



Magino Gold Project

MAGINO GOLD PROJECT

Finan Township, Algoma District, Ontario

ENVIRONMENTAL IMPACT STATEMENT

CHAPTER 8: ACCIDENTS, MALFUNCTIONS AND WORKER SAFETY

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8.0 ACCIDENTS AND MALFUNCTIONS AND WORKER SAFETY

8.1 Effects of Accidents and Malfunctions

8.1.1 Approach

The assessment of the environmental effects potentially resulting from accidents and malfunctions differs from the assessments completed for individual VCs. Fundamentally, this assessment is a risk based assessment that involves three steps:

1. Identification of hazards associated with the Project works and activities to be undertaken on-site or off-site. These potential hazards are identified based on past experience with mines similar to the Project and with similar types of works and activities in general;
2. Identification of potential environmental effects or the anticipated consequences of the identified hazards;
 - o Reviewing the “mitigation by design” measures that have been incorporated into the Project. These measures are the design and operational safeguards that are intended to avoid or reduce the likelihood of an accident or malfunction from occurring; and
 - o Describing the types of contingency and emergency response procedures that will need to be in place to anticipate and/or correct issues that may lead to accidents and malfunctions, or to respond to these in the unlikely event they occur.
3. Completion of a qualitative risk assessment aimed at providing some perspective on the hazards and consequences identified by rating the likelihood of the adverse environmental effects occurring. This rating represents the overall assessment of significance for the potential adverse environmental effects of accidents and malfunctions.

On the basis of experience of similar mining operations, in similar climatic conditions, accidents and malfunctions that are considered to have both a measurable environmental effect and a high probability of occurring during the life of the Project are considered. For these “credible” accidents and malfunction, the environmental effects identified represent a reasonable worst case outcome.

For the Magino Project, Prodigy will establish an Environmental Management Plan (EMP) that will include a comprehensive Emergency Response Plan (ERP) to address the full range of accidents and malfunctions.

8.1.2 Hazard Identification

Virtually all of the Project works and activities described in Chapter 6 have some potential to result in environmental effects, as well as personnel injuries to workers or members of the public. Prodigy’s methodology for hazard identification and risk evaluation is presented in TSD 20. Those hazards with the greatest potential to result in environmental effects are:

- **Structural Failures:** These include open pit slope failure, TMF embankment failure, MRMF slope failure, overburden stockpile(s) slope failure, water quality (WQ) control pond failure, and creek diversion failure;
- **Accidents:** These include an explosives accident, tailings pipeline failure, water pipeline failure, transportation accident (e.g., vehicle collisions) with fuel or reagent shipment, and chemical spills within containment facilities; and
- **Other Malfunctions:** These include unexpected water quality effects, and project related fires.

Table 8-1 summarizes these hazards in terms of the Project phases during which they are most likely to occur. A solid dot indicates that there is higher potential for environmental effects to occur, while a hollow dot indicates a lesser potential.

Table 8-1: Summary of Accidents and Malfunctions by Project Phase

Risk Category	Project Works or Activities	Project Phases During which Accidents and Malfunctions Could Occur				
		Site Preparation	Construction	Operations	Closure	Post-Closure
Structural Failure	Open Pit	-	-	○	●	○
	TMF Embankment	-	-	●	○	○
	MRMF	-	-	●	○	○
	Overburden Stockpiles	-	●	○	●	-
Accident	Explosives	-	○	●	-	-
	Tailings Pipeline	-	-	●	-	-
	Water Pipeline	-	-	●	○	-
	Fuel Transport, Transfer and Storage	○	○	●	○	-
	Reagent Transport	-	-	●	-	-
	Chemical Spill	-	-	●	-	-
Other	Unexpected Water Quality Effects	●	●	○	○	-
	Project related fires	●	●	○	○	-

Legend:



Greatest potential for adverse environmental effects.

Lesser potential for adverse environmental effects.

8.1.3 Emergency Response and Spill Prevention / Contingency (ERSPC) Plan

The ERSPC Plan is an integral part of Prodigy's Environmental Management System. The ERSPC is presented in TSD 20. The plan outlines procedures to deal with emergencies and spills.

8.1.4 Structural Failures

8.1.4.1 Open Pit Slope Failure

Two primary open pit slope failures are considered:

- Failure of the bedrock slopes caused by improper mine design and operational procedures (including groundwater controls); and
- Failure of overburden slopes.

The open pit will be excavated through overburden and into bedrock to an ultimate depth of approximately 430 m below ground surface. The side slopes will be benched to provide for slope stability and space for mine truck access ramps and roads. The geotechnical pre-feasibility pit slope design developed in 2016 and used in the Pre-feasibility Study (PFS) is used as the basis for the following analysis (JDS, 2016).

As described in Chapter 4, the main rock types within the southern portion of the Magino property where the open pit would be located are mafic metavolcanics of “good to excellent” quality. They have a Rock Quality Designation (RQD) of 80-90% and a rock mass rating (RMR_{76}) generally of 70 to 80 throughout the pit and are classified as “strong to very strong” in accordance with the International Society for Rock Mechanics. Therefore, any potential pit instabilities are likely to be structurally controlled (along major joints/discontinuities).

As part of the PFS studies, kinematic analyses were carried out for bench heights of 16 m and 20 m with bench widths of 8 m and 8.5 m. To be conservative, the bench face angle was limited to 76° and an inter-ramp slope angle which ranged from 41.6° to 56° was adopted for the pit design. The analysis assumed that pit slopes would be drained. Given these parameters, a minimum factor of safety of the open pit slope was established as the ratio between the rock strength that stabilizes the pit slope and the sum of the water pressure and gravitational forces that destabilize a slope. In this case, the factor of safety for overall pit slope was found to be 1.6 with drained slopes, which is considered indicative of a low risk of large scale failure.

During the mining process, the open pit slopes are continually inspected by mine staff and other professionals who can observe conditions on a day to day basis and can adjust the design of the pit wall to avoid unstable conditions. While the factor of safety of 1.6 is considered to be high for a mine pit, it does not account for any potentially destabilizing water pressures that may develop in the actual pit.

Measures (construction of slurry wall and interception wells) will be undertaken to minimize groundwater seepage from Goudreau Lake to the east and from Water Body 10 to the south (diversion channel).

With respect to the overburden, saturated overburden thickness in the vicinity of the pit ranges from 6 m to 20 m. Pit slope design angles (in overburden) have yet to be established but will likely range between 2H:1V to 3H:1V. Rock fill berms and buttresses may be used to allow overburden slopes to be steepened, taking into consideration the presence and effectiveness of groundwater controls.

Potential Effects

Improperly designed and operated open pits can pose a safety hazard to workers during construction and operation, and potentially affect the environment if the failure substantially enlarges the footprint of the open pit. Increased groundwater inflows into the pit due to pit slope failures and decreases in lake water levels are the main potential environmental concern since Goudreau Lake shoreline is located near the pit rim. Failure of overburden slopes, with associated slumping into the open pit, could cause the pit rim to expand and result in erosion damage along the rim.

The maximum effects due to pit slope failure are likely to occur during the pit closure period (i.e., just after mining is completed and the pit is allowed to start filling). This is because, groundwater inflow will occur along the lower portions of the pit walls and because operational monitoring of the pit slope will be less frequent, since the mining crew will no longer be operating in the pit. To a lesser extent, the effects could occur during the operations phase (post-active mining) and during the post-closure phase as the pit continues to fill as a lake.

Mitigation by Design and Operational Safeguards

Webb Lake and Lovell Lake are within the footprint of the pit and will be dewatered. Slope depressurization and engineering and groundwater management controls are anticipated for the development of the pit. These controls may include slurry cut-off walls, particularly between the pit and Goudreau Lake, and dewatering/depressurization. A diversion channel will be constructed north of Water Body 10 to intercept and divert flows from that area to Goudreau Lake.

To ensure worker safety and slope stability, the following design factors have been incorporated:

- Overall slopes (inter-ramp angles) bench heights, bench face angle and bench widths have been determined in accordance with recommended geotechnical and rock-slope stability evaluations, incorporating engineering controls;
- Ramp grades will be 10 % or less; and
- Catch and control berms and additional geotechnical berms may be provided should they be deemed necessary during the subsequent more detailed design phases of the Project.

Overburden slope angles will depend on thickness of overburden encountered in the field and the groundwater controls installed. Overburden slopes will be designed to minimize the potential for failure and related impact to the surrounding environment. Progressive rehabilitation will ensure that exposed overburden is revegetated as soon as practical to assist with slope stability.

Geotechnical monitoring of the stability of the pit wall will take place continuously during the excavation of the pit by licensed geotechnical engineers who will be responsible for evaluating the excavation and making changes if required. This monitoring will include survey points to detect any movement (up, down, or sideways) of the surface of the pit wall, and instruments called inclinometers installed deep into the rock, that measure any deformations that may occur in the deeper rock. Piezometers which are essentially wells that measure water pressure will also be installed to assist with slope monitoring.

Contingency and Emergency Response Procedures

Bedrock and overburden pit slope angles will be established using standard approaches and methodologies. Failing rocks will generally be captured by the safety berms. A failure of overburden is unlikely to affect pit activities but may require localized repair of surrounding surface infrastructure, depending on location and extents of such occurrence.

For the mine operating period specific emergency response procedures regarding how to respond to a pit slope failure, will be incorporated into the Emergency Response Plan. Prodigy will meet all statutory responsibilities regarding incident reporting.

8.1.4.2 Tailings Management Facility Embankment Failure

As described in Chapter 6, tailings will be transported from the processing plant to the TMF as slurry via a pipeline and deposited behind an embankment. Embankments will be constructed in stages. The initial TMF embankments will be constructed utilizing a combination of pit area overburden (glaciofluvial deposits consisting of sand, gravel, cobbles and boulders) and rock from initial pit excavation activities. Subsequent embankment phases will be constructed using mine rock from the open pit as the primary source of fill material. The conceptual design for the TMF is presented in the TSD 6.

Embankments will be constructed on a prepared bedrock foundation. Unsuitable overburden above the bedrock will be removed. Depending on localized topography and base slopes, some limited rock blasting may be required for “keying-in” of embankments for stability purposes. Overburden materials within embankment footprints will be either removed or used as supplemental construction material. The inside face of the embankment will be lined with a geomembrane making it impermeable to seepage, and an interior seepage collection/cut-off system will be installed. Seepage through the shallow bedrock will be intercepted by a seepage collection trench installed at the downstream of the final embankment.

The TMF embankment will be constructed in 2 to 3 stages during the mining phase of the Project. Each stage of the embankment will be constructed using the overburden and mine rock materials placed in layers and compacted to approved specifications. A spillway will be incorporated in the construction of each stage. The liner on the upstream face of the embankment will be underlain by sandy to gravelly layers of material to prevent puncturing.

The selected TMF alternative would encompass approximately 390 hectare (ha). Subject to final design considerations, at a proposed deck elevation of 480 masl, the maximum thickness of the stored tailings of up to 72 m (above its lowest point). Final overall downstream slopes of the TMF embankment would range between 2:1 to 3:1 (horizontal:vertical), depending on stability and other closure and post-closure grading considerations. Intermediate slopes may be as steep as 1.5:1 (H:V). Upstream slopes will be on the order of 2:1 (H:V).

The TMF embankment will be designed to meet the 100 year flood event and maximum credible earthquake design criteria. The design of the TMF will undergo extensive review to ensure compliance with the *Ontario Lakes and Rivers Improvement Act* and Canadian Dam Standards (Canadian Dam Association, 2013).

The TMF will be operated with tailings being discharged from along the crest of the constructed dam. This will force the water to pool to the eastern side where it will predominately abut natural

bedrock. A natural rock cut spillway will be provided for each stage of the embankment construction, thereby providing a safe exit for any excess water that may accumulate.

In addition to this robust design, the mine rock management area will extend from the north-east and south faces of the dam thus providing additional buttress for the embankment. It is expected that over 200 Mt of mine rock will be stockpiled in that area.

Potential Environmental Effects

Taking into consideration the basic design outlined above, a partial or complete breach of the TMF embankment is considered to be extremely unlikely in the case of the Magino Project. Such a breach would result in a release of tailings solids and stored water into the environment immediately downgradient of the TMF.

Uncontained discharge of tailings slurry would inundate and cover terrestrial and aquatic habitat, thereby damaging or destroying plants and resulting in serious harm to fish and fish habitat. Water quality in the streams and lakes downstream would be degraded. These direct effects would have indirect consequences for the users of these resources.

Due to the underlying topography at the proposed TMF site, embankment breaches towards the southwest would affect both Spring Lake and McVeigh Creek systems. Embankment breaches to the northwest would affect the Otto and Herman systems. In the near term these system would not be able to support aquatic life. Depending on the emergency response measures taken, measureable effects on water quality may be experienced further downstream because surface water from these systems discharge into the Michipicoten River.

A breach along the northwestern embankment perimeter could affect terrestrial and aquatic habitats in both Otto and Herman Lakes. Depending on the emergency response measures taken, water quality effects could extend down to the Magpie River.

Over the long term, tailings remaining on the ground surface have the potential to affect groundwater as leachate could infiltrate the ground over time.

If the breach were to occur under frozen ground conditions, the effects would be somewhat lessened as the tailings and frozen water could be readily removed prior to the snowmelt, facilitating the recovery of the affected habitats. If the lakes or watercourse are frozen, tailings slurry would be less able to enter the waterbody which would minimize downstream transport of contaminants.

The greatest potential for such environmental effects is during the operating phase of the Project when tailings and the associated water are being pumped into the TMF. During closure, the potential for a breach occurring is substantially reduced as the water pond on the TMF surface is smaller and the tailings mass will have consolidated over time, becoming stronger. During the post-closure phase, the potential for such an event and its associated effects is considered minimal and limited to erosion damage on the surface of the rehabilitated TMF.

Worst Case Dam Failure Assessment

This assessment is presented in TSD 6 (section 6.6 Dam Break Analysis).

Mitigation by Design and Operational Safeguards

As described above, the TMF embankment will meet strict design (Canadian Dam Association, 2013), operational and maintenance requirements in order to withstand the probable maximum flood and the maximum credible earthquake. The TMF embankment will be designed to hold the environmental design flood over the maximum operating water level. An emergency spillway has been incorporated into the Project design that will be capable of passing any flows in excess of the environmental design flood.

As the TMF embankment is constructed over time, mine staff and other qualified personnel will inspect the construction activities and will test the placed and compacted materials to ensure they meet the density specifications.

A key operational safeguard will be the development and implementation of a site-specific Operation, Supervision and Maintenance (OSM) Manual that establishes clear TMF performance standards. These standards will be in accordance with principles in the Mining Association of Canada (MAC) Guide to the Management of Tailings Facilities; Canadian Dam Association (CDA) Dam Safety Guidelines, applicable international guidelines and standards; and all commitments to regulators and stakeholders. Specifically, the OSM shall include provisions for:

- Ensuring that construction of all embankments and critical infrastructure is overseen by qualified professionals and all materials and construction methods are tested to ensure they meet the required technical specification of the design;
- Providing for regular independent audit and assessment of the TMF and other critical infrastructure;
- Providing for visual inspections of the TMF dam daily/each 12-hour shift with respect to maintaining a safe operating pool, and not exceeding operational freeboard restrictions or other visual inspection points of reference which will be outlined in the OSM Manual;
- Implementing financial and operational controls (assign responsibility and budgetary authority) to establish an ongoing program of review and continual improvement to manage risks (health, safety and environmental) as well as change over the life-cycle of the TMF;
- Establishing safe operating objectives and ensuring staff responsible for implementation of the OSM Manual, have the appropriate knowledge and skills (awareness, training and competence) to implement it; and
- Integrating technical, managerial, and financial aspects (i.e., operational and financial controls) of TMF operation. This will include providing employee training and engaging competent professionals to ensure consistent application of awareness, communication and sound engineering practice and corrective actions, as needed, within an effective management framework.

Contingency and Emergency Response Procedures

In the event of a failure or imminent failure of the TMF dam, the emergency response plan would be initiated.

The initial response to any embankment failure will be to protect worker health and safety and shut down pumping of tailings to the TMF area.

The emergency response plan could permit emergency repairs, if safe to do so. The TMF pond could be pumped to the pit to reduce the amount of effluent released during the emergency repair. The spill would be contained to the extent possible using temporary devices including earthen or snow dams, silt fences, sand bags and other available equipment. Mine rock will be available from the MRMF to construct temporary containment berms and to repair the TMF embankment.

A remedial action plan would be developed in consultation with regulatory agencies. All affected areas would need to be rehabilitated to the extent practicable. A surface and groundwater monitoring program would be created to monitor the improvement in water quality and the success of rehabilitation measures. Prodigy will meet all statutory responsibilities regarding incident reporting.

8.1.4.3 MRMF Slope Failure

The MRMF will cover an area of approximately 400 ha and provides a total of up to 430 million tonnes of disposal capacity. At a crest elevation of 510 metres above sea level (masl), the MRMF would have an average height of approximately 85 m above existing grades and a maximum height of up to 100 m (from its lowest point). Final side slopes MRMF would range from 2:1 to 3:1 (horizontal:vertical), depending on stability and closure and post-closure grading considerations. Intermediate slopes may be as steep as 1.5:1 (H:V). The conceptual design of the MRMF is presented in TSD 6.

Potential Environmental Concerns

A major slope failure of the MRMF rock slopes could result in the release of rock (and if progressively reclaimed, overburden and topsoil) that pose a safety hazard to any personnel, facilities and wildlife in the immediate vicinity of the rock pile. This could cover terrestrial or aquatic habitats in the immediate vicinity of the rock pile. However, given that there will be a perimeter ditch surrounding the facility; mine rock is not expected to migrate beyond this ditch.

The greatest potential for such effects is during the operating phase of the Project when mine rock is being placed and during closure when the mine rock is being contoured. During the post-closure phase, the potential for such an event and its associated effects is considered minimal and limited to erosion damage on the surface of the rehabilitated MRMF.

Mitigation by Design and Operational Safeguards

The mine rock pile will be developed with a factor of safety of 1.5 which is a standard in the industry. Safety berms and/or perimeter ditches will be located in critical areas to preclude release of mine rock beyond the defined perimeter limits. The mine's infrastructure buildings and other facilities will be located a sufficient distance from the toe of the MRMF. Where sufficient offset cannot be provided, the mine rock in the vicinity of the affected facility will be compacted as necessary to reduce the risk of failure.

Contingency and Emergency Response Procedures

If MRMF failure were to occur, the first response will be to cease all work in the area and ensure worker safety. Once the failure area is secured, and depending on the scale of the failure, the stockpile slopes would be re-contoured in place. Material which migrated as far as the perimeter

ditch would be excavated and returned to the MRMF. If required drainage ditches would be repaired. Spill reporting and surface runoff monitoring may be required if encapsulated PAG rock or runoff has migrated beyond collection ditches. Prodigy will meet all statutory responsibilities regarding incident reporting.

8.1.4.4 Overburden/Topsoil Stockpile Slope Failure

Overburden and topsoil stockpiles will be located as discussed in Chapter 6.0. Stockpiles, in general, could affect the quality of adjacent waterbodies which may in turn affect aquatic life. The conceptual design of the overburden and top soil stockpiles are presented in TSD 6.

Potential Environmental Concerns

A major slope failure of the overburden stockpile slopes could result in the release of soil and sediment that would pose a safety hazard to any facilities in the immediate vicinity, as well as the potential release of sediment to adjacent waterbodies which may affect aquatic life. Should a failure occur, the maximum potential distance of displacement would be less than 10 meters from the toe.

The greatest potential for such effects is during the construction phase, when the stockpiles are being established, and the closure period when the maximum amount of material will be removed from the stockpile to support the rehabilitation activities. Lesser potential for effects exists during the operations phase.

Mitigation by Design and Operational Safeguards

The stockpiles will be placed at a minimum of 30 m from a waterbody in a stable configuration and will be compacted with the placement equipment. They will be vegetated to prevent erosion. As necessary, perimeter ditches will be located to preclude release of overburden (sediment) beyond the defined perimeter limits.

Contingency and Emergency Response Procedures

If stockpile failure were to occur, the first response will be to cease all work in the area and ensure worker safety. When the failure area is secured, and depending on the scale of the failure, the stockpile slope would be re-contoured in place. Material which migrated as far as the perimeter ditch area would likely be excavated and returned to the stockpile, and if required drainage ditches would be repaired. Prodigy will meet all statutory responsibilities regarding incident reporting.

8.1.5 Accidents

8.1.5.1 Explosives Accident

Prodigy will sub-contract the provision of the ANFO and emulsion explosives to a service supplier fully experienced and licensed to perform these activities. The blasting patterns and schedules will be determined by the mine personnel in accordance with operational requirements and any applicable limits established for the protection of fish and fish habitat.

Potential Environmental Effects

A spill of fuel oil, ammonium nitrate, the ANFO mixture, or an emulsion has the potential to contaminate soil and local ground and surface water. Due to the use of explosives in the pit area, any release would likely be to pit water which is collected for recycle and ultimately discharged into the TMF. The approach for, and effects of, TMF discharges to the receiving environment have been assessed in previous section of Chapter 7.

Spills of explosives outside of the pit area may occur during loading/unloading and storage and transport, which would potentially affect water quality in the immediate vicinity of the spill. Blasting also has the potential of releasing ammonia compounds to the air should problems arise with the detonation of the ANFO mixture.

Mitigation by Design and Operational Safeguards

Prodigy will have a contract with an explosives supplier who will produce ANFO or other blasting agents such as emulsion when required at an off-site location. The supplier will load the blast holes with the blasting agent and Prodigy personnel will load the blast hole with accessories (detonator, non-el, etc.) according to Prodigy's design. Prodigy personnel will tie the shot in on the surface and initiate the blast according to Prodigy safety procedures. Accessories will be stored on-site in magazines provided by the supplier.

The ANFO components for the emulsion will be transported in tanker type trucks. All transport of the explosive chemicals will be by a licensed explosive contractor with the driver trained in handling and spill management of the components. The driver will have a method of communication to initiate any response action and to seek assistance from mine personnel. Routes to the explosive magazines and bulk tanks will be established to eliminate interaction with the large ore transport vehicles. The contractor and Prodigy personnel will follow best management practices in the cleanup and disposal of spilled material.

Contingency and Emergency Response Procedures

Emergency response procedures will be created as part of the Emergency Response Spill Prevention / Contingency Plan (ERSPC). This plan will address how to respond to a spill on the mine property. The procedures will ensure the safety and health of the site workers and notification of site health and safety supervisor.

Should an explosive component spill occur, it will be handled as described in the transportation section of the chapter related to liquid and solid spills. Once the ANFO mixture or emulsion is created, spills other than minor spills around the blasting holes will be handled by the blasting contractor following its spill cleanup procedures. Prodigy will meet all statutory responsibilities regarding incident reporting.

8.1.5.2 Tailings Pipeline Failure

The treated tailings will be pumped, at approximately 55% solids by mass, through a pipeline from the plant and spigotted around the perimeter of the TMF.

Prior to discharge in the TMF, the tailings slurry will be treated for the destruction of cyanide and dissolved heavy metals. The tailings slurry transfer line from the mill to the TMF, and recycle

water from the TMF to the mill, poses a potential concern due to the residual levels of cyanide present in the liquid even after in-plant cyanide destruction. Additionally, the tailings from the slurry transfer line are likely to contain heavy metals, cyanate and ammonia from the cyanide destruction process.

A reasonable worst case scenario would be that, even though the pipeline will be fitted with automatic pressure sensors designed to detect leakage and close valves, the pipeline failure would not be detected for an 4-hour period (assumed to be the pipe inspection interval) and that the amount of a tailings slurry spill would be the volume of pipe, which has a length of appropriately 2,500 m (at 30 cm in diameter). Table 8-2 provides an estimate of the volume of tailings that would be spilled under this scenario.

Table 8-2: Leakage Scenario

LEAKAGE SCENARIO	VOLUME OF TAILINGS SLURRY SPILLED (M ³)	SOLIDS CONTENT (TONNES)
2.5 km of pipeline drains	200	230
Constant release after 4 hours of discharge	10,000	5,500

Since this pipeline will be located within the confines of the site perimeter ditches, any spill of tailing slurry would be captured by the perimeter ditch and channeled to the Water Quality Control Pond. The solids (essentially silt) contained in the slurry would likely be retained in close proximity to the pipeline rupture, irrespective of season.

Mitigation by Design and Operational Safeguards

The pipeline will be designed to handle the high pressure and erosive nature of the tailings transfer from the mill to the TMF. A redundant transfer line may be installed to allow for mill operation to continue in the event of a line failure. The pipes will be:

- Sized to minimize the flow velocity while maintaining sufficient velocity to prevent freezing of the line and keep the slurry from settling;
- Equipped with pressure transducers which will alert the mine operator of a potential leak or line failure due to an unexpected pressure drop or increase in flow rate; and
- Inspected at least once every 4 hours.

A catchment area will be located at low point near the mill to allow for gravity drainage of the line should it be necessary during repair to prevent tailings slurry from impacting sensitive areas if a leak were to occur.

The pipe will be located on the inside of the TMF embankment crest. In the event of a line failure, tailings slurry will drain into the TMF.

Contingency and Emergency Response Procedures

In the event of a leak identified by instrumentation, the mill will switch to the redundant transfer pipeline if there is one. If another pipeline is not available, the mill will shut down transfer operations to the TMF. Trained personnel will immediately be sent to inspect the line and verify

if a leak has occurred and the location of that leak. Appropriate containment and cleanup procedures will be followed as per the instructions created as part of the Emergency Preparedness Plan. This plan will address how to respond to a spill on the mine property. The procedures will ensure the safety and health of the site workers and the immediate notification of site health and safety supervisor. Prodigy will meet all statutory responsibilities regarding incident reporting.

8.1.5.3 Water Pipeline Failure

Water pipelines on the site may be characterized according to the quality of water being transferred:

- Freshwater lines will be used to pump process make-up water from Goudreau Lake to the Process Plant. Other water lines will be used to convey potable and freshwater throughout the Project area; and
- Impacted water lines and pipes will be used to pump water from the open pit to the TMF, from the Water Quality Control Ponds to the TMF Pond, and from the TMF Pond to the Process Plant. An impacted water line will also be used to pump water from the TMF Pond to a Water Quality Control Pond.

Potential Environmental Effects

All impacted water pipelines are constructed within the site perimeter ditches. Although rupture or significant leakage from any water pipeline could cause erosion downslope through the force and volume of water being released, the water will be captured by the drainage works. All site contact waters will be routed to the Water Quality Control Pond. On mine rock slopes and TMF slopes the effect will be negligible.

The single discharge to the receiving environment is from the Water Quality Control Pond overflow, which is continuously monitored. The pond is sized to handle extreme weather events and has ample storage capacity. As site drainage involves no pumping (all flow is by gravity to the Water Quality Control Pond), spills resulting from a pipeline break can reliably be contained and will not result in a discharge to the environment.

A break or leak from a fresh water or treated water pipeline would not have any other discernible environmental effect.

Mitigation by Design and Operational Safeguards

Active pipelines will be inspected on a routine basis. Should flow lessen or stop in a pipeline, an inspection will be immediately conducted. Incidental observations could also provide notice in the event of a visible leak or failure, as a considerable length of the pipelines (and in particular those containing impacted water) run through well-travelled areas of the site.

Gravity drainage of the entire site to a single Water Quality Control Pond is the primary mitigation feature. Any spill occurring within the perimeter collection ditches will drain by gravity to the Water Quality Control Pond.

Contingency and Emergency Response Procedures

On discovery of a leak or failure, pumps will be shut down and the pipeline repaired. Prodigy will meet all statutory responsibilities regarding incident reporting.

8.1.5.4 Fuel Transport, Transfer and Storage

Diesel fuel, gasoline, and potentially a separate fuel oil for explosives will be shipped to the site by truck. Most materials will be sent from Sault Ste. Marie by way of the Trans-Canada Highway (Route 17) to route 519 to Goudreau Road to the site. Prodigy has consulted the Ontario Ministry of Transportation and determined that Goudreau Road, including associated bridges, is adequately rated for the heaviest loads expected for the project.

The expected annual usage of these materials is listed in Table 8-3.

Table 8-3: Annual Consumption and On-Site Storage of Hydrocarbon

Type	Consumption		Transportation to Site			On-site Storage
	Litres/year	Amount per trip	trips/year	Tanker truck trips/day	Tank Capacity	
Diesel	49,000,000	40,000	Litres/trip	1225	Three to four	2000 m ³
Gasoline	165,000	20,000	Litres/trip	8	One tanker every 6 weeks	10 m ³
Fuel Oil	250,000	20,000	Litres/trip	12	One tanker per month	10 m ³

Assuming an average bulk delivery of 40,000 litres per trip, a total of 1225 trips per year of flammable liquids is anticipated due to the project. This amounts to an expected 3 to 4 trips per day.

Based on the site location and the distance traveled for the bulk liquid deliveries there is always the potential for spills due to collisions or single vehicle accidents caused weather conditions, driver error or other mishaps such as mechanical malfunction.

Fuel spills can occur at any time, but the potential will be greatest during the construction and operations phases when most fuel is being transported to the site.

Potential Environmental Effects

Fuel oil has the potential to contaminate soil. If released close to or over a water body it has the potential to be toxic to aquatic life. Fuel oil could also pose a small danger to groundwater if the spill is not cleaned up in a timely manner. A fire is also possible if precautions are not taken to prevent exposure to an ignition source of spilled flammable material. A transient effect on air quality would also be possible due to the volatilization of the spilled material.

Mitigation by Design and Operational Safeguards

Transportation of fuels will be contracted to a licenced qualified contractor. Fuels will be transported in trucks specifically designed to carry these materials. The transporters will be fully licensed to carry these materials and spill kits will be supplied on each vehicle. The drivers will be trained in spill management and have a means of communication with the mine and fuel company. The equipment and supplies required to be carried on the trucks will be defined in the ERSPC Plan (TSD 20).

To ensure spill containment, the fuel storage facilities at site will be located within a containment area designed to accommodate 110% of the content of the largest tank. The tanker trucks unloading station will be designed to contain spillage. The storage tanks will be equipped with level indicators and instrumentation to ensure that spills do not occur during normal operation. Appropriate ventilation, spill response equipment, fire and safety protection, eye wash stations, and Material Safety Data Sheet (MSDS) stations will be provided.

Although efforts will be made to reduce the potential for spills to the environment, it is recognized that minor spills associated with heavy equipment usage may occur occasionally. Contaminated overburden and other materials associated with any such spills, will be excavated and treated in an on-site remediation area, or transported off-site to a licensed facility for disposal, as appropriate.

Contingency and Emergency Response Procedures

Refer to the ERSPC Plan presented in TSD 20.

8.1.5.5 Reagent Transport, Transfer and Storage

Quantities of reagents that will be used and stored on-site are listed in Table 8-4. Raw materials such as hydrochloric acid, sodium hydroxide, and sodium cyanide are expected to be shipped to the site by truck. Because they would be shipped as bulk liquids, environmental effects are likely in the event of a release due to an accident or leaking transport container. Table 8-5 summarizes the expected transportation methods and quantities required for the Project.

During storage, the reagent facilities will be located within a containment area designed to accommodate 110% of the content of the largest tank. The storage tanks will be equipped with level indicators and instrumentation to ensure that spills do not occur during normal operation. Appropriate ventilation, spill response equipment, fire and safety protection, eye wash stations, and Material Safety Data Sheet (MSDS) stations will be provided.

Potential environmental concerns, design and operational safeguards, and contingency and emergency response procedures for fuel oils, sodium cyanide, hydrochloric acid, sodium hydroxide, and solids reagents are addressed individually in the following subsections.

Mitigation by Design and Operational Safeguards

All reagents will be shipped by licensed transportation companies whose drivers are trained in spill management. Trucks will be equipped with appropriate spill control equipment and supplies. All shipments will comply with the TDG regulations.

Table 8-4: Reagents and Hydrocarbon Consumption, Transportation and On-Site Storage

Reagents		Transportation to Site				On-site Storage	
	Consumption	tonnes/year	Litres/year	Amount per trip	trips/year	trips/day	
Lime (CaO)	2555			20	tonnes/trip	130	One shipment every three days Stored in 100 tonnes silo.
Sodium Cyanide (NaCN)	9580			20	tonnes/trip	480	One to two shipment per day Stored in 40 seacan containers on site (20 t capacity per container). Bags/wooden box
Caustic Soda (30% strength)	255	200,000	20,000	Litres/trip	11	One shipment per month	Up to two iso-containers on site stored on laydown area close to the mill.
Hydrochloric Acid (36 - 38% strength)	130	110,000	20,000	Litres/trip	6	One shipment every 60 days	Up to two iso-containers on site stored on laydown area close to the mill.
Activated Carbon	640		20	tonnes/trip	32	On shipment every 10 days	Three 20 ft seacan container stored on laydown area next to mill. Bag transferred
Sodium Metabisulphate	4800		20	tonnes/trip	240	One to two shipment per day	Twenty 20 ft seacan container stored on laydown area close to the mill. Bag transferred to mill by forklift as required.
Copper Sulphate (CuSO ₄ .4H ₂ O)	1625		20	tonnes/trip	80	One shipment every 5 days	Seven 20 ft seacan container stored on laydown area close to the mill. Bag transferred to mill by forklift as required.
Magnafloc 155	255		20	tonnes/trip	13	One shipment every 28 days	One 20 ft seacan container stored on laydown area close to the mill. Transferred to mill as required.
Anti-scalant	385		20	tonnes/trip	19	One shipment every 20 days	Two 20 ft seacan container stored on laydown area close to the mill. Transferred to mill as required.
Fuels							
Type	Consumption	Transportation to Site				On-site Storage	
	Litres/year	Amount per trip	Litres/trip	trips/year	Tanker truck trips/day	Tank Capacity	
Diesel	49,000,000	40,000	Litres/trip	1225	Three to four	2000 m ³	
Gasoline	165,000	20,000	Litres/trip	8	One tanker every 6 weeks	10 m ³	
Fuel Oil	250,000	20,000	Litres/trip	12	One tanker per month	10 m ³	

Hydrochloric Acid (36-38% Solution)

The usage of this material is expected to be approximately 110,000 litres per year. Assuming an average bulk delivery of 18,000 litres per trip, a total of 6 trips to the project per year is anticipated. A typical ISO-container for the transportation and storage of hydrochloric acid is shown in Table 8-4.

Based on the site location and the distance traveled for bulk liquid deliveries there is always the potential for spills due to collisions or single vehicle accidents caused by weather conditions, driver error or other mishaps such as mechanical malfunction.

Spills can occur at any time, but their potential will be greatest during the operations phase when most liquids are being transported to the site.

Potential Environmental Effects

A spill of hydrochloric acid solution has the potential to contaminate soil and groundwater or, if released close to or over water body, the potential to be toxic to aquatic life. The air quality in the immediate area of the spill will be impacted as acid fumes are released. Hydrochloric acid is extremely corrosive and will kill plant life in the area. This risk will be confined to the operational phase of the Project.

Mitigation by Design and Operational Safeguards

Hydrochloric acid will be transported in trucks specifically designed to carry this material. The transporter will be fully trained and licensed to carry this material. All drivers will be trained in

spill management and will have a method of communication to initiate response action and notify authorities. The equipment and supplies required to be carried on the trucks are specified ERSPC Plan (TSD 20).

Contingency and Emergency Response Procedures

Emergency response procedures are detailed in the ERSPC Plan (TSD 20). This plan will address how to respond when the spill may affect the health and safety of the public. The procedures will ensure the safety and health of the public by:

- Establishing procedures to notify government authorities and mobilize a spill response team;
- Establishing procedures for communication with Aboriginal groups, site neighbours, local communities and other stakeholders;
- Checking wind direction and setting up an exclusion zone to protect the public;
- Controlling and containing the spill by constructing berms;
- Diluting the spill where possible with water, and/or neutralizing the spill with lime;
- Removing the spill by:
 - Neutralizing material and removing contaminated soils by excavation; and
 - Following up with an investigation and detailed incident report, including and recommendations for reducing the probability of a repeat incident.

Sodium Hydroxide (30% Solution)

Sodium hydroxide will be shipped to the site from Sault Ste. Marie. The expected usage of this material is approximately 200,000 litres per year. Assuming an average bulk delivery of 18,000 litres per trip, a total of 11 trips per year of this material is anticipated.

Based on the site location and the distance for the bulk liquid deliveries, there is always the potential for spills due to collisions or single vehicle accidents caused by weather conditions, driver error or other mishaps such as mechanical malfunction.

Spills can occur at any time, but the potential will be the greatest during the operations phase when most liquids are being transported to the site.

Potential Environmental Concerns

A spill of sodium hydroxide solution has the potential to contaminate soil or, if released close to or over a water body, the potential to be toxic to aquatic life. Sodium hydroxide is extremely corrosive and will be toxic to any plant life it contacts. There is little chance of air quality impacts unless it comes in contact with an acid solution.

Mitigation by Design and Operational Safeguards

This material will be transported in trucks specifically designed to carry this material. The transporter will be fully trained and licensed to carry this material. The drivers will be trained in spill management and have a method of communication to initiate response action and notification of authorities. The equipment and supplies required to be carried on the trucks are specified in the ERSPC Plan.

Contingency and Emergency Response Procedures

Emergency response procedures will be created as part of the ERSPC Plan (TSD 20). This plan will address how to respond when the spill may affect health and safety of the public. The procedures will ensure the safety and health of the public by:

- Establishing procedures to notify government authorities and mobilize a spill response team;
- Establishing procedures for communication with Aboriginal groups, site neighbours, local communities and other stakeholders;
- Setting up an exclusion zone to protect the public;
- Controlling and contain the spill by construction of berms;
- Where possible divide the spill with water and/or neutralizing with a mild acid;
- Removing the spill by:
 - Use of neutralizing material and removal of contaminated soils by excavation; and
 - Follow-up investigation and a detailed incident report including recommendations for reducing the probability of a repeat incident.

Sodium Cyanide (solid briquettes)

The expected use is approximately 9,580 tonnes per year. Sodium cyanide will be delivered in solid briquettes transported in super bags specially designed for transportation of sodium cyanide. Assuming an average bulk delivery of 20 tonnes per trip, a total of 480 trips per year of this material is anticipated.

Sodium cyanide could also be delivered as a 30% solution. However, the closest manufacturing plant is located in Cadillac, P.Q. which is over 800 km from the Project site. Therefore, this option is not considered practical for the Project.

Based on the site location and the distance for the bulk deliveries there is always the potential for accidents and spills due to collisions or single vehicle accidents caused by weather conditions, driver error or other mishaps such as mechanical malfunction.

Spills can occur at any time, but the potential will be greatest during the operations phase when most liquids are being transported to the site.

Potential Environmental Effects

Cyanide crystals are highly soluble in water. A spill of sodium cyanide has the potential, if it comes into contact with low pH water, to result in the release a toxic gas. If released into a water body, cyanide can be extremely toxic to aquatic life. Cyanide itself is extremely toxic and corrosive.

Mitigation by Design and Operational Safeguards

As cyanide will be transported in solid form, spills of cyanide caused by a transportation incident will be limited. This material will be transported in packaging and in trucks specifically designed to carry this material. It will be packaged either in one tonne bags doubly contained inside a wooden box, or in plastic containers as shown on Figure 8-1. The transporter is fully trained and licensed to carry this material and it is transported following the regulations of the International Cyanide Manufacturers Code (Cyanide Code, ICMC).

Figure 8-1: Typical Packaging, Transportation and Storage of Cyanide Briquette



Source: (Kemcore, 2016).



Source: (Kemcore, 2016).

The Cyanide Code is a voluntary initiative for the gold mining industry and for producers and transporters of cyanide. It is intended to complement an operation's existing regulatory requirements. Compliance with the rules, regulations and laws of the applicable political jurisdiction is necessary; this Code is not intended to contravene such laws. The Cyanide Code focuses exclusively on the safe management of cyanide that is produced, transported and used for the recovery of gold, and on mill tailings and leach solutions. The Cyanide Code originally was developed for gold mining operations, and addresses production, transport, storage, and use of cyanide and the decommissioning of cyanide facilities. It also includes requirements related to financial assurance, accident prevention, emergency response, training, public

reporting, stakeholder involvement and verification procedures. Cyanide producers and transporters are subject to the applicable portions of the Cyanide Code identified in their respective Verification Protocols.

The cyanide transporters must:

- Establish clear lines of responsibility for safety, security, release prevention, training and emergency response in written agreements with producers, distributors and transporters; and
- Require that cyanide transporters implement appropriate emergency response plans and capabilities, and employ adequate measures for cyanide management.

To comply with the code, transporter has the following items:

- Driver emergency “panic” button (used to initiate immediate action and response at the manufacturer to notify all necessary authorities and Emergency Response (ER) personnel);
- Emergency communication via satellite link in the truck to the manufacturer Control Room. The two-way system also allows manufacturer to provide information to the driver at the scene;
- GPS tracking and street-level mapping enables manufacturer to know the truck's exact location (within approximately 100 feet). This enables the manufacturer and local ER Teams to locate access routes and direct response teams to the site; and
- Control room at the manufacturer is then able to coordinate communication with the driver, appropriate authorities, and emergency response teams.

Contingency and Emergency Response Procedures

Emergency response procedures will be created as part of the ERSPC Plan (TSD 20). This plan will address how to respond when the spill might affect health and safety of the public. The procedures will ensure the safety and health of the public by:

- Establishing procedures to notify government authorities and mobilize a spill response team. Only persons trained on cyanide releases and wearing proper personal protective equipment will be allowed at the release site;
- Establishing procedures for communication with Aboriginal groups, site neighbours, local communities and other stakeholders;
- Setting up an exclusion zone to protect the public;
- Controlling and containing the spill by constructing berms around the spill; and
- Removing the spill by:
 - Removal of contaminated soils by excavation; and
 - Following up with an investigation and detailed incident report including and recommendations for reducing the probability of a repeat incident.

Solid Reagents

The mine site will use several reagents shipped in a solid form such as hydrated lime for pH control, activated carbon for gold recovery, and sodium metabisulphite and copper sulphate for cyanide destruction. These chemicals will be shipped in bags to the mine site and are all classified as non-hazardous.

Based on the site location and the travel distance for the deliveries, there is a potential for spills due to collisions or single vehicle accidents because of weather conditions or other mishaps such as mechanical malfunction.

Potential Environmental Effects

A spill of any of these reagents has the potential to contaminate soil and surface waters, should the solid materials be discharged directly or indirectly into a waterbody.

Mitigation by Design and Operational Safeguards

This material will be transported in trucks and the driver will be trained in spill management and have a method of communication to initiate response action and notification of authorities if required.

Contingency and Emergency Response Procedures

Emergency response procedures will be developed during preparation of the ERSPC Plan (TSD 20). This plan will address how to respond when the spill will affect the health and safety of the public. The procedures will ensure the safety and health of the public by:

- Establishing procedures to notify government authorities and mobilize a spill response team;
- Establishing procedures for communication with Aboriginal groups, site neighbours, local communities and other stakeholders;
- Setting up an exclusion zone to protect the public;
- Controlling and containing the spill by construction of berms around the spill to prevent contact with water; and
- Removing the spill by:
 - Removal of contaminated soils by excavation; and
 - Follow up with an investigation and detailed incident report including and recommendations for reducing the probability of a repeat incident.

8.1.5.6 Chemical Spill within Containment Areas

The Magino mine mill operation requires the makeup and use of certain chemical solutions which could cause environmental harm if released through operational errors such as overfilling a makeup tank or addition of the wrong chemical. Also, inadequate treatment of tailings slurry could result in potential harmful effects to wildlife in the area should animals land on or drink the water in the TMF.

Potential Environmental Effects

A spill of any of these reagents has the potential to contaminate soil, groundwater and surface water. A release to the air of fumes of cyanide or hydrochloric acid could be harmful to workers and wildlife in the immediate area. However, since these fumes rapidly disperse into the air, the potential risks would only occur in close proximity to the release source.

Mitigation by Design and Operational Safeguards

Tanks in the mill containing hazardous chemicals will be equipped with secondary containment which is sufficient to contain the volume of the full contents of the tank. Tanks will also be

equipped with a high level alarm system to alert the mill operators when the tank is reaching its capacity to prevent an overflow. The mill processes will undergo HazOp evaluations to minimize risk of an operational upset, and mill operators will be fully trained by mine management in procedures for proper operation of equipment. Special safety precautions will be designed into the cyanide circuit to ensure conditions are maintained at a pH greater than 9 to prevent the release of cyanide gas in the environment.

Operations in the cyanide destruction circuit will be closely monitored to ensure that the cyanide is reduced to a level that will not cause a danger to wildlife that may come in contact with the TMF pool recycle water.

Contingency and Emergency Response Procedures

Emergency response procedures will be prepared during the development of the ERSPC Plan and mill operating instructions. This plan and its procedures will address how to respond to a spill or an unintended release to the environment at the mill.

8.1.6 Other Malfunctions

8.1.6.1 Project Related Fires

Potential Environmental Effects

In addition to health and property concerns, the main environmental concerns related to fire are air quality and habitat loss. Should a fire occur in an area housing chemicals, release of toxic fumes to the air may occur, and water from firefighting activities may pose a hazard to surface water, groundwater, and aquatic life.

Mitigation by Design and Operational Safeguards

Fire detection systems will be installed at all appropriate locations at the mine site, including but not limited to the offices, warehouse, mill, and explosives magazines. All buildings will meet construction standards and be equipped with appropriate fire suppression systems such as sprinklers, fire extinguishers, foam and or carbon dioxide at electrical sub-stations. Where required, foam systems will be available to fight fires whose fuel source is oil or other fuel.

The fuel storage facilities will be designed to meet the National Fire Code of Canada requirements along with a low expansion foam generation system.

Operations will be in accordance with the Ontario *Forest Fires Prevention Act*, Ontario Regulation 207/96, and the Modifying Industrial Operations Protocol as required.

Prodigy will meet all regulatory requirements regarding fire protection and fire-fighting, including ensuring that a suitable number of workers at the mine shall be trained in firefighting procedures and tested for proficiency at least once per year. All plant personnel will be trained on:

- Fire hazards;
- Fire prevention; and
- Firefighting roles, responsibilities and requirements for their respective positions.

In addition, Prodigy shall provide all personnel with orientation and training which includes conducting regular fire drills. Worker safety is of the highest concern in the event of a fire. Only trained personnel will be allowed to attempt to contain and extinguish a fire. Prodigy will meet all statutory responsibilities regarding incident reporting.

Contingency and Emergency Response Procedures

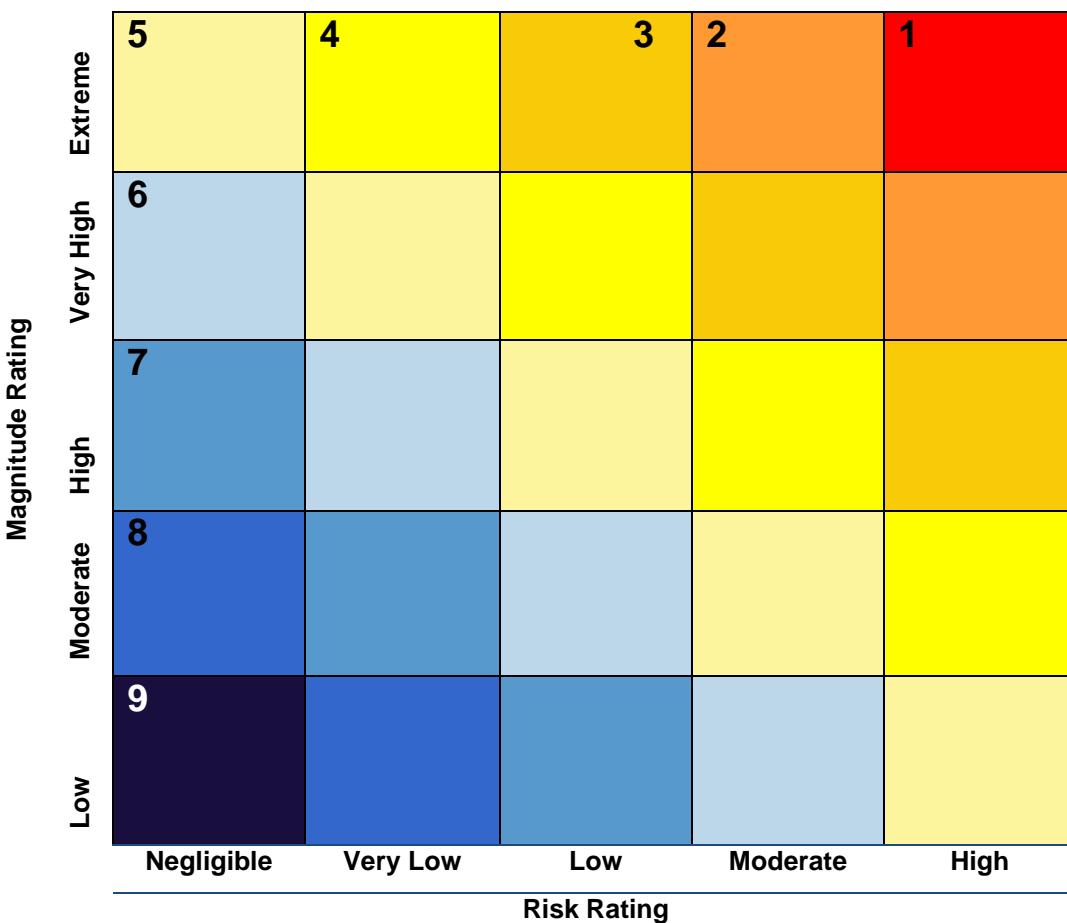
Emergency response procedures will be developed as part of the ERSPC Plan (TSD 20). This plan will address how to respond to a fire on the mine property. Evacuation of personnel from the area will be the highest priority. Meeting or muster sites for site workers will be established and headcounts taken to account for all personnel. The local fire department will be notified as soon as possible. It will also be notified of any hazardous materials on-site and any health concerns related to the chemicals, including required personal protective equipment.

8.1.7 Significance Assessment

The significance assessment for environmental effects resulting from accidents and malfunctions differs from the assessments completed for individual VCs. Rather than applying the standard significance criteria (i.e., magnitude, geographic extent, duration, etc.); significance was assessed by completing a qualitative risk assessment that rates the likelihood of the adverse environmental effects occurring.

Each potential accident and malfunction discussed above was assessed according to the likelihood of the event occurring, and given a risk rating from “negligible” to “high”. Potential environmental effects are assigned a magnitude rating from “low” to “extreme”. The combination of the likelihood of an event and the magnitude of its environmental effects is determined by plotting these ratings on a matrix as shown on Figure 8-2. Risk increases for accidents and malfunctions which have a greater likelihood of occurrence and greater magnitude of effects.

Figure 8-2: Risk Rating Matrix



The risk ratings are defined as follows:

- **Negligible:** Not likely to occur (less than a 1 in 10,000 probability per year - 1/10,000 events per year);
- **Very Low:** Unlikely to occur (less than a 1 in 1,000 probability per year);
- **Low:** Possibly could happen (less than a 1 in 100 probability per year);
- **Moderate:** May happen (less than a 10% probability per year); and
- **High:** Can happen over the life of the mine (greater than a 10% probability per year).

The magnitude ratings consider not only the mitigation by design, operational safeguards and contingencies available to minimize environmental effects, but also the cost of remediation (as a measure of severity). The magnitude ratings are defined as follows:

- **Low:** No long term effects, readily remediated with a cost in the \$10,000's;
- **Moderate:** Limited or no long term effects, remediated for costs in the \$100,000's;
- **High:** Moderate long term effects expected, remediated for costs over 1 million and less than 10 million;
- **Very high:** Significant long term effects expected, costly remediation in the \$10s millions; and
- **Extreme:** Highly significant long term effects likely, remediation cost in the \$100s millions.

Accidents and malfunctions with an overall combined rating of greater than or equal to 4 are not considered to be significant events or consequences. An overall combined rating of 3 requires that the accident or malfunction be considered further in detailed the design phase. An overall combined rating of 2 or less is considered significant.

Results of this qualitative analysis are provided in Table 8-5. The results indicate that all of the accidents and malfunctions which were considered had a rating of either 6 or 7. These events and their environmental effects are therefore considered not significant.

Table 8-5: Accidents and Malfunctions Rating Summary

MALFUNCTION/ACCIDENT	KEY ENVIRONMENTAL EFFECTS	RISK RATING	MAGNITUDE RATING	OVERALL RATING (1 = MAXIMUM 9 = MINIMUM)
Open Pit Slope Failure	Effects on habitat, limited flooding of open pit, effects on lake levels	Low	Low	7
TMF Embankment Failure	Effects on terrestrial habitat, aquatic life	Negligible	Very High	6
MRMF Slope Failure	Effects on terrestrial habitat, possibly aquatic life	Moderate	Low	6
Overburden/Stockpile Slope Failure	Effects on terrestrial habitat, possibly aquatic life	Moderate	Low	6
Explosives Accident	Water quality impacts	Very Low	Moderate	7
Tailings Pipeline Failure	Effects on terrestrial habitat and aquatic life	Low	Moderate	6
Water Pipeline Failure	Effects on aquatic life	Low	Low	7
Reagent Transport	Effects on terrestrial habitat and possibly aquatic life	Very Low	High	6
Fuel Transport	Effects on aquatic life and possible terrestrial life	Very Low	High	6
Chemical Spill within Containment Areas	Effects on property and effects to human health and terrestrial and aquatic fauna	Negligible	High	7
Unexpected Water Quality Effects	Effects on aquatic life	Low	Moderate	6
Project-related Fires	Human health concerns and effects on fauna	Very Low	Moderate	7

8.2 Worker Safety

Miners are subject to a number of potential health hazards in their normal daily work. If health hazards are not managed effectively work-related injuries, disease, or even death can occur. As such, worker safety in mining is a key priority for Prodigy as well as the mining industry as a whole. Mining companies have legal responsibilities under Ontario's *Occupational Health and Safety Act* and regulations administered by the Ministry of Labour. A serious workplace injury, disease or death can change the lives of families, friends, communities, and co-workers alike. If a worker is injured on the job, it costs the company in lost work hours, increased insurance rates, workers' compensation premiums, and possibly in litigation. Productivity is also lost. An outline of Prodigy's Health and Safety Management Plan is presented in TSD 20.

8.2.1 Legislative Requirements and other Guidance

Table 8-6 summarizes the legislative requirements and other guidance that has been considered in this assessment. Each relevant piece of legislation and regulation, standard or other form of guidance is briefly described and presented in terms of its relevance to this VC.

Table 8-6: Relevant Legislative Requirements and Other Guidance

LEGISLATION OR REGULATION	DESCRIPTION	RELEVANCE TO THE VC
<i>Occupational Health and Safety Act</i> (1990, last amendment in 2011).	The legal framework to ensure safe and healthy workplaces. Outlines the rights and duties of all parties in a workplace and provides a description of enforcement of the law in the case of non-compliance.	S.2.2 describes how, despite details on health and safety provided in another general or special Act, the provisions of this Act shall prevail.
<i>Occupational Health and Safety Act – Mines and Mining Plants</i> (Regulation 854, last amendment O. Reg. 34/14).	Governs the occupational health and safety of mines and mining plants, as well as related mining development and works.	Allows for protection of employee occupational health and safety in the mining industry.
<i>Occupational Health and Safety Act - Critical Injury - Defined</i> (Regulation 834, last amended O. Reg. 34/14).	Defines the meaning of a critical injury.	In the event that a critical injury occurs.
<i>Occupational Health and Safety Act - Roll-Over Protective Structures</i> (Regulation 856, last amended O. Reg. 357/91).	Governs the requirements of roll-over protective structures for machines.	S.3.1 outlines how all machinery on-site must be equipped with roll-over protective structures, unless it falls under the requirements in S.2.
<i>Occupational Health and Safety Act - Workplace Hazardous Materials Information System (WHMIS)</i> (Regulation 860, last amended O. Reg. 36/93).	Governs the use, storing and handling of workplace hazardous materials.	Will apply to any controlled products being used.
<i>Occupational Health and Safety Act - Confined Spaces.</i> (Regulation 632/05, last amended O. Reg. 95/11).	Regulates the requirements of an employee entering a confined space. It includes but is not limited to training requirements,	Applies in the event an employee is required to enter a confined space as long (as the employee is not exempt under

LEGISLATION OR REGULATION	DESCRIPTION	RELEVANCE TO THE VC
	environmental considerations, program requirements, PPE, permits, and record keeping.	Section 3 of the Act).
<i>Occupational Health and Safety Act - Basic Occupational Health and Safety Awareness Training (Regulation 297/13).</i>	Provides framework for basic health and safety awareness training programs to be provided by the employer. Includes requirements for basic instruction of a worker and a supervisor, record of training and certification of training.	Requirements to be followed for basic occupational health and safety training.
<i>Occupational Health and Safety Act - Joint Health and Safety Committees – Exemption from Requirements (O. Reg. 385/96, last amended, O.Reg. 19/09).</i>	Defines the minimum number of employees that are allowed in a workplace before a joint health and safety committee is required.	Mine operations will be greater than the minimum requirements; therefore a joint health and safety committee will be required.
STANDARDS OR OBJECTIVES	DESCRIPTION	RELEVANCE TO THE VC
Ontario Ministry of Labour - Mining Sector Plan (2014 to 2015).	Outlines the Ministry's enforcement initiatives to protect Ontario's mining workers from occupational injury and illness.	Provides a summary of documents related to Mining occupational health and safety. Indicates the appropriate focus on for mine Health and Safety plans and protocols.
OTHER GUIDANCE	DESCRIPTION	RELEVANCE TO THE VC
International Cyanide Management Code (2012).	Focuses on safe management of cyanide, cyanidation mill tailings, and leach solutions for gold mining companies who voluntarily participate in the program.	Guidance on improving management of cyanide for the protection of human health and reduction of environmental impacts.
Workplace Safety North: Emergency Response Planning for Surface Mines.	Provides a step by step approach to developing an effective emergency response plan. Includes an extensive list of components to be taken into consideration.	Guidance for the development of a surface mine emergency response plan.

8.2.2 Key Indicators and Measurable Parameters Worker Safety

The assessment of the effects on worker safety differs from the assessments completed for individual VCs in that it identifies and discusses the key types of workplace hazards that mine workers are likely to be exposed to. The assessment also presents information relevant to the Ontario Mining industry's safety record. No attempt has been made to quantify the types or rates of worker injuries; because it is Prodigy's goal of having zero harm in the workplace and to be fully compliant with all legislative and regulatory requirements related to occupational health and safety (refer to Health and Safety Management Plan – TSD 20).

8.2.3 Effects Mechanisms

Virtually all of the Project works and activities described in Chapter 6 could present some associated hazard that may result in personnel injuries to workers or members of the public.

8.2.4 Assessment Methods

The information presented regarding workplace hazards is based on past experience with mines similar to the Project and with similar types of works and activities in general. Information regarding the mining industry's safety record is based on published secondary sources.

8.2.5 Effects Analysis

8.2.5.1 Types of Workplace Hazards

Mining operations are similar to many other industrial workplaces in that workers are exposed to a variety of physical hazards related to ergonomics and working at heights, in confined spaces, etc. At mine sites, vehicular traffic poses a major hazard due to the amount of traffic and types of vehicles used. Vehicular traffic including cars, small trucks, large trucks, dozers, loaders, crawler drills will be operating at the mine site continually during operations. Additionally, specialty vehicles such as forklifts, ATVs, snow mobiles, and boats will be used for site activities such as chemical delivery, monitoring activities, and sampling wells and lakes.

Large processing equipment such as crushers, mills, conveyors, and cyclones will also be operating virtually continuously during mining operations. Workers will be exposed to the physical hazards of operating equipment, including noise which is almost ubiquitous in mining. It is generated by drilling, blasting, cutting, materials handling, ventilation, crushing, conveying, and ore processing.

Workers will be exposed to a variety of chemical hazards. Mining activities require the use of several hazardous chemicals characterized as toxic (sodium cyanide), reactive (ammonium nitrate), corrosive (hydrochloric acid and caustic soda), flammable (fuel oil, gasoline), and explosive. Several of these chemicals are incompatible with each other and will need to be stored in separate specially designated areas in the warehouse and in explosives magazines. In some cases the chemicals used must be made up into solutions of a specific strength (hydrochloric acid, cyanide, caustic soda, lime) by adding them to water. Most of these reactions generate heat (i.e., exothermic) and/or fumes and odours.

Blasting represents a workplace hazard for workers in the open pit. Proper and improper use of explosives could lead to dangerous situations such as exposure to fly-rock, explosive fumes poisoning, misfires, and premature blasts. There is always potential that some explosives or pyrotechnical products which remain in the ground could be triggered during other works or activities.

Several large mammals such as wolf, bear, lynx, and others are present in the area and may pose a danger to workers. Other seasonal elements such as insects and hot/cold weather may pose safety issues including heat exhaustion, dehydration, hypothermia, or frost bite. Additionally, the site has uneven terrain and could, especially in winter, pose a high slip, trip and fall hazard for workers operating in the open.

8.2.5.2 Ontario Mining Industry Safety Record

According to the Ontario Mining Association (2013, August) Ontario is one of the safest mining jurisdictions. In 2012, approximately 18,700 employees at mine sites in Ontario worked a total of more than 38.3 million hours. For all of 2012, mining's lost time injury rate was 0.5 per 200,000 hours worked. This was an improvement of 0.1 from 2011. The industry's previous best lost time injury rate over a quarterly, or yearly, period was 0.4. Available statistics for the first 3 months of 2013 indicate that Ontario's mining sector had a lost time injury rate of 0.2 per 200,000 hours worked.

Ontario's mining industry has an excellent record of improving its safety performance. Since 1976, the sector's lost time injury rate has improved by 96%. The industry-wide lost time injury rate was 12 per 200,000 hours in 2002, and declined to the 0.4 to 0.2 range in 2012 and 2013.

8.2.6 Effects Mitigation or Enhancement

Prodigy is committed to providing its workers with a safe workplace. It will comply with all relevant Occupational Health and Safety legislation and regulations, including Ministry of Labour enforcement activities. Prodigy shall provide information, instruction, and supervision to all its workers to protect their health and safety. More specifically, Prodigy shall:

- Comply with the practice of, arranging safety meetings and refresher training for returning workers at the beginning of season;
- Take every precaution reasonable in the circumstances for the protection of workers;
- Ensure workers meet minimum age requirements;
- Ensure equipment, materials and protective devices are well maintained and used as per manufacturer's instructions;
- Ensure workers are provided with appropriate supervision and personal protective equipment;
- Prepare and review, at least annually, a written occupational health and safety policy, and develop and maintain a program to implement that policy;
- Post a copy of the *Occupational Health and Safety Act* (OHSA), as well as the name and phone number of the MOL inspector for the district, prominently in the workplace;
- Advise contract truck drivers on traffic control procedures and policies at the workplace; and
- Ensure all workers receive appropriate training, including site orientation and core courses depending on their duties (Ministry of Labour, 2012).

As noted in Chapter 6, Prodigy will become a signatory to the International Cyanide Management Code (ICMC or Cyanide Code) for the gold mining industry prior to the Project becoming operational. The Cyanide Code contains a far reaching and comprehensive set of principles and standards of practice. Cyanide producers and transporters are subject to the applicable portions of the Cyanide Code, which address production, transport, storage, the use of cyanide, and the decommissioning of cyanide facilities. Also included are requirements related to financial assurance, accident prevention, emergency response, public reporting, and stakeholder involvement and verification procedures. The Code is intended to reduce the potential exposure of workers and communities to harmful concentrations of cyanide, to limit releases of cyanide to the environment, and to enhance response actions in the event of an exposure or release.

8.2.7 Residual Effects on Worker Safety

Workplace hazards will always remain at a mine site and some level of harm to workers is likely unavoidable. However, taking into consideration the mitigation by design measures and Prodigy's commitment to providing its workers with a safe workplace, neither serious nor extensive harm to workers is anticipated. No further assessment regarding significance, follow-up or monitoring is warranted.

8.3 References

- Canadian Dam Association (CDA). (2013). Dam Safety Guidelines 2007, 2013 Edition.
- Canadian Environmental Assessment Agency. (2013). Guidelines for the Preparation of an Environmental Impact Statement – Magino Gold Project.
- Canadian Food Inspection Agency. (2011). Canadian Consumption Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products, Appendix 3.
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