendix 6.8-A); and
- Post-Closure ecosystem unit development for the various mine facilities based on the combined influences of soils, elevation, slope, aspect and solar radiation on vegetation communities.

Table 11.26-1 shows the pre-mine and post-mine structural stages and generalized ecosystem descriptions within the proposed mine footprint. The proposed Project includes two former open pits and reclaimed mine rock storage facilities (MRSF) previously developed as part of the former Afton Mine operated by Teck Resources. It is recognized that re-creation of the existing habitats within the proposed disturbance areas is not feasible over short timeframe. Evolution of the new landscape resembling the current conditions and species mix will occur over the long-term, following the creation of suitable conditions to support successional pathways.

Table 11.26-1. Pre-mining and Conceptual Post-mining Structural Stages and Generalized Ecosystem Descriptions for the Ajax Mine[1]

TEM Structural Stage	Description	Pre-Mine Area (ha)	Post-Mine Area (ha)
1. Sparse/bryoid	Existing pits/mine disturbances	35.7	313
	Rock outcroppings	32.9	15
2. Herb	Disturbed grasslands (old Afton lands)	101	0
	Cultivated fields	62.2	100
	Grasslands	1,003	1,125
	Herbaceous	24.7	12
3. Shrub/Herb	Sagebrush grasslands	0.8	0.5
	Shrubby forest	62.3	22.5
	Shrub wetlands	2.1	2
4. Pole/Sapling Forest		113.4	35
5. Young Forest		176.4	50
6. Mature Forest		37.1	10
7. Old Forest		0	0
Other/Miscellaneous	Water features	27.5	10
	Roads	26.2	10.5
Total		**1,705**	**1,705**

[1] *Based on the TEM mapping in the Terrestrial Baseline (Appendix 6.8-A).*

Final reclamation planning will focus on creating stable landforms with low erosion rates that will support a variety of ecosystems. It should be emphasized that the goal is to ensure return to equivalent capability for a variety of end land uses including agriculture, wildlife and recreation. Variable site conditions, determined by aspect, slope, surface morphology, soil conditions, and vegetation dynamics will ensure that the post-mine landscape is capable of supporting all the identified end land uses.

11.26.3 Conceptual Restoration Principles

Reclamation success will depend on ecological functions of Post-Closure ecosystem units. The Biogeoclimatic Ecosystem Classification System (BEC) is used in BC to classify ecosystems based upon climate, vegetation, and site conditions. The principles used in this system will help group the post-mining landscape into appropriate treatment units. Prior to reclamation commencing, the areas to be reclaimed will be grouped into treatment units by grouping areas with similar ecological characteristics based upon climate and site conditions. Treatment unit climatic conditions will be identified based on the Biogeoclimatic Unit (BEC Unit) that they occur in. The Project area includes the Okanagan Very Dry Hot Bunchgrass variant (BGxw1), Thompson Very Dry Hot Ponderosa Pine variant (PPxh2), and the Thompson Very Dry Hot Interior Douglas-fir variant (IDFxh2; Table 11.26-2; Lloyd et al. 1990).

Table 11.26-2. Biogeoclimatic Units for the Ajax Mine[1]

BEC Unit	BGxw1	PPxh2	IDFxh2	Total Area
Area (ha)	7.3	4.9	1692.8	1705

[1] BEC Unit areas were calculated based on the Flora and Fauna Baseline Study (Appendix 6.8-A).

Site characteristics include slope, aspect, soil texture, soil depth, soil moisture regime, and soil nutrient regime. The BEC Units and site characteristics are key determinants of potential ecosystem vegetation communities and will be used to define treatment unit types.

For a number of years after reclamation post-mine landforms (e.g., rock storage facilities, mining pits) typically develop drier than pre-mining site conditions. Soils, degraded after long storage, will also require time to regain their full fertility. Consequently, the Post-Closure site conditions are expected to be different from pre-mining conditions. The goal of reclamation is to restore ecosystem functions by re-establishing vegetation communities that govern energy and nutrient cycling, soil development, accumulation of organic matter, and augment primary productivity. The species selected for use in reclamation will be selected according to their abilities to restore these functions. If they are suitable, native and traditionally important species will be preferentially selected. As well as establishing vegetation communities, habitat features such as woody debris, wildlife trees, and structural features such as boulders and open water are also key contributors to restoring structural diversity and ecosystem function and will be included in the final reclamation planning.

11.26.3.1 Post-mining Landforms

The existing terrain on the plateau south of the Thompson River valley at Kamloops consists of glacial drumlins and other morainal landforms oriented from northwest to southeast. This complex terrain includes many hollows, folds and varying aspects (diversified meso and micro-topography), which account for the numerous habitats that support species diversity, nutrient cycling and vegetative productivity. As an example, grasses in shaded hollows remain green throughout the growing season despite the arid climate typical for the region. To the extent practical, post-mining landscape features including mine rock storage facilities will emulate the surrounding terrain, and site-specific reclamation activities will utilize these features to replicate pre-disturbance diversity.

Most slope gradients created during reclamation will be less than 26° and will include benches and swales to increase slope complexity, reduce soil erosion, create site diversity for vegetation communities, and promote use by animals.

11.26.3.2 Site Preparation – Soils

Soils currently present on site vary from thin, eroded Regosols on hill crests to productive grassland Chernozems in the valley bottoms. Additional landscape features include weathered rock outcrops, shaded linked hollows, and saline sloughs.

The soil types and thickness play an important role in determining the vegetation and wildlife communities associated with these various habitats. The variation in soil depth that occurs during resloping activities as well as range of moisture gradients created by topography will help contribute to diversity of soil moisture and nutrient conditions that will, over the long-term, favour more diverse plant and wildlife communities.

Re-establishing productive soils is vital to ensure that successful plant communities are self-sustaining. Site preparation will occur during reclamation activities or, if needed, during targeted Post-Closure treatments. Site preparation will focus on creating diversity on slopes by creating small mounds with an excavator and by ripping subdued ground to help seedlings establish. The treatments will create microsites with favourable conditions to reduce desiccation by wind and sun and to increase soil moisture. Treatments will be conducted before snowfall to maximize soil moisture (Przeczek and Amos 2014). Additional treatments such as soil roughening or subsoil ripping will be conducted to increase favourable conditions for seed germination.

Specific site preparation, soil handling, and sediment prevention and erosion control measures are addressed in the Closure and Reclamation description (Section 3.17); Erosion and Sediment Control Plan (Section 11.2); and Soil Salvage and Handling Plan (Section 11.3).

Soil nutrition is vital to plant growth. During planting of shrubs and trees, fertilizer will be applied to improve plant establishment success. Soil nutrient analyses will be conducted to identify deficiencies and to guide the selection and application of soil amendments.

Soil microbial and fungal communities are vital to re-establishing productive soils and vegetation communities. While natural colonization of soils by microorganisms will occur, this process can be very slow. To accelerate this, tree and shrubs species that come from nursery stock, will be inoculated with mycorrhizal fungi at the nursery or during planting. This will help re-establish soil biochemical processes and increase primary productivity by increasing plant growth rates. Where possible, plants salvaged from the site will be used as these already have local fungal and bacterial communities that will contribute to microbial diversity in reclaimed areas.

11.26.3.3 Structural Diversity

Availability of organic material will be a limiting factor in reclamation. Where woody debris from clearing / grubbing can be used in concurrent reclamation, it will be stockpiled and retained for various reclamation uses. Excess material will be chipped and incorporated in stored topsoil as storage of this material until closure is not practical. After clearing/grubbing, the coarse woody material will be used for concurrent reclamation in the following ways:

- slash and stumps will be chipped or shredded and incorporated into lower quality soil or growth medium stockpiles to enhance organic matter content and structure;
- "natural" livestock barriers will be created to protect planted deciduous trees and shrubs from browsing and trampling during the critical re-establishment period;
- brush piles will be created for structural diversity and habitat enhancement for small mammals and reptiles, as well as raptors and other avian species; and
- excess woody debris will be spread on mine rock storage facilities prior to soil placement to establish pockets of nutrients that will encourage tree growth and create microcosms and depressions as it decomposes.

Wildlife trees, scattered large woody debris, brush debris piles, and rock boulder piles will contribute to a structurally diverse landscape. Wildlife trees are some of the most important habitat structures on the landscape that contribute to biodiversity. Clearing will be limited to required widths and where possible, wildlife trees will be retained and protected where possible. During reclamation, dead trees will be placed to provide habitat for perching and cavity nesting birds. To allow for cavity nesting for most species, the tree diameter should generally be greater than 30 cm. Only sound, competent trees without decay will be used for this purpose to avoid handling and safety issues during reclamation work.

Large woody debris and brush debris piles composed of fine woody material will also be created. These provide habitat, especially prior to shrub establishment, for a variety of animals and contribute to soil organic development as they decay. Large woody debris should be larger than 20 cm in diameter, and brush piles should be at least 3 to 4 m in diameter and 1 m in height. The preferred option is to use material created by grubbing and clearing as part of concurrent reclamation. For reclamation activities that occur later in the mine life, material will be sourced from adjacent forest licensees or other sources of woody debris with a focus on using waste wood.

Rock boulder piles are a common part of the natural landscape and provide structures used for perching, burrow and den sites beneath, and provide unique microclimates. Piles of large and small boulders will be created to provide these habitat structures.

11.26.3.4 Water Conservation

The most limiting factor to habitat capability and productivity in the BC Central Interior is the availability of water. Where water is available, vegetation communities have higher biomass and are often more floristically diverse. It is important that the Post-Closure mine topography (slope and aspect) is varied in order to collect, store and meter water to ensure it is available for vegetation, livestock and wildlife. Promoting rapid surface drainage of runoff is ill-advised and will hinder reclamation efforts. Where post-mining conditions are indicative of shallow groundwater or surface water, reclamation designs will create landscape features that optimize water storage and promote conservation.

11.26.4 End Land Use Objectives

Livestock Management

Agriculture, predominantly seasonal cattle grazing, will continue to be an important land use following mine closure. Creation of level to gently undulating grazing areas which are linked by suitable travel corridors, appropriate fencing and livestock watering systems, will allow for the creation of planned grazing systems. Cattle grazing will be limited in key wildlife areas and critical riparian habitats. Watering facilities will be strategically placed to maximize grazing efficiency and ensure uniform forage utilization. By using a variety of early, mid and late season native and agronomic forage species, up to nine months of annual grazing may be possible while maintaining pastures in excellent condition and preserving the quality of water and high value wildlife areas.

Wildlife Objectives

One of the objectives of the reclamation program is to re-establish a productive land use that is of value to wildlife. This objective also includes mitigation of potential effects of the project on wildlife, wildlife habitat, and the habitat of species at risk. Key wildlife species within the proposed footprint of the mine have been inventoried (Flora and Fauna Baseline Study, Appendix 6.8-A) and their habitat requirements described (Wildlife Habitat Objectives for Reclamation Plan, Appendix 11.26-A). General reclamation practices to promote the return of wildlife and specific habitat features to the reclaimed mine site include:

- re-contour surfaces where appropriate and feasible to facilitate optimum plant production, appropriate site drainage, and wildlife access and movement;
- replace soils to stimulate establishment of plants for suitable quality forage for wildlife consumption, and long-term ecosystem function;
- seed areas after soil placement with a seed mix suitable for erosion protection that may also provide summer forage and nesting cover;
- plant native deciduous and coniferous tree and shrub species in variable densities and clumps to create habitat patches and forest openings that increase the suitability of the reclaimed landscape for target wildlife species for feeding and shelter; and
- add coarse woody debris (large logs and stumps) and rock piles to reclaimed areas (including future forested areas) to provide microhabitats and visual breaks for wildlife moving through reclaimed areas.

Additional techniques to further improve site suitability for wildlife use will include:

- maintain connections to adjacent undisturbed habitats by leaving natural vegetation cover intact within the mine site where possible; and

- create and promote the establishment of vegetation corridors between undisturbed and planted habitat patches in reclaimed areas to ensure habitat connectivity and enable wildlife movement.

Wildlife habitat objectives for the proposed Ajax Mine are included in Appendix 11.26-A.

11.26.5 Reclamation Species Selection

Recommendations provided by the BC Ministry of Energy Mines (2011) indicate that *"the reclamation program be aimed at ecological restoration of naturally occurring grassland communities. We recommend consideration of an approach including the collection and possibly cultivation of native grass seed for reclamation purposes."* Further, the Environmental Code of Practice for Metal Mines (Environment Canada 2009) states that *"Species used in revegetation and the resulting plant community should be consistent with the goals of mine closure and the intended Post-Closure use of the site. Species native to the area around the mine site should be used for this purpose, and invasive species should never be used."*

Native vegetation is a major component of the existing landscape within the proposed Ajax Mine footprint. Predominant species include bluebunch wheatgrass and rough fescue. Native shrubs include big sagebrush, rabbit-brush, rose, and snowberry. Tree species include aspen, ponderosa pine and Douglas-fir. Native grassland ecosystems and associated forb species are targeted for approximately 72% of the post-mine landscape; shrub and woody species account for approximately 10% of the area; and the remaining 18% is associated with a lake that will be developed in the Ajax pit.

11.26.5.1 Collection of Native Seed and Cones for Propagation

Reclamation with native species can be problematic due to availability of suitable seed and planting stock. A native seed program to collect seeds from native tree, shrub, and grass species that are suitable for reclamation will be established and will help ensure reclamation success by using locally adapted stock. This will also help maintain native plant genetic diversity on the reclaimed site.

11.26.5.2 Revegetation – Species Selection for Agricultural Objectives

The current primary use of the proposed Ajax Mine property is seasonal livestock grazing of predominantly native grass/forb vegetation communities. In keeping with the recommendations noted above, and in consideration of the Agricultural Land Reserve (ALR) status of the property, which dictates that the land is returned to agricultural uses with equivalent capability following mine closure, the re-establishment of natural grasslands is a key priority.

Reclamation activities and research have been conducted at the nearby New Afton Mine operated by New Gold Inc., which has similar biogeoclimatic characteristics as the proposed Ajax Mine. These reclamation efforts indicate success with a custom-blended natural seed mix referred to as the "Stump" mix, distributed locally in Kamloops by Purity Feed Co. Ltd. This mixture is adaptable to a wide range of environmental conditions and includes ecologically and culturally important native grass species common on the Ajax property (Table 11.26-3). Two agronomic species, fall rye and annual ryegrass, are included to provide quick establishment and ground cover for erosion control, soil stabilization and weed control.

Table 11.26-3. Proposed Native Grassland Reclamation Seed Mixture for the Ajax Mine Project

Species	% by Weight	% by Species Composition
Fall rye	50.0%	3.9%
Bluebunch wheatgrass	16.5%	12.0%
Annual ryegrass	10.0%	10.9%
Rough fescue	9.5%	19.8%
Rocky Mountain fescue	8.0%	19.6%
Sandberg bluegrass	4.5%	21.3%
Junegrass	1.5%	12.4%

Agronomic forage species will also be utilized to establish spring pasture (Table 11.26-4) and fall turn-out (Table 11.26-5) areas that will facilitate planned grazing systems that relieve grazing pressure on native grasslands during sensitive times and protect sensitive wildlife areas. Fencing and watering facilities will be developed to achieve effective forage utilization in support of year round productivity.

Table 11.26-4. Proposed Spring Pasture Seed Mixture for the Ajax Mine Project

Species	% by Weight	% by Species Composition
Crested wheatgrass	70%	55%
Alfalfa	20%	20%
Hard fescue	10%	25%

Table 11.26-5. Proposed Fall Turn-out Pasture Seed Mixture for the Ajax Mine Project

Species	% by Weight	% by Species Composition
Slender wheatgrass	30%	31.5%
Dahurian wild ryegrass	30%	15.7%
Tall fescue	20%	29.8%
Russian wild ryegrass	20%	23.0%

11.26.5.3 Revegetation – Species Selection and Structure for Wildlife Habitat Objectives

The strategy is to revegetate the disturbed areas with regionally suitable grasses, shrubs, and trees which will re-establish ecological functions and provide wildlife habitat and graze for cattle.

It is recognized that re-creation of the existing habitats within the proposed disturbance areas is not feasible within a short time frame (Appendix 11.26-A). Evolution of a post-mine landscape that might resemble the current conditions and species mix will take many decades following the creation of suitable conditions for the natural trajectory of ecosystem changes to occur. Progressive reclamation proposed in some areas during the early phases of mine development is designed to shorten this period as much as possible. The physical characteristics of the existing ecosystems were used to suggest long-term target habitat conditions, recognizing that in the early stages of reclamation growing conditions may not match the requirements of the endemic species. While the use of native species is desirable, initial growing conditions will necessitate the use of agronomic species as well (Tables 11.26-3 to 11.26-5). These species will help re-establish vegetation cover that meets the functional requirements to re-establish soil and habitat characteristics that contribute to the long-term objectives.

The medium to long term objectives for habitat creation will provide for the following broad habitat types and special features:

- conifer (Douglas-fir) forests with grass/shrub understory;
- ponderosa pine forests with grass/shrub understory;
- aspen copses with grass/shrub understory;
- grasslands with shrub patches;
- wetlands with emergent vegetation;
- streamside riparian;
- pit lake;
- shrub gullies and damp depressions;
- high rock faces;
- scree slopes with large rocks and interstitial spaces;
- boulder clusters in grasslands and forests;
- coarse woody debris; and
- specialized features for species of conservation concern:
  - flat knoll tops with bunchgrass mix for sharp-tailed grouse;
  - snake dens; and
  - snags.

The following sections, adapted from Howie (Appendix 11.26-A), describe the physical and functional nature that may be achieved over the long-term for the four predominant target habitat types that presently exist on the proposed mine site. The target habitat characteristics represent the end objectives of restoration. To achieve some of the characteristics, such as the number of tree stems per hectare, will require higher initial density to account for mortality. Other features such as woody debris and boulders density are not expected to change over time and this will be reflected by reclamation prescriptions. Additional details and descriptions of the remaining habitat types are provided in Wildlife Habitat Objectives for Reclamation Plan included in Appendix 11.26-A.

Habitat *Df* – Douglas-fir Forests

The target Douglas-fir forest habitat should ultimately consist primarily of a multi-layered, multi-age canopy of Douglas-fir with a layer of both tall and low shrubs and a ground cover of grasses (Table 11.26-6). These sites should ultimately have about 25% of the forest with a low crown closure, 25% with a moderate closure, and about 50% in a high closure condition with overlapping branches. Shrubs should consist of berry-producing species such as rose, common juniper, soopolallie and Saskatoon. The forest floor should be 80% covered with native bunchgrasses and forbs. Large downed wood is a valuable feature component that should be provided early in the reclamation process.

Large boulders or boulder clusters are not a typical feature of such sites but occur occasionally under natural circumstances. Provision of such features will contribute to the site diversity throughout the evolving life of the habitat. It is expected that such sites will develop at higher elevations and on cooler aspects. Though flatter sites are desirable, stands will be developed on slopes up to 30°. Planting within areas that will accumulate moisture will be highly beneficial.

Habitat *At* – Aspen Copses

Trembling aspen is an important tree that grows on moister sites with groundwater sources such as springs. Aspen groves should be located in depressed areas, as well as along the bases of mine rock slopes and along the margins of some wetlands. Creating small areas of standing water within some groves would be an excellent way of enhancing biodiversity. Aspen's short-lived characteristics and soft wood leads to centre rot and renders the trees valuable for both primary and secondary cavity nesters. The highest percentage of cavity nesters in fir/aspen forests use aspens for nesting. The open canopy favors an extensive shrub understory with a grassy forb layer. Middle to older age stands result in high levels of wildlife diversity, particularly when cattle browsing is eliminated or strictly limited. The ultimate goal is to achieve self-sustaining stands of aspens ranging in size from 0.5 to 1.5 hectares each. The stands will ultimately contain older, decaying trees as well as new, suckering growth that are free to reach maturity with minimal interference from cattle or horses (Table 11.26-7).

Typically, abundant deadfall characterizes a biologically diverse aspen stand. Such material will be spread early on the reclamation site in order to protect young growth from excessive browsing. Conifers can be used if a ready supply of aspen from salvage is not available to use as deadfall.. Downed material should have varied diameters from 10-25 cm. Fencing will be required to keep livestock out of these areas until planted stock is sufficiently tall as to not be affected by browsing. Under natural conditions, scattered boulders can be found in some groves depending upon geological history of the site. The addition of these features using large mine rock would be of value. Rocks as large as can be transported are suitable as well as pieces ranging from 1 to 1.5 m in diameter.

Habitat *Py* – Ponderosa Pine Forests

Ponderosa pine forests currently exist on some warm, south-facing slopes north of Jacko Lake. Such habitats might be re-created on south or west-facing slopes of the mine rock storage facilities where soil depths would be adequate. The long-term goal would see a mature forest with stem densities similar to local natural habitats with a large woody debris component. Boulders in clusters and as single features are recommended as useful additional components recognizing that they are occasionally found under natural conditions. Shrubs are important understory features and will be included in the prescription. Where feasible, draws will be created to capture moisture and serve as planting locations for shrubs (Table 11.26-8).

Table 11.26-6. Target Habitat Characteristics for Douglas-fir Forests (*Df*)

			Overstory	Understory		LargeDowned Wood		Boulders		
Slope Degrees	Aspect Degrees	Species	Stems / ha (Spacing in metres)	% Groundcover	Plants / ha	Diameter (cm)	Pieces / ha	Singles / ha	Clusters	Snags / ha
0-30	320-90	Douglas-Fir	800-1,200[1]			20-60	100-250[4]	3-5	1	20
		Common Juniper	3-5	.05	5-7					
		Fescue Bunchgrass and/or Bluebunch Wheatgrass	(0.7-1)	70+						
		Saskatoon			20					
		Rose			200					
		Soopalalie			20					
Moist Sites										
0-5	320-90	Engelmann Spruce	250[2]			20-60	100-250[4]	3-5	1	20
		Black Birch			250[3]					
		Red-osier Dogwood			200-300[3]					
		Willow			150[3]					

Note: All species listed in the table are traditionally important to ***Secwepemc*** *First Nation (HCMC 2015). While grasses are also important as a group, there is no specific information about the uses of the two listed species.*

[1] *Initial planting densities are higher to account for mortality and to reduce solar insolation and desiccation of understory plants. 800-1,200 stems per ha is the old growth target. Planting densities should be approximately 1,500 stems per hectare.*

[2] *250 is old growth target; 1,200 stems per ha when stems are 12-25 cm dbh.*

[3] *These should be planted 5 clumps per 100 m^2 and from 5 – 10 plants per clump. Species can be mixed in clumps.*

[4] *Coarse woody debris levels have been established to emulate downed woody debris that would occur after a stand replacing fire and to provide microsites for plants and wildlife to re-establish. These have been modified from Howie (2014) after consultation with the author.*

Table 11.26-7. Target Habitat Characteristics for Aspen Copses (*At*)

			Overstory	Understory		Large Downed Wood		Boulders		
Slope Degrees	Aspect Degrees	Species	Stems / ha	% Groundcover	Plants / ha	Diameter (cm)	Pieces / ha	Singles / ha	Clusters	Snags / ha
0-5	All; in depression areas	Trembling Aspen	4,000[1]			15-30	100-200	2-3	1	20
		Rose[2]			1,500					
		Red-osier Dogwood[2]			1,000					
		Willow[2]			300-400					
		Common Snowberry[2]			2,000					
		Pinegrass[2]		70						

Note: All species listed in the table are traditionally important to ***Secwepemc*** *First Nation (HCMC 2015).*
[1] *Spacing: 1 – 3 m.*
[2] *Plant shrubs as a dense mix throughout understory.*

Table 11.26-8. Target Habitat Characteristics for Ponderosa Pine Forests (*Py*)

			Overstory	Understory		Large Downed Wood		Boulders		
Slope Degrees	Aspect Degrees	Species	Stems / ha	% Groundcover	Plants / ha	Diameter (cm)	Pieces / ha	Singles / ha	Clusters	Snags / ha
10-20	160-270	Ponderosa Pine	200-700			20-40	100-200	3-5	1	15
		Common Juniper			3-5					
		Saskatoon			25					
		Rabbit brush			1,000					
		Pasture Sage			1,500					
		Bluebunch Wheatgrass		75%	10,000					
		Rough Fescue		15%	1,500					
		Prickly Rose			[1]					
		Common Snowberry			[1]					

Note: All species listed in the table are traditionally important to ***Secwepemc*** *First Nation (HCMC 2015). While grasses are also important as a group, there is no specific information about the uses of the two listed species.*
[1] *Low shrubs should be planted densely with patch sizes from 100 -500 m^2, 2 to 4 patches/ha.*

A bunchgrass understory is preferred, though it has not been determined if grasslands of native bunchgrasses can be created. Research associated with progressive reclamation on site will provide guidance regarding the best choice of grass species for various applications. In the long term, successful growth and aging of the pine forests will generate snags but in the short term, snags will be created.

<u>Habitat *Gr* - Grasslands</u>

Grasslands are a major component of the existing landscape within the proposed Ajax Mine footprint. The dominant species of bluebunch wheatgrass and rough fescue can be challenging to re-establish on a native soil base and perhaps more so on an impoverished soil base. Portions of the existing grasslands are composed of the introduced Kentucky bluegrass which has been mostly accepted as a naturalized component of our grasslands despite its non-native origins. Crested wheatgrass is another common species that has been widely introduced in the general area. Weed control will likely be an early challenge during the process of revegetating both the mine rock and tailings storage facilities.

The general target is to have a densely-covered terrain of bunchgrasses with deciduous shrub patches in depressed areas and moisture-accumulating sites (Table 11.26-9). In an ungrazed condition, the mature grass bunches should have the top growth hang over and intersect with the top growth of neighbouring plants. Isolated ponderosa pine trees scattered across the landscape would be appropriate. Kentucky bluegrass is an acceptable co-habitant in patches. Aromatic shrubs (*Artemisia sp.*) occupying low density patches of south-facing slopes are also a target association.

Patches of rose and snowberry, species traditionally important for First Nations (HCMC 2015), will be planted in irregularly shaped mixed species groups along linear depressions that are designed to concentrate moisture. These patches will vary in size from 100 to 500 m^2. Patches of water birch are particularly desirable where sufficient water and soil conditions can be created to enable growth. Protection from cattle browsing and loafing is desirable and at least 50% of the patches will have barriers placed to minimize or eliminate cattle access.

Rock outcrops occur naturally in places within the undeveloped mine property. Boulders and boulder clusters are proposed as alternatives to the exposed outcrops. The densities of rocks and clusters noted in Table 11.26-9 are not suggested for every hectare of grassland. Of the grasslands created, about 25% will contain single, large boulders and the areas treated in this way will be scattered randomly across the landscape. The boulder clusters of varying size rocks up to 100 m^2 will be scattered on about 10% of the area reclaimed as grasslands.

11.26.6 Soil Fertilization Recommendations

Representative soil samples from stockpiled topsoil and reclamation material will be routinely analyzed to determine specific nutrient deficiencies and requirements for fertilizer application prior to use in revegetation treatments. The need for sulphur additions to bring down soil alkalinity also will be assessed at that time.

Table 11.26-9. Target Habitat Characteristics for Grasslands (*Gr*)

Slope Degrees	Aspect Degrees	Species	Overstory Stems / ha	Understory % Groundcover	Understory Plants / ha	Large Downed Wood Diameter (cm)	Large Downed Wood Pieces / ha	Boulders Singles / ha	Boulders Clusters	Snags / ha
Warm Variant										
0-30	0-360	Bluebunch Wheatgrass		80%	12,000-15,000	30-40	25-50	2-3	1	3
		Junegrass		5%						
		Sandberg bluegrass		10%						
		Prickly Rose	[1]		[1]					
		Common snowberry	[1]		[1]					
	100-220	Big Sagebrush	800-1200							
	100-220	Rabbit brush	200-300							
Cool Variant										
0-30	300-80	Rough Fescue		60%	5,000-6,000	30-40	25-50	2-3	1	3
		Rocky Mountain Fescue		15%	5,000–6,000					
		Junegrass		5%						
		Sandberg bluegrass		10%						
		Prickly Rose			[1]					
		Common snowberry			[1]					

Note: Shrub species listed in the table are traditionally important to ***Secwepemc*** *First Nation (HCMC 2015).*

[1] *Create linear patches along drainages, plus irregular polygons of mixed species from 00 – 500 m², plus isolated plantings of 200-300 stems/ha.*

11.26.7 Long Term Stability

Long-term physical and chemical stability will be addressed for all facilities, structures and discharges from the mine site and will meet stability criteria specified in the Interim Guidelines of the British Columbia Mine Waste Rock Pile Research Committee (1991) and the Canadian Dam Association Dam Safety Guidelines (CDA 2013).

The East, South and West Mine Rock Storage Facilities , and Tailings Storage Facility (TSF) Embankments (East, North, South and Southeast) have been designed to allow recontouring and progressive reclamation during mining operations, enabling long-term physical stability and erosion control. The final surface of the TSF, which will consist of dry tailings, will be reclaimed during post-mining operations. The Ajax pit walls will be constructed in rock and will be stable, with natural weathering causing slow raveling of the slopes over time. A pit lake will be developed using mine contact water augmented by precipitation and groundwater inflow.

All mine site roads that are not required during Post-Closure phase will be decommissioned and, where necessary, access control measures will be constructed to prevent vehicular transit. The long term chemical stability of surface and groundwater discharging from the site is addressed separately in the EA application (Chapters 6.3 and 6.4). Mitigation and contingency plans have been developed to address potential water quality changes due to mine water discharges and groundwater seepage into the receiving environment (Section 11.2 Surface Water Quality Management and Monitoring Plan).

Facility-specific reclamation programs are provided in the Closure and Reclamation description (Section 3.17).

11.26.8 Operational and Post-closure Monitoring and Reporting

KAM, with engagement of First Nations and stakeholders, will conduct a range of monitoring programs to ensure:

- compliance with the terms and conditions of permits, licenses and approvals issued to mine operations;
- compliance with applicable provincial and federal legislation relating to mine operations and environmental protection;
- conformance with the Mining Association of Canada's Towards Sustainable Mining (TSM) Mine Closure Framework;
- the success of reclamation programs;
- the geotechnical stability of structures, including mine rock and tailings storage facilities, diversion ditches, sediment control ponds, soil stockpiles; and
- impacts to the environment are minimized.

Reporting will summarize the findings of the monitoring programs and be included in the annual reclamation reports. Monitoring during the closure period is required under section 10.7.30 of the

Code (BC MEMPR 2008) and the Environmental Code of Practice for Metal Mines (Environment Canada 2009) to demonstrate that reclamation and environmental protection objectives are being achieved. Monitoring activities will be carried out by qualified technicians and the results provided in annual reclamation and environmental monitoring reports (per section 10.1.5 of the Code; BC MEMPR 2008). Reporting is described in greater detail in the Closure and Reclamation description (Section 3.17).

11.26.8.1 Vegetation Composition and Productivity

Post-Closure vegetation monitoring for the mine site will continue until a self-sustaining vegetation cover that meets end land use objectives has been established and documented. The program will be conducted annually for the first five (5) years after closure, every second year for Post-Closure years 7 through 11, and then at five year intervals until all revegetated areas are deemed as having met end land use objectives. The monitoring program will be subject to adjustment for specific areas as required, and will be reviewed annually in the annual reclamation report submitted to the Ministry of Energy and Mines.

The monitoring plan will include:

- establishment of permanent transects for assessing vegetation biomass, species composition and spatial characteristics in both reclaimed and native (undisturbed) sites;
- visual surveys of vertebrate species which use the mine site;
- rangeland health and productivity assessments; and
- weed and invasive plant management and control measures.

11.26.8.2 Trace Elements in Soils and Uptake in Vegetation

Soil metal content will be assessed according to the *Environmental Management Act* (2003). Where potential issues with trace elements are identified during soil salvage and handling (Section 11.20 Soil Salvage and Handling Plan), a trace metal monitoring program will be established.

Trace metal concentration analysis of both soils and vegetation will be conducted at regular intervals during mining operations and Post-Closure to determine the quality and safety of browse and forage for wildlife and livestock.

11.26.8.3 Range Capability

At closure a Range Management Plan will be developed for the Ajax mine site in consultation with Sugarloaf Ranch. Range capability and quality will be assessed each spring and fall by a qualified professional who will determine range readiness. The Range Management Plan will be assessed every three years once in use, and revised as necessary.

11.26.9 Reclamation Research

Reclamation research conducted over the years prior to closure of the Ajax Mine will provide invaluable opportunities to test, refine, and optimize proposed reclamation techniques before their implementation. The proximity of the mine site to Thompson Rivers University (TRU) provides unique and expanded post-secondary learning options and potential opportunities for collaboration between KAM, TRU, other academic institutions, and local First Nations. There are numerous opportunities for graduate student research related to the reclamation programs at Ajax, and KAM is committed to establishing these linkages and participating in relevant research studies.

Key areas of reclamation research for the Ajax Mine include:

- native grassland restoration using native hay as a seed source;
- planned grazing systems, including fencing and stock watering options for mine sites;
- agricultural irrigation and diversification (crops and livestock);
- soil amendments, including methods to develop an organically enriched surface layer;
- salvage and propagation of locally adapted native grass, forb and shrub species, particularly those useful for tailings, wetland and riparian zone reclamation;
- salvage, relocation and propagation of biological soil crusts (cryptogams);
- wildlife habitat enhancement techniques;
- fish and aquatic habitat enhancement;
- opportunities for traditional land use by First Nations; and
- health and safety.

11.27 WILDLIFE AND VEGETATION MONITORING PLAN

11.27.1 Purpose

The Wildlife and Vegetation Monitoring Plan (WVMP) has been developed to outline monitoring that can detect effects to wildlife and vegetation Valued Components (VCs) resulting from the Construction, Operation, Decommissioning and Closure, and Post-closure activities of the Project. This plan provides strategies for the ongoing monitoring of metal uptake, rare plants, ecosystems, wildlife species and wildlife habitat. The WVMP is designed to be adaptive, effective, and achievable in both the short and long term. Adaptive management should be implemented when an identified threshold is reached or if unanticipated effects are observed. Thresholds for adaptive management are not fixed, they depend on the amount of information available about those VCs, and variability in the data collected. The purpose of the Wildlife and Vegetation Monitoring Plan is to:

- monitor and verify potential effects related to the Project;
- ensure monitoring efforts are able to detect natural and Project-related changes to the environment and wildlife;
- monitor and evaluate the effectiveness of mitigation measures;
- identify unanticipated effects related to the project;
- monitor control sites for comparison;
- provide an early warning of undesirable change in the environment; and
- inform adaptive management measures.

The WVMP will be implemented at the start of Construction and will remain in place until the completion of mine Closure and reclamation activities. This plan outlines the monitoring measures that will be used for all wildlife and vegetation VCs.

11.27.1.1 Guiding Principles

The monitoring program established by KAM requires the input of specialists to carry out many of the wildlife surveys and studies required to monitor Project effects. Throughout the life of the Project, KAM will endeavor to hire qualified personnel to conduct these studies. As much as possible, KAM anticipate and encourage inclusion and participation of local experts, First Nations and Aboriginal Groups, and stakeholders in the execution of these surveys and studies.

Finalization of the monitoring program will occur through consultation with Federal and Provincial government agencies, Aboriginal groups, the public, and other stakeholders.

The monitoring of wildlife and vegetation will take an adaptive approach. Management measures implemented will be reviewed periodically and updated based upon initial outcomes and on current Best Management Practices (BMPs) and methods. The plan is designed to be adaptive, effective, and achievable in its implementation in both the short and long term.

<u>Components of the Wildlife and Vegetation Monitoring Plan</u>

This WVMP includes monitoring of:

- habitat loss and alteration due to Project footprint/activities;
- wildlife observations;
- Project-related mortality;
- vegetative health (metal uptake);
- rare plant occurrences/translocations;
- ecosystems;
- wetlands:
  - amphibian breeding,
  - migratory birds including waterfowl;
- bird and raptor nests;
- rock outcrops:
  - snakes,
  - bats;
- grasslands:
  - grouse leks, and
  - badgers.

This plan has been developed to complement related plans in the Application such as: Erosion and Sediment Control Plan (Section 11.2); Soil Salvage and Handling Plan (Section 11.3); Air Quality Monitoring and Dust Control Plan (Section 11.6); Water Management and Hydrometric Monitoring Plan (Section 11.7); Invasive Plant Management Plan (Section 11.17); Dark Sky Management and Monitoring Plan (Section 11.19); Transportation Management Plan (Section 11.20); Access Management Plan (Section 11.21); Noise and Vibration Management Plan (Section 11.22); Surface Water Quality Management and Monitoring Plan (Section 11.23); Landscape Design and Restoration Plan (Section 11.26); and Reclamation and Closure Plan (Section 11.28).

11.27.1.2 Regulatory and Policy Framework

Specific federal and provincial legislation, standards, and best practices guidelines that apply to vegetation, wildlife, and wildlife habitat are identified. These standards and best practices are guidelines that encourage development to occur in ways that will avoid, limit, or mitigate negative effects. Legislation relevant to this WVMP includes:

- Kamloops Land and Resource Management Plan (Kamloops Interagency Management Committee 1995);
- Nicola Thompson Fraser Sustainable Forest Management Plan (SFMP Working Group 2015);
- *Canadian Environmental Assessment Act, 2012* (2012a);

- *Species at Risk Act* (SARA; 2012b);
- BC *Environmental Management Act* (2003);
- BC *Mines Act* (1996a);
- BC *Wildlife Act* (1996b);
- *Forest and Range Practices Act* (2002a);
- BC *Environmental Assessment Act* (2002b); and
- *Migratory Birds Convention Act, 1994* (MBCA; 1994).

Examples of best practices and standards that may be used on this Project include:

- Guidelines for Translocation of Plant Species at Risk in British Columbia (Maslovat 2009);
- Accounts and Measures for Managing Identified Wildlife: Southern Interior Forest Region (BC MWLAP 2004);
- Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia (Cox and Cullington 2009);
- Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC MOE 2012);
- Guidelines for Amphibians and Reptile Conservation during Urban and Rural Land Development in British Columbia (BC MFLNRO 2014); and
- Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (BC MFLNRO 2013).

Recovery planning is a process to identify and facilitate the implementation of priority actions to ensure the survival and recovery of species and ecosystems at risk. The goal of recovery planning is to help arrest or reverse the decline of a species, and/or reduce or remove the threats to its long-term persistence in the wild. Recovery strategies are prepared for threatened species and management plans are produced for species of concern (Table 11.27-1). General approaches to recovery include habitat securement/protection, habitat management/stewardship, and research including monitoring trends.

Table 11.27-1. SARA Species on Site with a Recovery Plan

Species	Provincial Listing	SARA Schedule	Plan
Alkaline Wing-nerved moss	Blue	1-T	British Columbia Bryophyte Recovery Team 2009
Great Basin Spadefoot*	Blue	1-T	British Columbia Southern Interior Reptile and Amphibian Recovery Team 2008
Western Toad	Blue	1-SC	Provincial Western Toad Working Group 2014
Common Nighthawk	Yellow	1-T	Environment Canada 2015a
Olive-sided Flycatcher	Blue	1-T	Environment Canada 2015b
American Badger*	Red	1-E	*jeffersonii* Badger Recovery Team 2008

**Provincially identified wildlife (BC MWLAP 2004).*

11.27.2 Performance Objectives

The overall objectives of the WVMP are to:

- monitor local wildlife and habitats;
- verify the predictions made during the environmental assessment;
- track and evaluate mitigation measures to enable the implementation of adaptive follow-up programs as needed; and
- ensure compliance with regulatory requirements.

Specific targets related to achieving the objectives are to:

- meet legislation requirements with regard to:
  - active bird nests, leks, hibernacula, or mammal dens disturbed or destroyed during site clearing for the Construction phase, incremental growth of Project during the Operation phase, and general Project activities,
  - active or inactive raptor nests disturbed or destroyed during Construction and Operation, and
  - mortality of animals directly attributable to the Project, particularly species of conservation concern and migratory birds;
- minimize loss of high-quality habitat;
- minimize wildlife mortality as a direct consequence of the project;
- Minimize the disruption to wildlife movement; and
- prevent disturbance to deer within high-rated habitat and designated and draft Ungulate Winter Range (UWR) during the winter.

Direct changes to the quantity of habitat types associated with the mine footprint and progressive revegetation will influence some individuals within local wildlife populations. To verify impact predictions, KAM will monitor the temporal changes to habitat quantity in the Local Study Area (LSA) during the life of the Project.

11.27.3 Environmental Protection Measures

The following Project design considerations were integrated into Project planning:

- the surface footprint of the Project was designed to minimize disturbance to habitats;
- important habitats were avoided where practicable alternatives were available;
- minimize all clearing dimensions during Construction activities:
  - protect remaining undisturbed habitats,
  - ensure clearing activities are coordinated with other management plans;

- establish communication procedures between on-the-ground employees and environmental managers to facilitate timely reporting of any incident or concern during each phase of the Project;
- provide appropriate education and training for employees and contractors.

11.27.3.1 Wildlife Sensitivity Timing Windows

A pre-clearing approval process will be implemented to confirm that all required permits and authorizations are in place and that all required actions have been completed before clearing starts.

During the Construction phase an environmental staff member, reporting to the Environmental Manager, will be employed on site to identify sensitive wildlife features and implement appropriate measures to minimize potential adverse effects to these areas. For each wildlife VC, there are time frames during which wildlife individuals will be more sensitive to disturbance (e.g., breeding). Table 11.27-2 summarizes key sensitive periods for wildlife VCs applicable to the Project, and highlights legislation or BMPs relevant to each VC.

Where possible, Project construction activities that may disturb wildlife (e.g., vegetation clearing), will be avoided during sensitive periods. If avoidance is not possible, pre-clearing surveys will be conducted to identify features that must be avoided.

11.27.3.2 Nuisance Wildlife

No listed-indicator species were considered nuisance wildlife. Measures used to control wildlife attractants are intended to minimize or eliminate problem wildlife situations. However, if a problem wildlife situation does arise, the environmental coordinator will initiate the appropriate response actions. Any direct intervention with problem wildlife will be done by authorized personnel in consultation with, and as approved or directed by, the British Columbia (BC) Conservation Officer Service. KAM will opt for non-lethal solutions (e.g., aversive conditioning, relocation) whenever appropriate and safe to do so.

11.27.3.3 Heavy Metals Monitoring

An objective of this monitoring plan is to determine whether plants are accumulating metals in their tissue as a result of Project activities. Plant tissue chemistry can be affected by the deposition of dust (particulate matter) along unpaved roads and near blasting and processing sites. Plants can also accumulate metals from contaminated water and soil. This plan establishes a general methodology for monitoring of metal concentrations in plant tissue, and identifies opportunities for adaptive management.

As part of the monitoring program, vegetation will be sampled and analyzed for metal content. Data from these studies are compared to relevant baseline data. Since progressive reclamation will continue throughout the mine life, many of the long-term trends of vegetation metal uptake can be predicted prior to mine closure, which will limit the need for a large-scale post-closure program. A post-closure monitoring program will be developed based on the mine footprint and results of ongoing sampling.

Table 11.27-2. Wildlife Sensitive Periods Applicable to the Project

VC	Sensitive Period	Season / Life Requisite / Habitat Feature	Summary of Guidelines	Legislation and Standards
Rare Plants	Apr 1 to Sep 30	Growing	A minimum set-back distance of 30 m is recommended	
RSEC	Apr 1 to Sep 30	Growing	Maintain representative sites within the LSA	
Grasslands		Growing	Maintain representative sites within the LSA	
Reptiles		Winter		
Amphibians	Late March to August	Breeding ponds/ toadlet dispersal	Avoid construction activities in areas adjacent to potentially high-quality breeding habitat from May to October.	SARA 2002 BMP
Migratory Birds	Mar 15 to Aug 15	Nesting/fledging	Schedule vegetation clearing activities outside of the general breeding bird period, where possible. If clearing must be completed during the breeding period, conduct pre-clearing surveys to identify areas where clearing will be prohibited. Buffer zones around any identified active nests will be maintained, where possible.	MBCA (1994) BC *Wildlife Act* (1996)
Raptors	Mar 1 to Aug 15	Nesting/fledging	200 m buffer of nest sites 500 m buffer of active nests	
Game Birds	April 1 to May 31	Breeding/rearing	400 m buffer of leks	
Mammals (Badger Dens)	May 1 to Aug 15	Breeding	50 m buffer of burrows	
Mammals (Bats)	Jun 1 to Aug 31 Oct 1 to May 31	Breeding Hibernation	Conduct pre-clearing surveys for bat maternal roosts if construction occurs within the breeding period. If maternity roosts are identified, maintain a buffer of at least 50 to 125 m radius around the roost.	

Methods

1. Site land cover types should be pre-stratified (for example: level mine rock storage facilities, sloped mine rock storage facilities, and tailings) and sample sites should be pre-selected to avoid bias. Additional samples should be collected in areas where the known mineralization is a concern.

2. Take vegetation metal uptake samples at baseline sites that have not been disturbed to monitor trends over time.

3. Establish monitoring locations farther from the mine site that have less potential to be affected by mining activities. Comparisons between data collected on site and data collected at these locations can be made to assess mine influence.

4. At all sites, take composite samples (to mimic animal browsing), as well as species specific samples as available. Based on the availability of baseline data, and species that are in reclamation seed mix or are commonly occurring, recommended desirable species are:

- Milk vetch (*Astragalus*) – legume;
- Grasses – deer forage;
- Dandelion (Malizia et al. 2012);
- Alfalfa or Clover – cattle forage and legume.

5. Continue to monitor vegetation metal uptake at established locations (reclamation, baseline, and control sites) every five years. Ensure enough sample are taken that statistically significant conclusions can be made.

6. Complete foliar analysis of foliage (summer) and stems (winter) of deciduous trees, and coniferous trees (October to December). Recommended species are:

- Willows;
- Saskatoon;
- Pine (this will provide information on soil nutrient deficiencies).

Samples will be collected in paper bags using scissors, with approximately a handful of fresh foliar material as the sample size. The samples will be kept cool before being shipped to an approved laboratory for analysis (BC Environmental Laboratory Manual 2013).

Data analysis used the student's t-test to assess if differences between the individual species samples and baseline individual samples were statistically different (using a 95% confidence interval).

11.27.3.4 Rare Plants

Impacts to rare plant and lichen populations will be minimized through the following actions:

- optimizing alternatives to ensure that rare plant and lichen populations are avoided, where feasible;

- applying adaptive Project design changes that avoid harm to rare plant and lichen populations, where feasible;
- adherence to best management practices for rare plants (buffer known occurrences to avoid disturbance and minimize effects related to dust and weeds); and
- translocation of priority species that cannot be avoided.

Maslovat (2009) outlines approach to select species, design, complete and monitor potential translocations. Using baseline data on rare plant occurrence within the Region and available information on the habitat requirements of each plant, three rare plant taxa were identified as candidates for a translocation program. The selected species have known occurrences in areas where avoidance is not feasible and no other known occurrences in the RSA (Table 11.27-3).

Table 11.27-3. Potential Rare Plant Translocations

Species	Type	Habitat	Plan
Collema crispum	Ground lichen	Grassland	Translocate
Fulgensia bracteata	Ground lichen	Grassland	Translocate
Peltula euploca	Rock lichen	Rock Outcrop	Translocate
Stegonia latifolia var. *pilifera*	Rock moss	Rock Outcrop	Shift dam

11.27.3.5 Rare and Sensitive Ecosystems

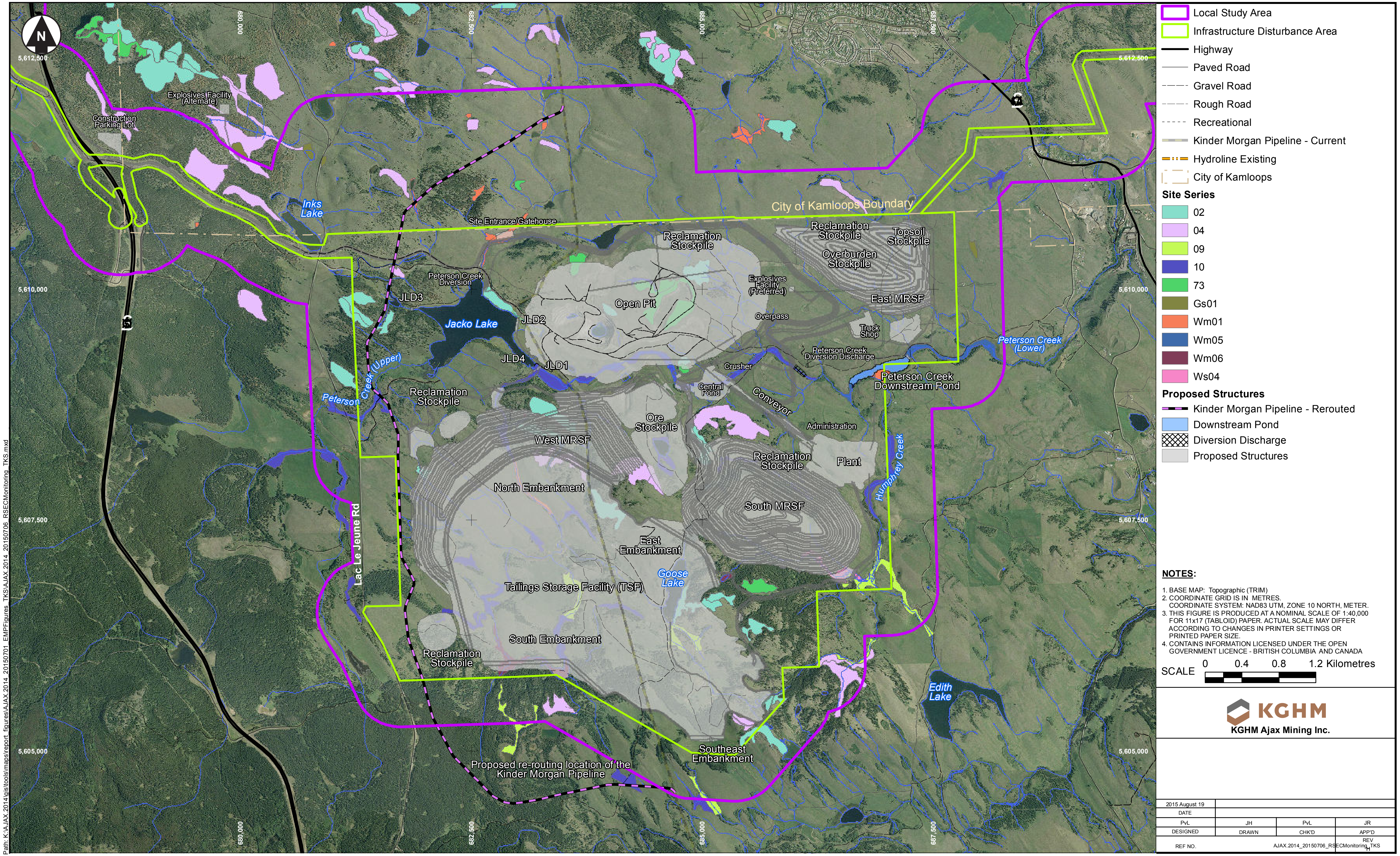
An ecosystem-based approach to vegetation and soil management is required to effectively avoid and minimize loss of ecosystem functions related to the potential Project-related effects. Ecosystems are complex interactions of abiotic (e.g., soil parent material, climate, snow duration, recent glacial history, natural disturbance) and biotic components (e.g., wildlife, nitrogen-fixing bacteria, mycorrhizae, disease, pollination, humans, competition) that result in unique species composition, structure, and functions. Minimizing effects to these ecological processes will reduce the likelihood of short- and long-term effects to ecosystem function and ecosystem integrity.

Those ecosystems with potential loss of greater than 50% of habitat (Table 11.27-4) were prioritized for monitoring to ensure the representation of ecosystems is maintained (Figure 11.27-1).

Table 11.27-4. Priority At-risk Forested Communities Mapped in the Local Study Area

Biogeoclimatic Subzone Variant	Site Series	At-risk Ecological Community	BC List	LSA (ha)	IDA (ha)	IF (ha)	Range of Loss
IDFxh2	02	Douglas-fir - ponderosa pine / Bluebunch wheatgrass	Red	70.7	56.5	31.7	45 - 80%
	04	Douglas-fir - ponderosa pine / Bluebunch wheatgrass - pinegrass	Blue	79.4	41.6	15	19 - 52%
	09	Western red cedar - Douglas-fir / Red-osier dogwood	Blue	24.4	16.4	8.2	34 - 67%
	10	Trembling aspen / Common snowberry / Kentucky bluegrass	Red	93.2	77.9	54.1	58 - 84%

Figure 11.27-1
Priority Ecosystems for Monitoring



Wetlands

Wetlands provide numerous functions including providing habitat for wildlife species including amphibians and waterfowl. Those wetlands with potential loss of greater than 50% of habitat were also prioritized for monitoring to ensure the representation of wetland habitats in the LSA (Table 11.27-5; Figure 11.27-2).

Table 11.27-5. Area of Wetlands Mapped in the Local Study Area

Biogeoclimatic Subzone Variant	Site Series	Wetland Community	BC List	LSA (ha)	IDA (ha)	IF (ha)	Range of Loss
BGxw1	Wm01	Beaked sedge - Water sedge		0.9	0.7	0.1	11 - 78%
	Wm05	Common Cattail marsh	Blue	8	5	3.4	43 - 63%
IDFxh2	Gs01	Alkali Saltgrass herbaceous meadow	Red	2.6	1.6	1.4	54 - 62%
	Wm01	Beaked sedge - Water sedge		7.4	4.7	3.6	49 - 64%
	Wm05	Common Cattail marsh	Blue	12.2	11.1	5.4	44 - 91%
	Wm06	Great bulrush marsh	Blue	10.9	9.6	8	73 - 88%
	Ws04	Drummond's willow - Beaked sedge		2.5	2.5	2.1	84 - 100%

Rock Outcrops

Rock outcrops may provide habitat for reptiles and bats. Those ecosystems with potential loss of greater than 50% of habitat were prioritized for monitoring to ensure the distribution of ecosystems (Table 11.27-6).

Table 11.27-6. Area of Rock Outcrops Mapped in the Local Study Area

Biogeoclimatic Subzone Variant	Site Series	Rock Outcrop Community	BC List	LSA (ha)	IDA (ha)	IF (ha)	Range of Loss
IDFxh2	73	Selaginella - Clad lichens		64.1	55.3	34.1	53 - 86%

Due to the limited amount of wetland and rock outcrops in the LSA monitoring may select suitable sites on KAM land outside of the LSA.

Priority sites will be visited to confirm the condition of the ecosystem and to confirm if the rare plant association is present (Figure 11.27-1). A Conservation Evaluation Form (http://www.env.gov.bc.ca/cdc/documents/Cons_Eval_Form_Aug09.pdf) will be completed to identify of threats and determine future monitoring.

11.27.3.6 Grasslands

Grassland ecosystems with a potential loss of greater than 50% were prioritized for monitoring to ensure representative grassland habitats are maintained (Table 11.27-7; Figure 11.27-3).

Table 11.27-7. Area of Grasslands Mapped in the Local Study Area

Biogeoclimatic Subzone Variant	Site Series	Grassland Community	BC List	LSA (ha)	IF (ha)	IDA (ha)	Range of Loss
IDFxh2	81	Rough fescue		445.3	183.7	294.3	41 - 66%
	82	Bluebunch wheatgrass - Sandberg's bluegrass		845.0	256.4	446.2	30 - 53%
		Bluebunch wheatgrass - Junegrass	Blue				
	83	Rough fescue - Bluebunch wheatgrass	Red	1,494.5	561.4	986.1	38 - 66%

11.27.3.7 Amphibians

Limit vegetation clearing and avoid road construction in identified amphibian breeding and upland areas, where feasible. If construction is required adjacent to any identified amphibian breeding and upland areas, implement appropriate barriers and set-back buffers around the sites in accordance with management of Important Wildlife Areas protection measures (Sarell 2004).

Implement amphibian salvage and relocation procedures as required.

Vegetation clearing activities will be avoided in areas adjacent to high-quality amphibian breeding habitat from May through October, unless pre-clearing surveys are conducted. Where avoidance is not possible, and in accordance with best management practices for amphibians (BC MFLNRO 2014), pre-clearing surveys will be conducted and a buffer zone of at least 30 m will be established between construction activities and identified breeding habitat (see Figure 11.27-2).

The following mitigation measures will be implemented to minimize potential effects on amphibians:

- identify and avoid sensitive habitat, such as wetlands and breeding ponds adjacent to work sites;
- minimize standing water in roadside ditches of access roads and monitor ditches for use as breeding sites for amphibians;
- report amphibian observations and incidents, including mass movements near access roads; and
- survey wetlands and ponds and monitor for amphibian breeding prior to construction activity.

During the Construction phase, Standard Operating Procedures (SOPs) will include procedural guidance in the event that amphibian breeding or mass dispersal is identified. This may include guidance on buffer distances from identified breeding sites, and salvage or relocation requirements and techniques in the event work must be undertaken at breeding sites.

If amphibians are observed within the Project footprint, salvaging may occur at discrete times corresponding to each incremental increase in the footprint during operation. Adult amphibians will be moved to the closest unaffected suitable wetland in order to augment the breeding population in that wetland.

Figure 11.27-2
Wetlands and Amphibian Habitat

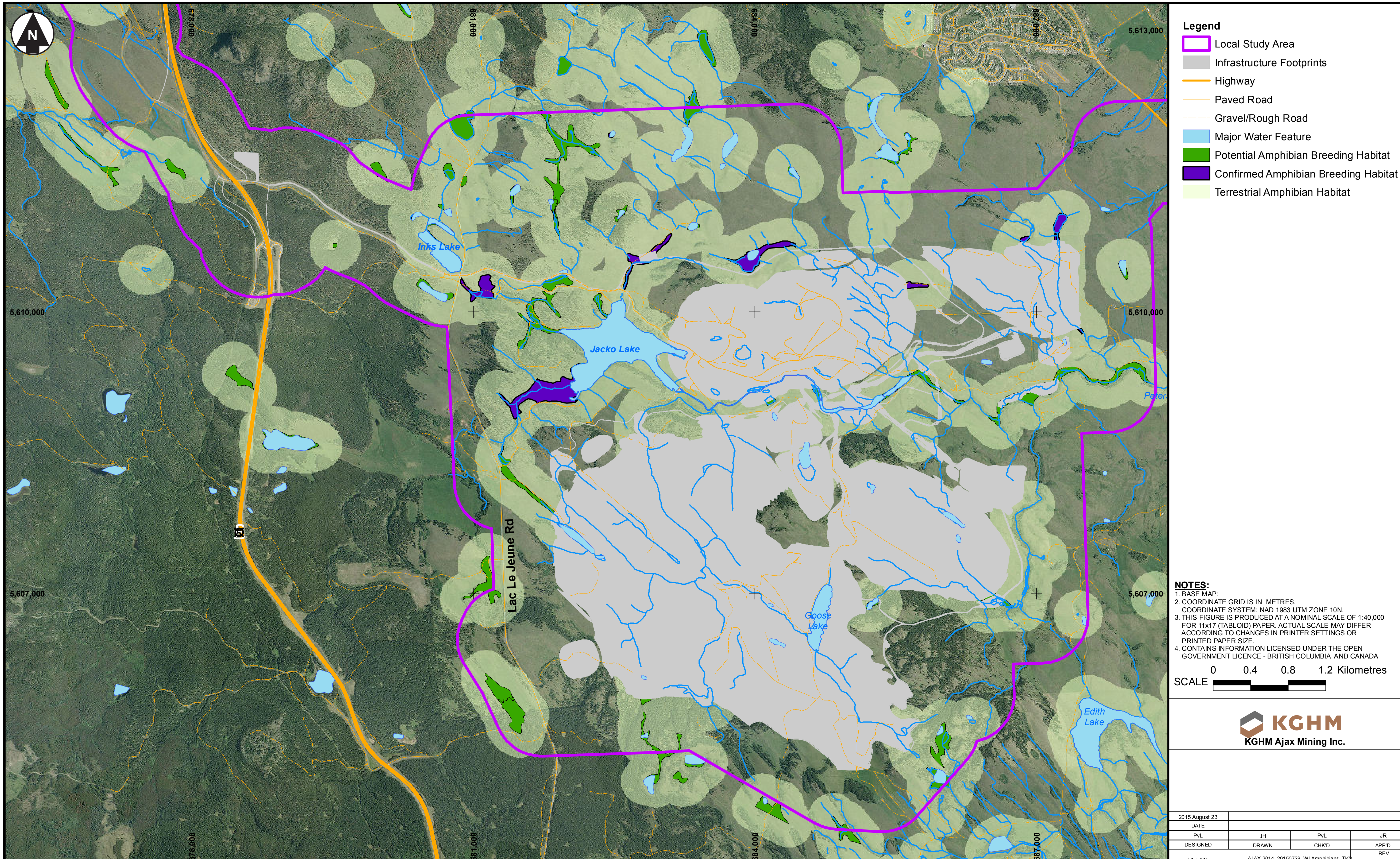
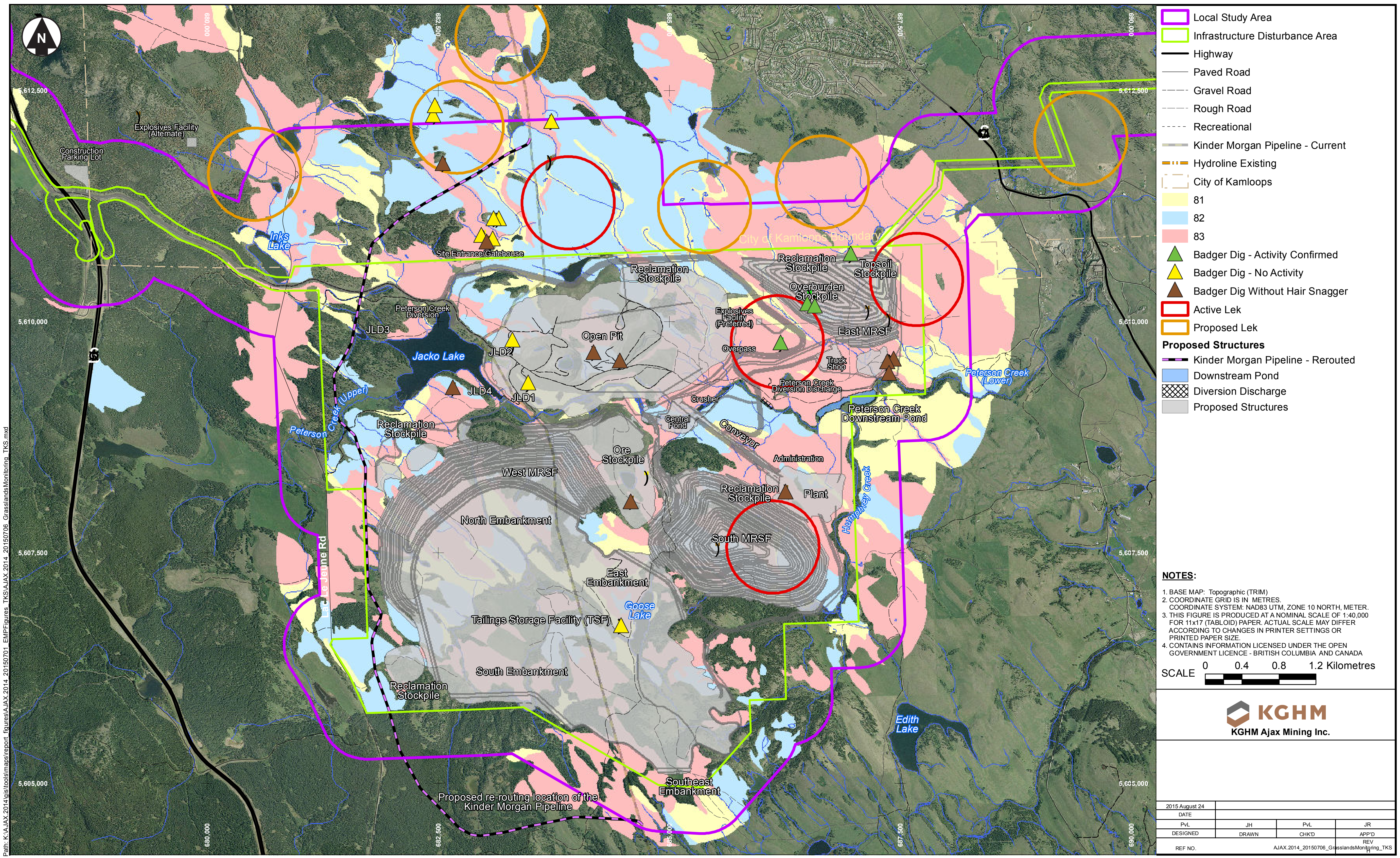


Figure 11.27-3
Grasslands, Sharp-tailed Grouse Leks and Badger Burrows



11.27.3.8 Reptiles

Preserve, restore, or incorporate a diversity of habitat features such as coarse woody debris, rocky outcrops, talus, and areas used for burrowing. Construction of up to five artificial snake dens will be completed to replace potentially lost hibernacula due to Project construction. Dens will be monitored every 3 years for up to 15 years into Operation.

11.27.3.9 Migratory Birds

Active bird nests will not be disturbed or destroyed during site clearing for infrastructure. Vegetation clearing activities will be scheduled outside of the general breeding period for waterbirds and landbirds (May 1 to July 31) to avoid contravention of Section 34 of the *Wildlife Act* (1996l), where practical. If clearing must be completed during the breeding period, pre-clearing surveys will be conducted to identify locations of active nests and disturbance-free buffers applied until the nest is inactive.

The *Migratory Birds Convention Act* (1994) protects migratory birds, their nests and their eggs from possession, molestation or destruction, protecting the nests of migratory birds while they or their eggs are in the nest. To ensure compliance with the *Migratory Birds Convention Act*, active migratory bird nests will not be disturbed or destroyed during site clearing for infrastructure. Vegetation clearing activities will be scheduled outside of the general breeding bird period (early May to mid-August), unless pre-clearing surveys for nests are conducted. If active nests are observed, these sites will be adaptively managed (e.g., buffer zones or contact the appropriate government agency if the nests should be moved).

If clearing is to take place outside of the least-risk window or inside the General Nesting Period a nest and lek search protocol will be developed in consultation with Canadian Wildlife Service and BC MFLNRO. The protocol will outline survey procedures that will be used to determine the presence of active nests and buffers required around active nests. Trees would be removed once nests are confirmed unoccupied.

11.27.3.10 Raptors

The BC *Wildlife Act* (1996) protects raptors, their eggs and active nests from possession, molestation or destruction, and protects the nests of eagles, Ospreys, falcons and raptors year-round. Work will be conducted in compliance with the *Wildlife Act*. If raptor nests are encountered, species-specific buffers will be established around the nest following recommended best BMPs (BC MFLNRO 2013), or the appropriate regulators will be consulted regarding potential relocation of nests.

<u>Monitoring of Active Nests during Blasting</u>

Active nests will be monitored until the young have fledged (anticipated to be mid-July or earlier in most instances) or the nest has failed, at which time the buffer will be lifted. If nests are identified adjacent to the right-of-way after ground clearing activities have commenced in an area, KAM will attempt to limit extensive disturbance in the area, but will assume that because the birds initiated nesting after construction began in an area that the nesting individuals are acclimated to construction-related noise and disturbance and, therefore, additional protections will not be implemented.

11.27.3.11 Non-migratory Game Birds

Sharp-tailed Grouse Lek

Artificial lek sites will be created to mitigate for loss of lek sites during Construction and disturbance during Operation. These sites will be on gentle hummocks raised slightly above the surrounding land surface and seeded with bunchgrass (see Appendix 11.26-A; Aspen Park Consulting 2013). These sites should also have dense grass cover for nesting and riparian areas nearby (Ritcey and Jury 2004). Lost leks will be replaced during reclamation. Male decoys, female decoys in the precopulatory position, and recorded grouse vocalizations may be used to induce grouse to attend replacement leks (Baydack 1986). Annual monitoring of known, artificial and replacement sharp-tailed grouse leks will follow RIC standards (1997) and be done in coordination with the BC MFLNRO.

Monitoring of disturbance effects for known remaining leks (Figure 11.27-3) within the LSA during the breeding season (April 1 to May 31) will be done during Construction.

11.27.3.12 Mammals

Badger

To avoid the potential mortality of American badgers, no grading would occur within 20 m of an active American badger burrow between April 1 and August 15 as determined by a qualified biologist. Construction activities between August 16 and March 31 would comply with the following measures to avoid mortality of adult and/or young badgers:

1. A qualified biologist would conduct a survey for American badger burrows within the project area between 2 and 4 weeks prior to the start of ground clearing or grading activity. The survey would cover the Project area, but would focus on the areas where suitable American badger habitat occurs. A fiber optic scope or other non-invasive means would be used to assess the presence of badgers within burrows that are too long to see to the end. Inactive burrows would be collapsed by hand with a shovel to prevent badgers from re-using them during Construction.
2. Prior to grading, badgers would be discouraged from using currently active dens by partially blocking the entrance of the burrow with sticks, debris and soil for 3 to 5 days. Access to the den would be incrementally blocked to a greater degree over this period. This would cause the badger to abandon the burrow site and move elsewhere. After badgers have stopped using active burrows within the project area, the burrows would be hand-excavated with a shovel and collapsed to prevent reuse. A qualified biologist would be present during the initial ground-disturbing activity. If badger burrows are found, all work would cease until the biologist can safely close the badger burrow. Once the badger burrows have been closed, work in the project area may resume.

Badger monitoring will continue through incidental observations and a DNA hair-snagging program (RISC 2007).

Bats

Active bat maternity roosts will not be disturbed or destroyed. Pre-clearing surveys will be conducted for bat maternity roosts if clearing is scheduled to occur between May and September (BC MWLAP 2004b). Surveys will only be conducted if there are known roosting sites in the area, as noted during the collection of baseline environment data, and will focus on suitable maternal roosting structures such as large diameter trees.

If active maternity roosts are identified that belong to the provincially blue-listed northern long-eared myotis or the federally listed little brown myotis, a buffer of at least a 125-m radius (BC MWLAP 2004c) will be maintained where possible, or BC MFLNRO (or the applicable agency) will be notified and alternative mitigation enacted. If the active maternity roost consists of other bat species (e.g., western long-eared myotis, silver-haired bat), a buffer or retention patch of at least a 50-m radius will be maintained where possible, or BC MFLNRO (or the applicable agency) will be notified and alternative mitigation enacted. The retention patch, if implemented, will include high-quality bat habitat (e.g., foraging habitat, corridor to foraging habitat, large diameter trees, cliffs/caves), if available nearby. In addition, blasting or construction will not occur within this buffer, unless there are no other options. If activities must occur within the buffer, the relevant regulating body will be consulted (e.g., BC MFLNRO) to develop appropriate mitigation strategies.

Install up to 10 bat roost and maternity boxes to provide roosting structures for tree roosting bats. Monitor boxes to determine use by bats through the first 10 years of Operation (RIC 1998).

11.27.4 Monitoring

In general, the monitoring will follow these principal guidelines with respect to population and habitat monitoring programs:

- on-site bird, mammal, and amphibian monitoring will be conducted annually and include recording of incidental observations, breeding evidence, mortality events and/or interactions with Project infrastructure;
- monitoring programs will include suitable treatment (i.e., close to the Project) and control sites (i.e., away from potential impacts due to the Project) that will be monitored using provincial Resources Information Standards Committee (RISC) methods, or other approved methods;
- data from monitoring programs will be analyzed using best practices and assessed for statistical power to detect changes in wildlife populations or habitat availability;
- the monitoring data, analyses, and power analyses will be reported in a monitoring report; and
- adaptive management will be implemented if local-area effects are reported for a wildlife VC, or if the monitoring report shows a decline in the VC population near the Project (i.e., treatment area) compared to control areas.

11.27.4.1 Work Planning and Schedule

The management measures that will be implemented to minimize and avoid adverse effects on wildlife, wildlife habitat and ecosystem function will occur throughout the various Project phases. (Table 11.27-8).

Table 11.27-8. Frequency of Monitoring Activities for the Wildlife Effects Monitoring Program

Type of Monitoring Activity	Focal Species	Monitoring	Frequency
Site Monitoring	Ecosystems	Habitat disturbed/reclaimed	Annually
Site Monitoring	All wildlife	Incidental observations	Annually
Mortality	All wildlife	Incidents and mortality events	Annually
Rare Plants		Population monitoring	Annually*
Vegetation Metals Uptake			Every 2 years
Wetlands - Amphibians		Breeding evidence in or near infrastructure	
Reptiles	Snake dens		Every 3 years
Bird/Raptor Nests		Population monitoring	Annually
Sharp-tailed Grouse Monitoring Program	Sharp-tailed Grouse	Population monitoring	In conjunction with MFLNRO, annually
Bat boxes			First 10 years
Badger Monitoring Program	Badger	Population monitoring	Annually

** Monitoring frequency is annually or prior to disturbing new areas.*

A summary of the monitoring data collected under the WVMP will be included in an annual WVMP report to government officials, Aboriginal Groups and local stakeholders. The report will summarize wildlife conflicts and identify any adaptive management measures that were employed.

If population monitoring is required as a result of mortality rates, results will be presented in the years they are conducted. The total area of habitat lost (if any) and the area that was reclaimed and revegetated (if any), will be presented in the WVMP report for that year. The WVMP will include analyses of the results with comparisons to data collected from earlier years (i.e., baseline and previous monitoring years) and will include recommendations (if any) for changes to wildlife monitoring and management practices.

Reporting on the application of the WVMP will be the responsibility of the Environmental Manager.

11.27.5 Reporting

The Project's Mine Environmental Manager, or his/her delegate (i.e., appropriately trained personnel), will ultimately be responsible for the development, implementation, and monitoring of the WVMP. Senior and technical environmental staff, as well as consultants, may be employed throughout the Construction and Operations phases to supervise, direct, monitor, and implement the monitoring strategies.

Individual reports will be prepared by mine staff or specialized consultants on an as needed basis to address specific or general environmental protection measures taken in respect of certain indicator species identified within VCs in the effects assessment or in respect of wildlife species generally.

The results of the monitoring programs will be included in annual reclamation report. The monitoring report will include:

- summaries of areas disturbed by development activities;
- summaries of areas reclaimed;
- monitoring results and discussion;
- evaluation of the effectiveness of the WVMP; and
- assessment of the effectiveness of additional adaptive mitigation measures taken.

These annual reports will be used to track the success of the management plans put in place, as well as to guide future projects on how best to be managed.

11.28 Reclamation and Closure Plan

This Mine Closure Plan summarizes the salient parts of the Mine Closure and Reclamation Plan (MCRP) provided in Section 3.17 (Project Description) of the application. The Mine Closure and Reclamation Plan is based on the requirements of the BC Mines Act Reclamation Code. Mine closure planning is a vitally important component of mine planning and requires adaptive strategies to account for a changing environment. Experience gained from progressive closure and reclamation activities need to be integrated into the planning to ensure success. KAM anticipates decommissioning and closure activities over a five year period followed by monitoring and potential maintenance for five (5) years. The MCRP addresses the information requirements outlined in the Application Information Requirements (AIR) for the Project (BC EAO 2015).

To mitigate effects on SSN occupancy of the land, KAM will work with the SSN to document past, present, and future land uses in the areas surrounding the Project and in the larger traditional territory. This will aim to support SSN involvement in future land use planning for consideration in the Reclamation and Closure Plan.

11.28.1 Closure Objectives

The primary closure objective (Section 3.17.4) is to achieve long term physical and chemical stability of reclaimed areas and the surrounding landscape. End land use objectives include agricultural, wildlife habitat and recreational uses. Post-mining land will be returned to the ALR after temporary non-farm use is complete. Wildlife habitat objectives will be achieved by creating wildlife habitat features within the predominantly agricultural grassland landscape. Recreation objectives will be met by re-establishment of vegetation communities that support the agriculture and wildlife objectives and restore aesthetic values.

The MCRP describes closure objectives and activities for all the mining components (Section 3.17.7). All mining equipment will be decommissioned, salvaged where possible and removed from site. All buildings will be demolished and salvageable materials removed from site. Building rubble will be buried in place and the surface contoured and reclaimed or disposed of within the Open Pit. The long-term water level in the Open Pit is predicted to remain approximately 220 m below surface. Access for ungulates to the Open Pit will be prevented by constructing a rock barrier (berm) around the perimeter. Access to the pit lake for monitoring purposes will be required and controlled by a locked gate.

Closure of mine rock storage facilities (MRSFs) will include surface preparation (e.g. grading to a maximum 23° slope) and covering with overburden and topsoil prior to re-vegetation with a mix of agronomic and native species. The overburden cover will use compacted till to limit infiltration into the rock piles. The lower slopes of the MRSF will be progressively reclaimed during operations.

Water from the TSF will be transferred to the Open Pit at closure to facilitate dry closure and reclamation of the TSF. Water management ponds will be reconfigured to evaporation facilities post-closure. The Tailings Storage Facility (TSF) will be closed with a dry cover to retain and shed excess water to the environment.

11.28.2 Temporary Closure

The MCRP provides details of activities should there be a temporary closure of the mine (Section 3.17.8). The objective of care and maintenance activities is to ensure that the Project facilities are kept in a manner that is safe for humans, livestock, wildlife and the environment. Temporary closure activities include restricting access to the site, securing all explosives and hazardous materials and removing them from site and locking out mechanical, hydraulic and electrical systems as well as carrying out all permit conditions. A full time security service would be maintained throughout a temporary closure and KAM would maintain a regular presence to inspect and monitor mine infrastructure and the environment.

11.28.2.1 Temporary Closure Monitoring and Decision to Close

Environmental monitoring as prescribed in applicable approvals (e.g., surface water quality) will be continued to ensure that regulatory requirements are being met. Additional reclamation activities will not be undertaken during temporary closure but would be limited to the monitoring and maintenance of reclaimed areas. Water management systems would be maintained to prevent contact water releases. The ‘care-and-maintenance’ status would remain in effect until KAM decides to continue mining or to permanently close the mine. If temporary closure continues for longer than one year, permit amendments will be required that identify hazards and their management (e.g., decant from TSF to Open Pit). With a decision to close the mine, decommissioning and closure as per the latest MCRP will come into effect.

11.28.3 Closure Monitoring

Frequent monitoring is anticipated during the decommissioning and closure phase as reclamation proceeds (Section 3.17.9). Geotechnical, water quality and quantity, aquatic effects and re-vegetation monitoring will be conducted and reported annually to regulators together with reclamation and maintenance activities (Table 11.28-1). Monitoring frequency will increase in the event of emergency situations during closure and reclamation activities at the discretion of the Chief Inspector. The frequency of monitoring is expected to reduce after the Decommissioning and Closure phase; however this will depend on the monitoring result and whether permit conditions are achieved. Applications to reduce the monitoring frequency and locations will be made when results indicate permit conditions have been achieved.

Table 11.28-1. Closure Plan Reporting

Report Type	Report Frequency	Report Submitted to	
		Provincial Regulatory Agency	Federal Regulatory Agency
Mine Closure and Reclamation Plan	5 years	BC Ministry of Energy and Mines	
Annual Monitoring and Reclamation Report	Annually	BC Ministry of Energy and Mines	

Preliminary mine closure cost estimates have been provided in the MCRP (Section 3.17.10). The costs include decommissioning and demolition of site infrastructure including all equipment, buildings, pipelines and utilities; reclamation and monitoring/indirect costs.

The MCRP will be revised every 5 years to coincide with the mine plan renewals (Table 11.28-1). The plan will provide more detail as it takes site conditions and monitoring results into account. Closure cost estimates will be revised annually and submitted to government agencies to reflect completed closure expenditures and outstanding liabilities.

11.29 SOCIO-ECONOMIC MONITORING PLAN

The Economic, Social, and Health valued components evaluated in the Environmental Assessment were assessed to determine effects on the Local Study Area (LSA) and the Regional Study Area (RSA). Table 11.29-1 provides a summary of potential effects and suggested monitoring activities for Labour Force Employment and Training, Income, Business, Property Values, Infrastructure and Public Facilities and Services, Land and Resource Use, Outdoor Recreation, and Community Health and Well-being.

The monitoring activities provided below have been drawn from the mitigations suggested in the listed sections for which there is a potential residual adverse effect.

Table 11.29-1. Overview of Social and Economic Monitoring Issues

Valued Component	Issue/Rationale	Applicable Timeline	Monitoring Frequency
Labour Force, Employment and Training	• To determine the overall employment outcomes of Project Construction, with emphasis on monitoring local and non-local employment as well as Aboriginal participation in employment.	• Construction Phase	• Quarterly • Interviews/focus groups in Year 2
Income	• To monitor and determine the levels of employment income generated by Project Construction.	• Construction Phase	• Quarterly
Business	• To monitor and track business outcomes related to procurement and contracting during Project Construction, with a particular focus on Aboriginal business participation.	• Construction Phase	• Quarterly • Interviews/focus groups in Year 2
Property Values	• To monitor mitigation measures and outcomes related to the Project's environmental effects that could potentially influence Property Value change, including implementation of Project design and best management practices for air quality, noise and vibration, visual impacts and aesthetic features, adaptive management. • To monitor the dissemination of monitoring results through engagement and information sharing mechanisms such as the Community Liaison Group (CLG).	• Construction and Operation Phases	• Semi-annual meetings
Infrastructure, Public Facilities, and Services	• To monitor use of rental accommodations (including hotel/motel, apartment, etc.) by KAM employees and contractor workers, and changes in vacancy rates, during Construction. • To determine any Project-related effects on infrastructure and/or provision of services (e.g. health, social, policing services) in Kamloops and the Thompson-Nicola Regional District (TNRD).	• Construction Phase	• Quarterly • Interviews/focus groups in Year 2

Valued Component	Issue/Rationale	Applicable Timeline	Monitoring Frequency
Land and Resource Use, and Outdoor Recreation	• To monitor mitigation measures and outcomes related to the Project's environmental effects that could potentially influence Property Value change, including implementation of Project design and best management practices for air quality, noise and vibration, visual impacts and aesthetic features, adaptive management. • To monitor the dissemination of monitoring results through engagement and information sharing mechanisms such as the Community Liaison Group (CLG) and the angling/recreation working group. • To monitor changes in land use (including ranching) and success of proposed mitigation measures. • To determine any Project-related effects on the achievement of land use planning objectives.	• Construction and Operation Phases • Construction Phase	• Semi-annual meetings with CLG and angling/ recreation working group • Periodic interviews with land users • Annual meetings with City and TNRD
Community Health and Well-being	• To monitor changes in community health indicators through engagement with service providers.	• Construction Phase	• Interviews/focus groups in Year 2 • Additional details to be defined in consultation with CLG

In addition to the monitoring programs and stakeholder groups, KAM also expects to develop separate monitoring programs with Aboriginal Groups as described within Part C of the Application.

11.29.1 Purpose

The Socio-economic Monitoring Plan (SEMP) is part of an integrated and coordinated Environment Management System (EMS) that has been developed to facilitate an effective transition from planning and assessment to implementation of all aspects of the Project. The purpose of the SEMP is to:

- define the process, scope, methods, documentation, and application of the socio-economic monitoring for the Project; and
- define the Community Liaison Group (CLG) that will be established to review results of the Monitoring Program and recommend adaptive management strategies that may be required as a result of changing effects to these valued components as a result of the Project.

11.29.2 Performance Objectives

It is important to note that in the case of social and economic effects, there typically are not measureable benchmarks or thresholds for the Valued Components (VCs) of interest. In some cases, however, performance measures can be readily defined and tracked over time (e.g., employment data and traffic statistics).

The SEMP establishes a framework to track the socio-economic performance of the Project, and evaluate the effectiveness of enhancement and mitigation measures related to specific economic, social, and health VCs over time to:

- test predicted effects identified in the application;
- identify unanticipated effects related to the Construction and Operation phases of the Project;
- monitor the effectiveness of mitigation measures;
- determine if adaptive management is required; and
- confirm compliance with regulatory requirements, including terms and conditions of Project approvals.

The monitoring measures outlined in this plan have been developed through experiences on similar projects, comments and questions provided during Project consultation activities, and discussions held during the collection of baseline data and assessment process (e.g., interviews, workshops with the City of Kamloops and other stakeholder groups).

Results from these socio-economic monitoring activities are expected to be reviewed regularly by Project personnel, regulatory agencies and interested stakeholders.

11.29.3 Monitoring Plans

11.29.3.1 Related Monitoring Plans

Project monitoring and environmental management plans that complement the SEMP have already been identified as mitigation measures within various economic and social VCs and include:

- Air Quality Monitoring and Dust Control Plan (Section 11.6);
- Noise and Vibration Management Plan (Section 11.22);
- Dark Sky Management and Monitoring Plan (Section 11.19);
- Transportation Management Plan (Section 11.20);
- Access Management Plan (Section 11.21);
- Fisheries and Aquatic Life Monitoring Plan (Section 11.25); and
- Wildlife and Vegetation Monitoring Plan (Section 11.27).

11.29.3.2 Socio-economic Environment Valued Components

Economic monitoring activities will include monitoring of employment and training, business, and income outcomes associated with the Project, including benefits and potential adverse effects identified in Chapter 7. Social monitoring activities will include monitoring of changes associated with potential effects identified in Chapter 8 including infrastructure, public facilities and services; dark sky and visual and aesthetic concerns; land and resource use and outdoor recreation.

The socio-economic monitoring activities are expected to be more extensive during Construction of the Project, but will also continue during the Operation phase. The following monitoring activities have been identified to address issues identified in Table 11.29-1.

Employment, Training, Income and Business

The following information will be tracked and reported on a quarterly basis using data from accounting, procurement, and human resources systems:

- Direct and contractor hiring processes and employment outcomes, including:
  - the duration, amount (e.g., FTE) and type (e.g., job classification) of positions;
  - applicants who self-identify as Aboriginal;
  - hires who self-identify as Aboriginal, including position details (duration, FTE, job classification) and wage rates, and ratio of Aboriginal applicants to hires;
  - applicants by community of residence;
  - hires by community of residence, including position details (duration, FTE, job classification) and wage rates, and ratio of local/regional applicants to hires;
  - number of hires by FTE and job classification (total, Aboriginal, and local/regional); and
  - value of paid wages (total, Aboriginal, and local/regional).
- Expenditures on procurement of goods and services, including:
  - records of procurement opportunities by category;
  - bids from Aboriginal, local and regional businesses;
  - contracts allocated by category, value, and Aboriginal and local/regional status.

In addition, KAM will engage with community and business representatives (e.g., employment centres, chambers of commerce, Aboriginal employment and business agencies) to determine the success of, or challenges to, efforts to support local and Aboriginal employment and procurement. The following activities will be conducted at the start of Year 2 of the Construction Phase:

- Conduct interviews and/or focus groups with local and Aboriginal employment and business organizations and services providers, as well as hiring and procurement decision-makers within KAM and the construction contractor. Discussions will focus on monitoring employment and business outcomes, identifying challenges to local/Aboriginal hiring and business participation, and—if necessary—identifying additional measure that may support the participation of local/Aboriginal workers and businesses.

Land Use, Outdoor Recreation, and Property Values

Potential effects on—and concerns about—land use, outdoor recreation, and property values are largely related to environmental changes that could occur as a result of the Project, including changes in air quality, noise and vibration, visual quality, water quality, fish, wildlife, and vegetation. Therefore, KAM will undertake the following monitoring activities throughout Construction and Operation phases:

- review environmental monitoring results for changes that could impact land and resource use, outdoor recreation, or property values;
- monitor use of Jacko Lake by anglers and other recreational users;
- share and discuss monitoring results and reports with the Community Liaison Group (described in Section 11.29.4 below), the angling/recreation working group, and other interested parties on a semi-annual basis; and
- implement a land use interview program (at the start of Year 2 of Construction, and in Years 1 and 2 of Operation, and as needed thereafter) involving anglers, other recreational users, and ranchers to review effectiveness of mitigation measures (including environmental and access mitigation and management).

KAM will also maintain dialogue with the City of Kamloops and TNRD regarding the effects of the Project and potential challenges that may arise in regard to the municipal and regional planning objectives, and monitor changes and actions that may need to be taken to address these challenges. KAM will meet with the City and TNRD at least annually during the Construction Phase, and as needed during the Operation Phase.

Infrastructure, Housing, Community Services, and Community Health

The presence of non-local construction workers during the Construction Phase is one of the primary drivers of potential effects on infrastructure (including housing and accommodation) and community services. KAM is committed to working with construction contractors and relevant stakeholders (including the City, social service providers, business community, and other organizations) to identify needs and suitable options for workforce accommodation, and will develop a Construction Phase Workforce Accommodation Plan in consultation with these parties. The Infrastructure, Public Facilities, and Services VC identified potential effects related to increased demand for rental accommodations (including hotels/motels, and apartments) during the Construction Phase, including potential constraints on tourism and challenges for vulnerable households to find and retain accommodation. As such, KAM will monitor the following on a quarterly basis during the Construction Phase:

- number of non-local workers (including KAM employees and contractor workers);
- use of rental accommodations (including hotel/motel, apartment, etc.) by KAM employees and contractor workers;
- changes in vacancy rates of hotel/motels and rental homes/apartments (using data from municipality, Tourism Kamloops, etc.) and possible correlation with Project-related use of accommodations; and
- changes in housing access for vulnerable households, including use of shelters and other supportive services, as reported through engagement with social service providers including interviews and/or focus groups be conducted at the start of Year 2 of the Construction Phase.

Other potential effects identified in related to potential pressures on community services, including policing and health services. In this regard, the following will be monitored on a quarterly basis during the Construction Phase through engagement with service providers (e.g., RCMP, Interior Health, Royal Inland Hospital) including qualitative feedback as well as any statistics that may be collected by these agencies:

- changes in number of calls to the RCMP, demand for police services, and the nature of incidents requiring police attention;
- changes in use of emergency room services at RIH and other health services;
- changes in number of physicians and medical specialists available in Kamloops; and
- changes in community health indicators that may be associated with the Project workforce or traffic, as indicated through publicly available health data, or data provided by service providers, related to incidence of sexually transmitted infections, communicable disease, alcohol and drug related health issues, and traffic collisions.

As for other Construction Phase impacts, interviews with service providers will be conducted at the start of Year 2 of the Construction Phase in order to identify and address issues promptly. Specific indicators and monitoring mechanisms will be developed in consultation with the Community Liaison Group, and will consider the availability of data collected by various service providers in the community.

11.29.4 Community Liaison Group

11.29.4.1 Overview

The Community Liaison Group (CLG) will provide the mechanism for communication and engagement activities between KAM, regulators, the general public, service providers and other stakeholder groups related to monitoring activities, monitoring results, and addressing community concerns throughout the Construction and Operation phases. This is particularly relevant given the volume of anticipated monitoring information that will be available from a variety of disciplines. Furthermore, KAM appreciates that the proximity of the Project relative to the City of Kamloops has led many community members and stakeholders to be interested in the Project; it is expected that many within the community will want to participate in the review of a wide range of ongoing monitoring results. The CLG will also provide a forum for participants to raise questions and concerns directly to KAM, and for KAM to provide information back to the community.

Project monitoring is expected to occur for a diverse range of topics, many of which require specialized knowledge. The CLG is intended to be the entity that facilitates the sharing and discussion of this information.

The purpose of the CLG will be refined through a consultation process with key stakeholders (e.g., municipal, regional and provincial regulators and specific interest groups), with the objective of finalizing a terms of reference for the CLG before Project construction begins. Topics that could be included in the terms of reference include the following:

- membership composition;
- frequency of meeting;

- roles and accountabilities of members;
- honoraria; and
- expectations regarding CLG activities and SEMP monitoring activities.

11.29.4.2 Stakeholder Participation

The CLG will be composed of local stakeholders, including representatives from municipal, regional and provincial governments, KAM, and relevant local stakeholders. The terms of reference for this group will include details around their involvement in monitoring and provision of input to potential adaptive measures.

Table 11.29-2 provides a preliminary list of groups and organizations that may be included in the CLG, along with their expected interest in the Project. To keep the CLG membership as streamlined and effective as possible, it is assumed that some stakeholders would be core members who will attend all meetings, while other stakeholders would be occasional members who likely attend meetings when topics of interest are included in the agenda. The list of special interest groups is not exhaustive as it focuses primarily on those parties expected to participate in monitoring advisory groups related to the economic, social, and selected health VCs. Other groups will be identified and included as KAM completes planning for the CLG.

Table 11.29-2. Stakeholders for Potential Inclusion in the Community Liaison Group

Stakeholder	Interest in Project
KAM	Project Proponent
First Nations and Aboriginal Groups	Project First Nations (i.e., SSN) and other Aboriginal Groups
City of Kamloops	City located closest to Project with a variety of interests in Project progress.
Thompson-Nicola Regional District	The Project falls within the jurisdiction of the TNRD, which will have a variety of interests in Project progress.
BC Ministry of Environment	Provincial permitting and regulatory authority. Will likely also have members on technical advisory committees.
BC Ministry of Energy and Mines	Provincial permitting and regulatory authority
BC Ministry of Forests, Lands, and Natural Resource Operations	Provincial permitting and regulatory authority
BC Ministry of Transportation and Infrastructure	Provincial permitting and regulatory authority
Health Canada	Provincial permitting and regulatory authority
Interior Health Authority	Health care service provider and likely interested in environmental monitoring (e.g., air quality) and socio-economic monitoring (e.g., infrastructure and services).
Recreational User Groups	Examples include Kamloops Trails Alliance and Kamloops Fish and Game Association. Likely interested primarily in Jacko Lake but also in any locations used to offset.
Landowners and Ranchers	Local landowners with interests in land use and water quantity, and ranchers who use the Project area.

11.29.4.3 Mechanisms for Communication and Engagement

The CLG will serve as an advisory group for KAM to share monitoring results, Project update information and to identify and address community concerns. Possible mechanisms for information sharing include the following:

- regular documented meetings to receive monitoring study reports and discuss issues and concerns related to Ajax project activities;
- an annual open house for the general public to share monitoring results and provide opportunity for feedback and discussion;
- regularly updated website that contains monitoring results, Project progress, and a section detailing how KAM is responding to community concerns. The website would also have a form/mechanism to allow individuals to share questions and concerns; and
- a direct contact line with KAM so that immediate questions and concerns can be communicated.

Each of the topics above would be considered in meetings of the CLG. Specific research activities would also be developed through the committee setting, as well as adaptive management strategies where effects require.

The CLG meeting schedule is expected to be quarterly with each meeting focusing on different areas of the Project monitoring efforts depending on the timing and availability of reports and the interests of participants. Table 11.29-3 outlines possible topics that could be the focus of each quarterly meeting based on the interests of stakeholder groups. It is provided here to illustrate how regular meetings are intended to share Project and monitoring information and coincide with stakeholder interests.

Table 11.29-3. Example of Meeting and Topic List for the Community Liaison Group

	CLG Meeting and Topic			
Stakeholder Group	Winter	Spring	Summer	Fall
Regulators (BC/Canada)				Annual Monitoring Reports
Recreational Groups	Fish and Aquatics, Recreation			
Aboriginal Groups		Harvesting interests		Harvesting interests
Kamloops/TNRD	Workforce, Public Services, Housing, Traffic	Workforce, Public Services, Housing, Traffic	Workforce, Public Services, Housing, Traffic	Workforce, Public Services, Housing, Traffic
Ranchers and Landowners	Field Use, Ranching issues including water use and availability			

11.29.5 Methodology and Schedule

The socio-economic monitoring program will employ a variety of methods to collect and review information including:

- review of project monitoring reports;
- collection of KAM information relevant to specific monitoring objectives (i.e., expenditures, employment);
- direct interaction with interested stakeholders (regular meetings and interactions with the City of Kamloops and the TNRD); and
- key person interviews where required with individuals or entities that have specific experience (contractors, service providers, KAM staff).

A key tool identified for the social and economic mitigation and monitoring of the Project will be the development and interactions with the Community Liaison Group (CLG) which will define the proposed schedule for review of monitoring results with Regulators and Stakeholders. More information about this is described in Section 11.29.4.

11.29.6 Reporting

Reporting associated with SEMP activities will be submitted on an annual basis to the regulatory agencies and shared with interested stakeholders though the Project website or open house. It will include discussion regarding:

- the effectiveness of the SEMP;
- data collection and record keeping related to monitoring data and analyses (e.g., an overview of the monitoring/research work undertaken during the time period of interest);
- monitoring plan results and interpretation;
- the effectiveness of additional mitigation measures taken to eliminate or reduce impacts unforeseen during the EA;
- potential effects that mitigation measures have failed to eliminate or reduce, or circumstances in which effects could not be avoided;
- any emerging negative environmental trends likely attributable to the Project identified by monitoring;
- proposed revisions to the SEMP to address emerging negative trends, or to adjust monitoring programs, if required; and
- accuracy of the conclusions of the EA.

11.30 COMPLIANCE REPORTING

11.30.1 Introduction

KAM will initiate a program of monitoring and compliance reporting to support the environmental assessment for the Project which will be carried out over the life of mine. Activities undertaken by KAM will be subject to various types of reporting that will address general legal requirements as prescribed under various statutes, and will also include more specific compliance reporting required under provincial and federal authorizations. This program will include the follow-up program used to support the federal EA Decision Statement.

The reporting responsibilities for the Project will be managed as an integral component of KAM's Environmental Management System (EMS) as described in Chapter 11. An EMS typically reflects the organizational structure that supports environmental management and in this case, KAM's Environmental Policy (KGHM 2012) provides the point of departure. The reporting responsibilities will be managed by KAM personnel specifically assigned the respective tasks, including oversight of contractors' reporting duties.

KAM will appoint an Environmental Manager who will ensure an effective EMS is developed, implemented, and maintained through planning, oversight, monitoring, awareness training, and reporting. The Environmental Manager will be supported by dedicated KAM Environmental Engineers and Environmental Technicians assigned to defined tasks as required. The Environmental Manager will provide line-function accountability to KAM's executive management and staff-function accountability to the Mine Manager, to whom compliance reports will be submitted. The Environmental Manager and his/her support personnel will work in collaboration with the Project's health and safety personnel, in the interests of integration and functional efficiency.

The Mine Manager will carry line-function accountability for the Project's environmental performance, with the support and advice of the Environmental Manager, which will include planning, oversight, monitoring and reporting. Environmental management tasks will typically comprise undertaking regular inspections, recording and reporting on inspection findings, initiating corrective actions for non-compliance, and maintaining an acceptable level of training and awareness among personnel.

The Environmental Manager will have the authority to suspend specific activities where non-compliance or infractions are occurring, until such time as the non-compliance or infraction is satisfactorily rectified. The importance of incident reporting of non-compliance or infraction is thus clear, contingent upon permit requirements, regulations and commitments being properly understood at the workplace level and managed accordingly for the Construction, Operation, Closure, and Post-closure phases of the Project.

The Project's Environmental Manager will be supported by KAM personnel assigned to defined tasks as required. In this way, a system of support and monitoring of environmental performance as carried out at the workplace can be provided. Contractors appointed to undertake aspects of the Project will also be required to meet prescribed environmental performance standards and to this end will be expected to provide their personnel with defined environmental responsibilities.

11.30.2 Authorizations and Compliance Reporting

The Application/EIS process currently underway is in pursuit of the statutory authorizations required for the Project to proceed, in accordance with both federal and provincial regulatory obligations. Applications will be submitted synchronously for the necessary authorizations and permits for particular Project components and activities beginning during the EA review process, and once obtained will maintain required permits for the life of the Project, complying with:

- the provisions of federal and provincial legislation and regulations; and
- the conditions of the Environmental Assessment Certificate, federal Decision Statement, permits, licences, and other authorizations and approvals.

To maintain compliance with permit conditions, KAM will undertake a reporting program that will be applied throughout the life of the mine. Compliance reporting will comprise the necessary reporting to address general legal requirements as well as the prescribed provincial and federal statutes. Voluntary reporting may be undertaken to supplement the statutory reporting and will be at the discretion of KAM.

Table 11.30-1 below presents expected reporting requirements for various authorizations, including applicable legislation, the phase of the Project when the reporting would be needed, the reporting frequency, as well as the responsible agency and particular regulatory instrument needing to be adhered to. This list will be updated as reporting requirements are identified and as the Project progresses, including responses to any changes in the authorizations or permitting conditions. The final suite of reporting requirements will be formulated based on permit conditions and in consultation with the responsible regulatory agencies.

11.30.3 Notifications

KAM will make the various reports and plans available to the relevant government agencies. The media and format in which the reports and plans will be provided, as well as the content and frequency of reporting will be defined by permit conditions or through discussion and mutual agreement by the appropriate parties.

11.30.4 Voluntary Reporting

KAM may undertake voluntary reporting in certain cases where the report has a clear purpose and is properly defined. An example would be participation in information gathering specific to a particular subject area that would contribute to Provincial databases, such as BC's Invasive Alien Plant Program.

Table 11.30-1. Expected Statutory Reporting Requirements for the Project

Legislation	Responsible Agency	Permit/ Authorization/ Program	Project Phase	Reporting Frequency	Anticipated Compliance Reporting Requirements	Related Environmental Management Plan (if applicable))
BC Environmental Assessment Act (2002a)	BC EAO	EA Certificate	To be determined	To be determined	Submission of reports as required in the EA Certificate and Schedule B, Table of Conditions.	As listed in Schedule B of the EA Certificate.
Mines Act (1996i) With reference to: • Health, Safety and Reclamation Code for Mines in British Columbia (the Code; BC MEMPR 2008)	BC Ministry of Energy and Mines	*Mines Act* Permit;	Construction, Operations and Closure	Annually	By March 31 of each year, deliver to the Chief Inspector a report for the previous calendar year outlining workplace conditions as per Section 1.9.3 of the Code.	11.14: Emergency Response Plan. 11.10: Hazardous Waste Management Plan.
			Construction and Operations	One time report updated as needed	Establish a written program (as per Section 2.1.3 of the Code) to monitor workplace contaminants to ensure employees shall not be exposed to airborne concentrations of chemical agents or noise in excess of the levels specified in Section 2.1.1 of the Code, and retain a written record of monitoring results to transfer to the Chief Inspector upon abandonment of the mine.	11.10: Hazardous Waste Management Plan. 11.4: Construction Waste Management Plan. 11.9: Solid Waste Management Plan
			Construction and Operations	Immediately following an accident or dangerous occurrence	In the event of an accident or dangerous occurrence, notify the Chief Inspector and provide a report, as laid out in Section 1.7 of the Code.	11.14: Emergency Response Plan. 11.10: Hazardous Waste Management Plan. 11.16: Spill Contingency Plan. 11.12 Risk Management Plan
			Operations	One time report updated as needed	Develop and file with the Chief Inspector, a Mine Emergency Response Plan, which will be kept up to date as per Section 3.7.1 of the Code.	11.14: Emergency Response Plan. 11.12 Risk Management Plan
			Construction	One time report updated as needed	A Construction Management Plan will be developed and submitted prior to the start of construction, relevant to the planned construction activities.	11.2: Erosion and Sediment Control Plan 11.3: Soil Salvage and Handling plan
			Construction, Operations, Closure, Post Closure	Annual	As specified in Section 10.1.4(5) of the Code, submit an annual report of reclamation and environmental monitoring work performed under Section 10.1.4(4).	11.28 Reclamation and Closure Plan
			Closure	One time	Upon closure or declared closure of a major impoundment, submit a report to the Chief Inspector in accordance with Section 10.6.10 of the Code.	11.28 Reclamation and Closure Plan
			Construction	One time	Prior to operation of each applicable tailings or water management facility, submit an "as-built" report to the Chief Inspector certifying that the facility was designed and constructed according to Section 10.1.5 of the Code.	11.7 Water Management and Hydrometric Monitoring Plan.
			Construction, Operations	Quarterly reporting, summarized in an annual report	Results of the ML/ARD analytical testwork (including raw data, sample descriptions, QA/QC and deposition inventory) will be reported in the Annual Reclamation Report.	11.5: ML/ARD Management Plan.
			Construction, Operations, Closure	Annual	Monitoring results of water quality and quantity, including interpretation of the results and any implications for management, will be reported in the Annual Reclamation Report.	11.25: Fish and Aquatic Life Monitoring Plan. 11.23: Surface Water Quality Management Plan. 11.24 Groundwater Quality Management Plan
		Explosives Storage and Use Permit;	Pre-Operations	One time, updated as needed	An Explosive Management Plan will be submitted by the explosives contractor for review and approval prior to any blasting being conducted.	11.11: Explosives Management Plan

Legislation	Responsible Agency	Permit/ Authorization/ Program	Project Phase	Reporting Frequency	Anticipated Compliance Reporting Requirements	Related Environmental Management Plan (if applicable))
Environmental Management Act (2003a) Including reference to: • Waste Discharge Regulation (BC Reg. 320/2004; effluent and air permits); • Municipal Wastewater Regulation (BC Reg. 87/2012; sewage treatment plant registration); • Hazardous Wastes Regulation (BC Reg. 63/88; hazardous waste registration); • Petroleum Storage and Distribution Facilities Storm Water Regulation (BC Reg. 168/94; storage facilities registration); • Spill Reporting Regulation (BC Reg. 263/90; spill reporting)	BC Ministry of Environment	MA/EMA Authorization	Construction, Operations, Closure, Post Closure	Annual	Annual water quality report (combined report is submitted to MEM and MOE to meet the requirements of both agencies), aquatic effects monitoring, reporting of any reportable spills; hazardous waste registration updates as applicable; fuel storage reporting (include in annual report); and monthly dustfall report.	11.10 Hazardous Waste Management Plan. 11.16 Spill Contingency Plan 11.6: Air Quality Management Plan. 11.23 and 11.24: Water Quality Management Plans. 11.25: Fish and Aquatic Life Monitoring Plan.
		Liquid Effluent Discharge permit	Construction	One time, updated as needed	A Construction Management Plan will be developed, submitted for approval, and implemented.	11.2: Erosion and Sediment Control Plan 11.3: Soil Salvage and Handling plan
			Construction, Operations, Closure, Post Closure	Annual	Annual summary report which includes the previous calendar year sampling results.	11.25: Fish and Aquatic Life Monitoring Plan. 11.6: Air Quality and Dust Control Management Plan. 11.23: Surface Water Quality MMP 11.24: Ground Water Quality MMP
			Construction	One time, updated as needed	An erosion and sediment control plan will be developed, submitted for approval, and implemented.	11.2: Erosion and Sediment Control Plan
		Air Discharge Permit	Construction, Operations, Closure	TBD in permit conditions, Monthly dustfall reporting	The reporting of the results from the Project source testing, ambient air quality, dustfall and meteorology monitoring will occur according to the schedule determined in the BC EMA Air Discharge Permit.	11.6: Air Quality and Dust Control Management Plan
		Solid Waste Discharge permit	Construction, Operations, Closure	Annual	Annual report on Landfill operation; The permit obtained for an onsite industrial landfill often includes conditions on reporting of the status of the landfill, including annual quantity disposed of in the landfill and remaining space.	11.9: Solid waste management Plan 11.4: Construction Waste Management Plan
		Spill Reporting	Construction, Operations, Closure	Within 24 hours of a recordable spill	A Spill Report will be completed for all spills on the Project A Spill Report be submitted within 24 hours to the BC Provincial Emergency Program at 1-800-663-3456, if prescribed spill quantities are exceeded.	11.16: Spill Contingency Plan
Heritage Conservation Act (1996f)	BC Ministry of Forests, Lands and Natural Resource Operations	Inspection Permit Investigative Permit Site Alteration Permit	Pre-construction, Construction, Operations, Closure	TBD	Reporting to Archaeology Branch. The permit application will specify the delivery date of the report to the Archaeology Branch as well as Aboriginal groups who will require a copy of the report for reference	11.18: Archaeology Management Plan.
Drinking Water Protection Act (Drinking Water Protection Regulation)	Interior Health Authority	Waterworks Construction and Operations	Construction, Operations, Closure	Monthly	Monthly sampling of potable water; submission of results	11.23: Surface Water Quality MMP 11.24: Ground Water Quality MMP
Weed Control Act (1996k)	Ministry of Agriculture	Weed Control Regulation (BC Reg. 66/85)	Construction, Operations, Closure, Post-Closure		Inspection reports as required.	11.17: Invasive Plant Management Plan 11.27: Wildlife/Vegetation Monitoring Plan
BC Greenhouse Gas Reduction (Cap and Trade) Act (2008a)	BC Ministry of Environment	BC Reporting Regulation (BC Reg. 272/2009)		Annually (if emissions meets reporting criteria	For those calendar years that the proposed Project meets the GHG emissions mandatory reporting criteria (over 10,000 t CO_2e/year): prepare a GHG emissions report and submit by March 31 the following year. For emissions over 25,000 t CO_2e/year, emissions must first be verified by an independent and accredited third party before the report is submitted.	11.6: Air Quality Management Plan.

Legislation	Responsible Agency	Permit/ Authorization/ Program	Project Phase	Reporting Frequency	Anticipated Compliance Reporting Requirements	Related Environmental Management Plan (if applicable))
Canadian Environmental Protection Act (1999)	Environment Canada	National Pollutant Release Inventory (NPRI; Environment Canada 2013)	Construction, Operations, Closure, Post-Closure	Annually (if reporting criteria are met)	For those calendar years that the proposed Project meets the NPRI reporting requirements (as per the NPRI Notice published in the Canada Gazette): create, certify, and submit an NPRI inventory report by June 1 (or whichever deadline the Notice states) the following year.	Only if emissions from previous year warrant reporting.
		Greenhouse Gas (GHG) Emissions Reporting Program; Ozone-depleting Substances Regulations (SOR/99-7)	Construction, Operations, Closure, Post-Closure	Annually (if reporting criteria are met)	For those calendar years that the proposed Project meets the GHG emissions mandatory reporting criteria (over 50,000 t CO_2e/year) specified in the annual notice published in the Canada Gazette: prepare a GHG emissions report and submit by June 1 (or whichever deadline the Notice states) the following year.	11.6: Air Quality and Dust Control Management Plan.
		Environmental Emergency Regulations (SOR/2003-307); Spill Reporting Regulation (BC Reg. 263/90)			A report on the release of a substance listed in the regulations (SOR/2003-307), detailing the substance and the company's response to the release; (BC Reg. 263/90) specifically requires the preparation of a plan to deal with environmental emergencies.	11.14: Emergency Response Plan. 11.10: Hazardous Waste Management Plan. 11.16: Spill Contingency Plan. 11.12: Risk Management Plan
Fisheries Act (1985c)	Department of Fisheries and Oceans	Authorization under Paragraph 35(2)(b) of the *Fisheries Act* Regulations.	Construction, Operations, Closure, Post-Closure	Annual	Offsetting Plan requires monitoring and reporting as dictated in the Fisheries Authorization Starting one year after construction, the Proponent will commence a five year monitoring program to demonstrate the success of the constructed offsetting measures. Surveys will be conducted annually, and will be carried out by qualified professional biologists. If offsetting objectives have not been achieved by year three of the monitoring program, effectiveness monitoring will continue. By year five, if successful criteria still have not been achieved, a work plan will be developed and additional offsetting works will be undertaken and monitoring will continue until performance measures have been met.	Appendix 6.7-C: Offsetting Plan 11.25: Fish and Aquatic Life Monitoring Plan.
Canadian Environmental Assessment Act, 2012 (2012)	CEA Agency Environment Canada Natural Resources Canada	EA Decision Statement	TBD	TBD	Follow-up reporting if required, per Section 5 of CEAA 2012.	If required.

11.31 References

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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