Knight Piésold CONSULTING

MEMORANDUM

To:	**Savannah Resources PLC**	**Date:**	07 December 2018
Attn:	Alan Rubio	**Our Ref:**	PE18-01237
		KP File Ref.:	PE501-00080/01-A bas M18008
cc:		**From:**	Brett Stevenson

RE: MINA DO BARROSO – SURFACE WATER QUALITY MANAGEMENT

Knight Piésold Pty Ltd (KP) has been engaged by Savannah Resources PLC (Savannah) to generate a surface water management system design for the Mina do Barroso Project, located in northern Portugal.

Surface water management structures will be required to control and manage runoff from all of the disturbed catchments and a number of the undisturbed catchments that are located in the project area.

This memorandum summarises the design intent and measures adopted to reduce the impact on water quality, specifically of the Covas River, which runs through and immediately downstream of the current project lease area.

1. DESIGN INTENT

The design intent of the surface water management system is summarised as follows:

- Intercept rainfall runoff from areas disturbed by mining. This will be achieved with a series of channels, shallow drains and low bunds which will direct water to containment structures.
- The containment structures will be located to manage storm flows in a controlled manner.
- The containment structures will be sized to contain storm volumes which occur on a regular basis. For larger storms, discharge will occur and the system will be designed to safely route the runoff through the system and into the Covas River.
- The structures will be designed to reduce the impact of the structures on the existing flow regime. For example, all discharges into the Covas River will occur close to or at the original natural catchment discharge point and flows will not be significantly changed from pre mining conditions.
- All attempts to contain sediment intercepted by the system will be made prior to discharge back into the Covas River.
- Poor quality water, e.g. discharge from pit sumps, will be directed preferentially into water treatment systems for use as process make up water.
- Runoff from undisturbed catchments will be kept separate for disturbed area runoff as far as practical.

2. DESIGN ISSUES

The ability to manage water at the site and ensuring that it is discharged into the Covas River at an acceptable quality is currently significantly constrained. The two most significant constraints are the steep topography and limited area available for

appropriately sized sediment control structures within the current lease boundary. Due to these constraints it will not be possible to contain all runoff from extreme storm events for a period long enough to ensure all sediment is contained on site.

It is also noted that currently the working assumption is that the waste rock and tailings are essentially benign and seepage and rainfall runoff from these areas (and the pit walls and sumps) will not contaminate the runoff water with environmentally significant elements. This assumption will require confirmation by additional geochemical testing (currently underway as part of the Definitive Feasibility Study).

3. CONSTRUCTION CONTROLS

A number of measures will be implemented during construction to reduce the impact of surface water runoff from area disturbed by construction and early mining activities, summarised as follows:

- Generation of a detailed construction surface water management plan prior to earthworks being undertaken.
- Scheduling of earthworks in critical areas during the drier months of the year.
- Limiting the area of disturbance at any one time as far as practical to reduce the overall amount of sediment generated which will need to be managed.
- Construct the formal sediment control system prior to any major earthworks.
- Construct a surface water management system that consists of a number of structures in series, with the water quality improving in each structure. Nominally, a target of three structures in series is planned:
  i. At the work face to capture coarse sediments.
  ii. Between the active work or mining area and final structure.
  iii. Immediately upstream of the discharge location into the Covas River.
- Capture sediment generated during construction using temporary structures such as silt fences, rock check dams, vegetation bunds and catch ponds.
- Undertake earthworks in a manner that utilises borrow areas as sumps (ie: do not direct discharge areas offsite).
- Prohibit side casting of fill from excavation, borrow and mining areas.
- Ensure all excavated soil and rock waste is placed in a formal engineered structure with diversions systems in place upstream and containment structures in place downstream.

4. OPERATIONAL CONTROLS

During operations, the following measures will be taken to:

- Continuously rehabilitate disturbed areas to reduce sediment loads and improve overall amenity.
- Capture sediment in permanent sediment control embankments.
- Ensure all excavated soil, tailings and waste rock is placed in a formal engineered structure with diversions systems in place upstream and containment structures in place downstream.

5. POST CLOSURE CONTROLS

Closure design will aim to re-establish the resulting landforms to a point which are:

- Safe to both humans and wildlife.
- Non-polluting.

- Geotechnically stable with erosion controlled to acceptable levels.
- Self healing / self armouring drainage lines.
- Self-sustaining vegetation, with minimal maintenance required.
- Ecologically similar to the pre-mining environment, incorporating local native taxa and fauna habitat to the extent practicable.
- Visually compatible with the surrounding natural landscape.
- Suitable for agreed post-mining land uses.

At closure, measures will be taken to:

- Finalise the rehabilitation, specifically the reestablishment of natural drainage lines and catchments wherever possible.
- Establishment of vegetation to reduce erosion, for the remaining disturbed areas of the project area.
- Revegetate the landscape where possible. This is unlikely to be possible for steep cut slopes and areas where there is rock at surface.

Yours faithfully
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