RESOLUTION COPPER
Superior, Arizona
Tailings Corridor Pipeline Management Plan

May 2019

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1.0 INTRODUCTION

Resolution Copper Mining, LLC (RCM) is proposing to develop an underground mine within the vicinity of the former Magma Copper Mine in the Pioneer Mining District near Superior, 65 miles east of Phoenix, Arizona. RCM is an LLC owned jointly by Resolution Copper Company (55%), a Rio Tinto plc subsidiary, and BHP Copper Inc. (45%), a BHP Billiton Ltd. subsidiary. Development of the project includes a panel cave mine approximately three miles east of Superior, a concentrator and associated facilities at the West Plant Site (WPS) directly north of the town, and a tailings storage facility (TSF) connected to the concentrator by a tailings corridor.

Tailings produced at the proposed concentrator will be piped to the TSF and reclaim water from the TSF returned back to the concentrator for reuse. The design basis for the tailings corridor is a concentrator throughput of 132,000 short tons per day (t/d) or 120,000 metric tons per day, as described in the Mine Plan of Operations.

The scavenger or Non-Potentially Acid generating (NPAG) tailings and pyrite or Potentially Acid Generating (PAG) tailings will be thickened and transported separately by pipeline to the TSF. The pyrite tailings will be placed subaqueously during operations in order to manage and prevent acid rock drainage. Water used to maintain saturation of the PAG tailings will be recovered and recycled to the concentrator for reuse in the process.

This Tailings Corridor Pipeline Management Plan outlines the design considerations and environmental and spill control measures for pipeline construction and operation.

1.1 Climate Conditions

The regional climate is characterized as semi-arid, with long periods of little or no precipitation. Annual rainfall is between 9 and 19 inches and falls primarily during the winter and summer months, more than 50% between November and April. Temperatures frequently exceed 100°F in the summer, and occasionally dip below freezing in the winter.

2.0 PROJECT DESCRIPTION

2.1 General

The tailings corridor route from the plant site to the TSF will accommodate separate pipelines for the transport of NPAG tailings, PAG tailings, and reclaim water; an access road adjacent to the pipelines and overhead power lines that in some cases follow the alignment.

The route includes pipeline bridges over substantial drainages and culverts to allow passage of stormwater. The terrain is mountainous with a varying degree of drivability.

The components of the design are outlined below and described further in the following sections:

- The design basis for the tailings corridor is a concentrator throughput of 132,000 t/d.
- NPAG tails will be pumped from the tailings thickener and then pumped and/or gravity to the TSF.
- The PAG tails will be pumped all the way to the TSF through a steel and/or HDPE pipeline.
- Reclaim water from the TSF will be pumped back to the process plant through a steel and/or HDPE pipeline.
- The pipelines will be buried to the extent practicable and for those sections above ground on land surface will be within an earth containment channel.
- For sections of the pipeline that are HDPE, earthen anchoring berms will be located at regular intervals across the channel to ensure the pipes are kept apart and do not encroach on adjacent pipes in the event of movement from thermal expansion (snaking). This is not necessary for steel pipelines as it will be heavy walled and thus does not snake.
- An access road will be constructed adjacent to pipelines, running the full length of the corridor at the same grade as the pipeline.
- Associated channels and culverts would be designed to allow passage of storm water to maintain existing upland runoff and major drainage paths that cross the corridor.
- Pipe bridges will be constructed where required to cross major drainages or washes.
- Overhead power lines will generally follow the corridor route in select locations.

2.2 Proposed Route

In general, longitudinal slopes are kept as low as practicable, bridge crossings are extended to avoid the ordinary high water marks of major drainages, and providing horizontal and vertical alignments that optimize the cut-and-fill balance as much as practicable, eliminating the need for long hauls of excavated or borrow materials. Bridges will be designed to span across the channel or canyon with no obstructions to ordinary high water mark, trails, and roads and to minimize disturbance.

A 500-ft to 1000-ft corridor was used in the horizontal alignment. This will provide suitable distance to change the direction of or bend the selected pipes within their specified criteria. The containment channel incorporates vertical curves where the grade changes. These curves allow a smooth transition of flow in select sections of the NPAG tails pipeline.

It was assumed that excavation slopes will average 1H:1V with fill slopes of 1.5H:1V; these parameters will need to be refined and optimized.

2.3 Corridor Profile

A typical section of the tailings corridor above ground would include the following elements:

- a deep gravel-based trapezoidal spill containment channel for pipelines (pyrite tailings, scavenger tailings and the reclaim water pipeline)
- a gravel access road for inspections, maintenance, and repairs
- earthen pipe anchor berms at regular spacing to reduce pipe snaking and provide containment cells for spill control only for sections that may be HDPE.
- outer drainage diversion channels both up gradient and down gradient on either side of the corridor.

Up gradient diversion channels will divert upper catchment storm water from those drainages that are too small for a culvert or alternatively the pipe will be placed on pipe sleepers. This water will be diverted to drainages with culverts under the corridor, to allow the flow to continue downstream. The down gradient channel may be used as a third means of containment beyond the secondary containment channel and for contact stormwater from the corridor.

The main focus of this spill containment channel is to contain any potential leaks and spills from the pipes and also minimize the amount of spills that flow into the outer down gradient channel, which is primarily for contact stormwater.

Power for the tailings and recycle water system will be provided by overhead power lines running along the tailings corridor in some sections The power line will include a ground wire and cabling with a multi-fiber optic cable for communication and instrumentation to support leak detection monitoring of the pipelines.

2.4 Drainage

Suitable drainage of the tailings corridor is essential in maintaining the integrity of this system. In general, all upland storm water runoff will be allowed to continue flowing down gradient within existing drainages via drainage culverts under the corridor. Where it is not practical to install a culvert along the alignment of an existing stream (e.g., where the corridor is in a cut), or where the discharges are small, runoff will be collected in the up gradient diversion channel and conveyed parallel to the corridor for conveyance through culverts placed at desired locations. Design of the drainage facilities and culvert sizing for major drainage paths under the corridor will need further optimizing.

The trapezoidal spill containment channel along the pipeline will be protected from upland runoff by a berm, and the adjacent access road surface will be sloped away from the pipeway. Runoff that collects within the footprint of the pipeway will be discharged to the down gradient collection channel at regular intervals by means of drain pipe installed above the base of the pipeway.

2.5 Pipelines

2.5.1 NPAG Tailings

The NPAG tailings pipeline was designed for 60-65% solids slurry. The slurry flow velocity is designed to exceed the expected settling velocity. Pipeline vents will be installed at changes in pipe slope. These allow for air release resulting from changes in flow depth. Float valves will close the vents if slurry levels rise to the top of pipe, ensuring no leakage.

The NPAG tails will be pumped from the tailings thickener underflow and will flow by gravity or be pumped through pipelines to the TSF. Pipe thicknesses will provide reasonable wear life.

The selection of suitable pipe material for the steeper sections of the pipe will control the slurry velocity without the need for drop boxes. Controlling the velocity will help reduce the wear rate of the pipe. Drop boxes were eliminated as an environmental and safety improvement as presented in the original GPO to reduce the potential for leaks and eliminate wildlife and human contact with tailings as the drop boxes are open to the atmosphere. The removal of drop boxes from the design also allows for the access road to follow the same grade as the pipes, making visual inspections and maintenance easier and more effective.

2.5.2 PAG Tailings

The pyrite tailings pipeline was designed for a pumped flow of 45-50% solids. The slurry flow velocity exceeds the expected settling velocity. The PAG tails will require pumping in series through a pipeline to the tailings impoundment.

2.5.3 Reclaim Water

The reclaim water pipeline recycles water from the tailings and thickeners to a reclaim water tank at the TSF site. From here, the system requires pumping to return the water to the concentrator for reuse.

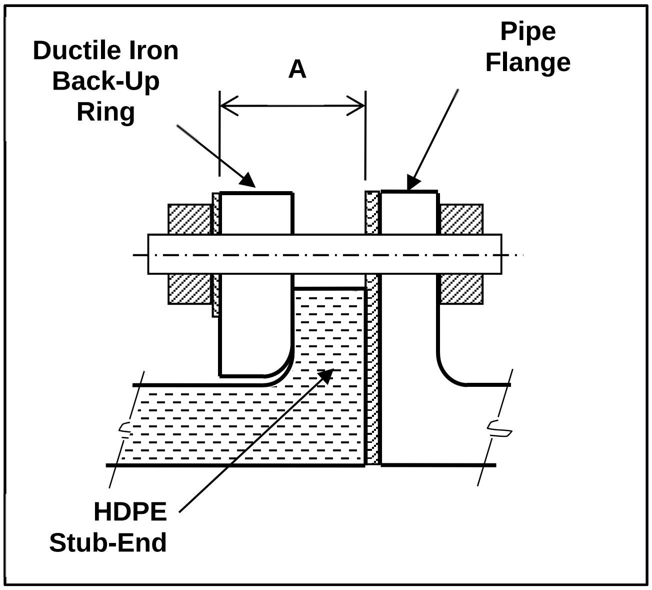
2.5.4 Pipe Material

The following types of pipe are used in the design:

- Heavy Wall Carbon Steel – The majority of pipelines for conveyance of NPAG, PAG and recycle water will likely be comprised of heavy wall steel. The PAG pipeline will also be lined with HDPE. This should allow the pipeline to last the entire mine life without requiring replacement. The pipe will be sleeved for crossings under washes, roads and railways or on bridges.
- HDPE (PE4710) of varying wall thicknesses may also be used for select sections of the pipeline. HDPE pipe comes in lengths of 40 ft or more. The ends are heat fusion welded together to reduce any chances of leakage.

The connection between the different pipe materials is a standard flange type. This type of installation is used extensively and provides for a bolted flange with backup ring to minimize leakage, as shown in Figure 2-1.

Figure 2-1: Typical Flange Connection between Pipes of Different Material



2.5.5 Pipe Installation

For sections on surface, the pipes will be laid at grade within a trapezoidal channel set below the top of the containment berm on one side and the access road on the other (see **Error! Reference source not found.**). The proposed width of the piping corridor will permit lateral expansion of the pipe due to temperature changes without affecting adjacent pipes.

The carbon steel piping on the pipe bridges will be anchored at a mid-point on the bridge and guided on the rest of the bridge. To accommodate thermal expansion for the steel piping sections that extend beyond the bridge, the first anchoring berm will be placed appropriately so that the system can expand laterally.

The piping also needs to be properly anchored at connections to rigid structures such as the tailings head tank. Expansion joints will be provided in cases where steel pipes need to be connected to rigid structures.

The NPAG, PAG and recycled water lines will be furnished with several vent pipes and/or equipped a vacuum breaker at high points. Vacuum breakers will be insulated and located close to the pipe, which generates enough heat from the constant flow to prevent freezing. Freezing of the pipes is also considered a low risk. The NPAG, PAG and recycled water lines will be flushed as required. Shut-off valves for the lines will be placed as required along the length of the pipelines, in particular at the bridges, to isolate a potential leak or spill away from riparian areas.

2.5.6 Pipeline Codes

Pipelines will be designed, manufactured, and installed to the following relevant codes and/or their updated versions as practicable:

- ASME B16 – Standards for Pipes and Fittings
- ASME B16.1 – Gray Iron Flanges and Flanged Fittings
- ASME B16.5 – Pipe Flange and Flanged Fittings
- ASME B16.21 – Non-metallic Flat Gaskets for Pipe Flanges
- ASME B31 – Standards for Pressure Piping
- ASME B31.4 – Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
- ASME 31.11 – Slurry Transportation Piping Systems
- ASME B36.10/19 – Carbon, Alloy and Stainless Steel Piping
- ASTM D3035/F714 – Standard Specification for HDPE Pressure Pipe
- ASTM D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Pipe

2.6 Access and Bypass Roads

The tailings corridor includes a gravel-surfaced access road running adjacent to the pipelines to provide access between the concentrator and the TSF. In fill areas, an earthen safety berm will be constructed alongside the road.

A wheel wash will be provided at the TSF end of the tailings corridor to ensure contact tailings material on site vehicles is removed before travelling along the corridor access road.

If pipe bridges are needed, bypass roads will be required at the pipe bridges because they are not designed for vehicular traffic.

2.7 Pipe Bridges

Pipe bridges if needed, will be constructed along the tailings corridor alignment to span major drainages outside of the ordinary high water mark.

The pipe bridges would include a walkway and a dolly-and-rail system for inspections and maintenance purposes.

2.8 Forest Service Road Crossings

Where the pipeline cross Forest Service roads, underpass and/or overpass structures will be provided to accommodate both the pipeline and road requirements in these areas.

2.9 Ancillary Facilities

An administration complex will be provided near the terminus of the pipeline corridor at the TSF. This complex will be the main location for ongoing monitoring, maintenance, and spill response for the tailings corridor.

3.0 HISTORICAL CAUSES OF FAILURE

3.1 General Description

Pipelines have the potential to fail for several reasons, resulting in leaks or release of slurry. The most common causes of pipeline failure are outlined below. The prevention measures, to reduce the chance of failure, are identified in the risk assessment (Section 3.3) and further detailed in Section 4.0 of this plan.

3.1.1 Mechanical

Mechanical failures include punctures, cuts, crushing, and separation. The cause of these failures is primarily accidental impact from construction or operations equipment. A small number of mechanical failures are the result of manufacturing defects or inferior materials.

3.1.2 Operational

Operational failures include separation, collapse, accidental release, or failures related to pipe movement. An overpressure event will cause ruptures or separation at joints or equipment connections. Water hammer events can result from all of these failures and cause pipe movement.

3.1.3 Corrosion and Wear

Corrosion is a natural process that converts a refined metal to a different form, such as an oxide, hydroxide, or sulfate. It is the gradual destruction of metals by chemical reaction with their environment. Corrosion may be seen as pitting, weld decay, crevice corrosion, and microbial corrosion.

Wear or abrasive erosion is defined as the gradual and progressive loss of material due to the relative motion between the pipe wall and a fluid containing solid particles. The magnitude of wear depends on the angle of impingement and the type of material being eroded.

Each of these can result in leaks and potential pipe failures.

3.1.4 Natural Hazards

Natural hazards are events or processes in nature that can result in damage from ultraviolet light, rainfall, flooding, landslides, wind, lightning strikes, plants, and animals. Historically, seismicity in the area is sparse and there is a very low potential for earthquake activity (URS, 2013).

3.1.5 Third-Party Damage

Third-party damage can be categorized as intentional / malicious damage, accidental damage, and incidental damage. Intentional / malicious damage would be the result of theft or intent to cause harm; historically there have been issues with people in the area shooting at objects for target practice. Accidental damage can take many forms including damage from private vehicles hitting the pipeline. Incidental damage is defined as damage to a pipeline that does not cause an immediate leak or failure but results in a failure over time.

3.2 Frequency of Failure

Historical data related to causes and frequency of failure of pipelines in Western Europe[1] were used in identifying the probability of failure. Conditions causing pipe failure under given circumstances are similar around the world, and this information on failure frequency is considered suitable for use in this analysis. It has been demonstrated that overland pipeline failures occur less than 0.01% of the time, generally as a result of third-party accidental, mechanical, and operational issues. Most of the time, 50% to 90%, these failures result in a leak size of 0.4 inches or less. Full-bore failure is usually caused by natural hazards but is the least frequent of the failures (0.001%).

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3.3 Risk Assessment

A risk matrix was developed for the pipelines running through the tailings corridor to better understand the potential issues associated with pipeline construction and operation. By determining how and where risks could originate, it was possible to develop preventive measures and management strategies for the pipelines. The risk matrix is shown in Table 3-1.

Spill prevention and detection and storm water management are the most important environmental aspects of the pipelines. The proposed corridor infrastructure and operational controls take these considerations into account over the entire alignment.

[1] Data source – Consideration of Clean Air Water in Western Europe Report 98: Western European Cross-Country Oil Pipelines 25 Years Performance Statistics, June 1988 and European Gas Pipeline Incident Data Group.

Best practice environmental protection measures and controls will be implemented to prevent leaks and spills from the pipelines. Preventive measures will be put in place and procedures followed throughout the life of the facility—from construction and operation. The proposed controls identified for each phase of work are outlined in the following section.

Quality assurance practices will help ensure the planned control measures are met during each phase. Equipment, materials, and the development of management plans will be in accordance with the international quality system requirements as well as other relevant specifications and codes, identified previously in this document, covering the following:

- pipeline treatment and testing
- inspection procedures during fabrication
- identification of specific product parameters
- fabrication and welding control
- pipe coating inspection and testing
- valve manufacture and testing
- pipeline hydrotesting.

Table 3-1: Risk Matrix for Tailings Corridor Pipelines

Category	Risk	Prevention Measures	Mechanical Fault	Operational Fault	Corrosion / Exposure	Joints & Flanges	Natural Hazard	3rd Party Accidental	3rd Party Deliberate	Addressed in Section
Environment		**During Construction and Operation**								
Geohazard	Rock fall	• slope stabilization, grade, revegetation, as required					x			**4.2.2, 4.3.1**
Storm Event	Runoff – water volume	• all storm water runoff directed away from containment into drainage channels and culverts designed to 100-year discharge flow rates • overflow pipelines for containment					x			**4.2.7, 4.3.1**
	Sediment and erosion	• gravel surface in pipeline corridor & road • road crossfall away from containment • upland runoff diverted to channels and culverts designed to 100-year discharge flow rates • revegetation as soon as practicable • sediment and erosion control – plan developed / equipment in place / team trained					x			**4.2.1, 4.2.5, 4.2.7, 4.3.1**

Table 3-1: Risk Matrix for Tailings Corridor Pipelines (cont'd)

Category	Risk	Prevention Measures	Mechanical Fault	Operational Fault	Corrosion / Exposure	Joints & Flanges	Natural Hazard	3rd Party Accidental	3rd Party Deliberate	Addressed in Section
Design / Technical										
Pipes	Leaks – at joints / at pipe material change points / splits / holes	• CCP with zero leakage requirements • separation of pipelines • secondary containment channel • secondary containment outer casing pipe on bridges • compliant leak detection / flow monitors in place	x	X	x	x				**4.2.1, 4.2.3, 4.2.4, 4.2.6**
Construction and Operation	Poor installation	• QA/QC system in place	x			x				**4.4, 4.5**
	Security / sabotage, public access – construction / operation	• fence / gates at required locations • separation at crossings • public awareness / signage • daily inspection						x	x	**4.2.4, 4.2.5, 4.5.3, 4.5.4, 4.5.6**
	Leaks – at joints / at pipe material change points / splits / holes	• routine preventative maintenance • regular review of leak monitor data • daily inspections • regular internal inspections • spill response – plan developed / equipment in place / team trained	x	X	x	x				**4.3.2, 4.5.1, 4.5.2, 4.5.4, 4.5.5, 5.0**

4.0 PREVENTION AND DETECTION OF PIPELINE FAILURES

4.1 General

Management of pipeline environmental protection involves various activities and procedures at different phases of the project. The success of the protection controls is highly dependent on thorough integration of the environmental objectives into the design of the pipelines and on proper implementation of drainage and spill containment features, both during installation and when the pipes are operational.

4.2 Design Control Measures

All pipelines are designed in accordance with the relevant standards and guidelines, as listed previously in this document. The following control measures have been incorporated or taken into consideration in the design of the tailings corridor.

4.2.1 Pipeline Route Selection

The pipeline route will be optimized within the ROW to minimize environmental impact by reducing and balancing the amount of cut-and-fill and total overall disturbance. As much as is practicable, fill needs will be met with existing material on site, resulting in less disturbance.

Bends will be designed to minimize ground disturbance to the extent practicable and provide suitable distance to change direction or bend the selected pipe within their specified criteria without increasing risk of leaks.

4.2.2 Earthworks

Earthworks will be balanced locally in zones along the corridor to further minimize haul distances and allow the earthworks to be carried out in stages. This would reduce the size of any exposed and disturbed areas at any given time.

Although seismic activity is not considered a major risk on site, the proposed design slopes in the order of 1.5H to 1V (to be reconfirmed in future as more geotechnical data become available) and controls (adjacent drainage channels and containment berms) will help minimize the potential for landslide or rock fall on the pipelines during major rainfall events.

4.2.3 Pipeline Materials of Fabrication

The pipeline materials and thickness are selected specifically to minimize scouring, corrosion, and UV deterioration. All piping on the pipe bridges will be heavy wall steel, HDPE or rubber-lined carbon steel to better control thermalexpansion and reduce "snaking" to help minimize the bridge width. These lines will also be enclosed within a casing pipe to provide a double-walled system for secondary spill containment and allow better leak detection.

All pipes in the tailings corridor are designed with a minimum wall thickness of 0.5 inches, although most pipe sections are thicker, to reduce the likelihood of failure.

To the extent practicable, pipelines above ground will be at grade for ease of visual inspection and access for maintenance and repair. The pipes will be separated, according to their size and material, to ensure they do not touch when in operation.

Joints and especially flanges where the pipe material changes, are the most susceptible locations for leaks. The connection between different pipe materials is a standard flange type. This type of installation is used extensively and provides for a bolted flange with backup ring to minimize leakage, as shown in Figure 2-1.

4.2.4 Leak Detection

The tailings and reclaim pipelines will be monitored to detect leakage. The monitoring information will be used for alarm, interlock, and reporting functions. Multiple types of monitoring will be applicable to accommodate differing pipeline applications, the pipe installation, and to provide redundancy in the system. The following methods will be used:

4.2.4.1 Flow and Containment Monitoring

- Flow monitoring of recycle water and tailings lines. Measurements from each end of the pipelines will be input to the plant control system, and the values will be compared to evaluate leakage in the system. Flow measurement and installation will be selected to suit each application.
- Containment area level monitoring, using non-powered level switches. These switches are float type and are connected to the I/O or serial type communications link. They have no electronics and do not require a separate power source. The monitors would be located at a low point in each containment, adjacent to overflow pipelines, at regular intervals. This instrumentation will also report the accumulation of excessive runoff in the containment area.
- Double-wall pipeline leakage detection across bridges, using a probe or float type level switch in pipeline pockets / stations. These would be located at regularintervals and at each end of the double-walled piping systems.
- CCTV cameras at critical locations, with Power over Ethernet type cameras at bridge locations, underpass / overpass areas, and changes in pipeline material types as a minimum. Other locations can be considered during detailed design. Images will be

available for recording / logging and will be displayed on monitors in the plant control room, security office, or other locations, as part of overall plant CCTV system.

- Daily inspections of double-walled systems using low point drain / valve.
- Daily inspections of complete pipeline system.

4.2.4.2 Communications

Information will be delivered from the monitoring systems to the plant control systems using multiple methods:

- Flow measurement analog signals using hard-wired connection to control system input modules at each end of the pipeline.
- Containment level monitoring (level switches) and double-wall pipe leak detection (station/switch type) using dedicated serial communication cabling (via pole line) to the tailings area and plant control systems.
- CCTV as part of the fiber optic cabling / communications network.

4.2.5 Roads and Bridges

The pipeline corridor service road will run along the full length of the pipelines, at the same grade, to provide uninterrupted access between the concentrator and the TSF. The proposed road is designed to readily accommodate daily inspections and maintenance of the pipelines. This road will be gravel-surfaced to allow all-weather access and to prevent scouring and erosion. The pipeline corridor will be designed to allow for uninterrupted ranching and recreational use of existing Forest Services roads and also to allow wildlife to pass through the area.

To reduce the risk of mechanical failure, the above ground pipelines will be segregated and bermed or buried to prevent contact with equipment and vehicles. Additionally, the designated access road will ensure vehicles can travel along the length of the corridor separated from the above ground pipelines to prevent interaction.

Where required, fencing and gates will be installed to restrict public access and wildlife along the corridor. Proper bedding will be provided for the pipes where roads cross the pipelines.

To the extent practicable bridge types will be selected to span the required widths with no obstructions, to minimize disturbance, and without the need for any intermediate supports along their length. The bridges across major drainages will be constructed outside of the ordinary high water mark. This reduces environmental impact by minimizing disturbance and eliminating any obstruction within the valleys and drainages.

4.2.6 Containment

As described throughout this document the above ground pipelines will be laid within a channel with containment berms to act as a secondary containment and to control any spills from potential pipe leaks escaping into the local environment. The containment areas will be gravel-surfaced to prevent scouring and erosion.

4.2.7 Drainage

The pipe bridges to be constructed over major drainages will be installed above the ordinary high water mark of those drainages. Alternatively, pipes may be placed under the scour line of major drainages. Other major drainage channels along the corridor are designed to direct all adjacent natural runoff towards culverts that will control flow through the project site. These drainage structures are provided at fill areas to handle the runoff from storms and minimize the impact on existing natural water courses.

The tailings corridor access road slopes away from the pipelines. This, combined with cutoff drains and bund walls that run along the length of the corridor, will channel non-contact water from up gradient drainages away from the above ground pipeline spill containment areas and into existing drainage paths. Rock protection will be provided for all drainage structures.

Runoff inside the containment may be contact water and will be held within the containment and used in the process. Overflow pipes in the containment zones will discharge runoff into local cutoff drains so that the water escapes under controlled conditions before overtopping the cell. The invert of these pipes will be above the containment zone floor so that sediment is kept within the containment and can be dug out and disposed of appropriately (within the TSF or tailings thickeners).

4.3 Stormwater Management

Before construction begins a stormwater pollution prevention plan, incorporating sediment and erosion controls , will be developed to describe how control measures are to be implemented and inspected, and to outline any requirements for analytical monitoring and recording. This will ensure that any areas prone to erosion and sediment flow during storms will be suitably controlled and stabilized, with drainage collection and diversion measures in place. A spill prevention and control plan will be prepared for both construction and operations, describing specific procedures for inspections, maintenance, incident actions and reporting, and emergency response. .

4.4 Construction Control Measures

All pipelines will be fabricated and tested in accordance with the requirements of American Society of Mechanical Engineers (ASME) B31.3 for quality assurance and quality control purposes.

It is planned to construct the access road along the corridor first, together with drainage structures and sediment controls, so that the installation of pipelines, bridges, and other corridor facilities can proceed along a managed, contained access-way.

Daily activities during construction will include visual inspections as part of a routine monitoring program, good housekeeping, erosion control maintenance, pipeline construction QA/QC, and any necessary repairs. Similar activities, at an increased frequency, will be required during and after rainfall events.

4.5 Operations Control Measures

Risk to pipeline integrity is governed by its physical characteristics, its environment, and its operation. During operation, risks are managed by implementing the appropriate prevention and control measures and following a standard management approach (plan, implement, monitor, review, and revise). QA/QC systems will be in place to monitor operational compliance.

4.5.1 Internal Inspection Pigging (intelligent pigging)

Pigging in the context of pipelines refers to the practice of using devices known as “pigs” to perform various maintenance operations. This is done without stopping the flow of the product in the pipeline. Pipeline pigs are devices that are placed inside the pipe and traverse the pipeline.

Internal inspection pigging is used primarily for defect monitoring, which enables potential problems to be identified and rectified well before leaks occur. Intelligent pigging is used as a tool for prevention of a leak by providing an assessment of pipeline integrity.

Intelligent pigging is carried out during the early period of pipeline operation to provide a baseline record of the pipe wall thickness and any anomalies that are present. Subsequent pig runs, as part of routine operations and preventive maintenance programs during the life of the operation, will identify any changes in wall thickness and the need for repairs.

4.5.2 Continuous Flow Monitoring

The operators will monitor flows in accordance with methods described in Section 4.2.4. A difference in flow rate will indicate a potential leak.

4.5.3 Daily Patrols

Regular patrols along the pipelines are a practical method of assessing all areas of the pipeline route. They are a visible reminder to people in the area of the presence of the pipeline and play a key role in preventing pipeline faults through third-party incidents. The patrols will ensure effective operation of the tailings corridor facilities and check for anomalies such as:

- pipeline leaks
- containment spills, sediment build-up and breaches
- drainage sediment build-up, blockages and wash-outs
- access road erosion and damage
- pipe bridges and over / underpass damage
- landslides
- third party interference
- other potential hazard.

The pipelines will be patrolled to check for leaks and hazards and to ensure the security of the system.

4.5.4 Planned Maintenance

A structured approach to maintenance optimization will be adopted, based on the appropriate application of condition-based, planned preventive and corrective maintenance techniques. .

5.0 SPILL RESPONSE

RCM's General Plan of Operations includes information to be included in a Spill Prevention and Control Plan. Although spill response plans are developed to reflect specific facility designs, they generally include the following components:

- description of site operations
- leak detection procedures
- facility drainage systems
- spill prevention measures
- emergency and spill response and cleanup procedures
- spill reporting and notification procedures
- employee training.

RC will have operators and staff working 24 hours per day throughout the life of the mine. Additional staff will be available on an emergency basis if needed during night shifts. Also RC has multi-year emergency services agreements with local emergency services to help provide support in the event of a leak. Staff members will be supplied with radios for instant communication with the control room and other staff. The mine will own all necessary equipment or have contractors readily available on site for repair of a pipeline failure. Spill response kits will be stored at both ends of the tailings corridor, at the concentrator area, at the tailings administration complex, and also on the pipe bridges. The pipeline access road will provide reliable and immediate access to the full length of the line. If the situation requires additional resources or heavy equipment, they are readily available in nearby Globe-Miami or Phoenix / East Valley, Arizona.

Any suspected leak will be investigated. If a leak is identified, an appropriate prepared response plan will be initiated. This plan will include an evaluation of the need to stop the pumps or shut off the flow. Some leaks may be temporarily repaired safely without taking the pipe out of service. Any such temporary repair would be formally addressed during the next scheduled shutdown of the pipeline. Pipeline shutdowns are anticipated to be in line with concentrator shutdown timing.

Leaks will be evaluated by RC staff to understand the root cause, quantity spilled, and regulatory reporting requirements.

Victoria Boyne

Subject: FW: EXTERNAL:Tailings Pipeline Management Plan
Attachments: Resolution Tailings Corridor Pipeline Mgt Plan-May2019.doc.pdf

From: Peacey, Victoria (RC) <Victoria.Peacey@riotinto.com>
Sent: Tuesday, May 14, 2019 9:09 AM
To: Rasmussen, Mary C -FS (mary.rasmussen@usda.gov) <mary.rasmussen@usda.gov>
Cc: Donna Morey <dmorey@swca.com>; Chris Garrett <cgarrett@swca.com>; RCPermitting <RCPermitting@riotinto.com>; Morissette, Mary (RC) <Mary.Morissette@riotinto.com>
Subject: EXTERNAL:Tailings Pipeline Management Plan

Hello Mary,

For your review and consideration, please see the attached tailings corridor pipeline management plan. Once a final TSF alternative is selected this plan would be refined specific to the alternative.

As a reminder, a separate pipeline management plan was submitted on 5/3/2019 for the concentrate pipeline corridor within the MARRCO.

Thanks,

Vicky Peacey
Senior Manager – Permitting and Approvals

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