APPENDIX 7D

AQ2 2019b - SURFACE WATER DISCHARGE ASSESSMENT

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Memo

To	Craig Bovell	**Company**	Doral Mineral Sands
From	Mark Nicholls	**Job No.**	136B
Date	21/10/2019	**Doc No.**	006a
Subject	Doral Yalyalup Operations - Surface Water Discharge Assessment		

Craig,

We are pleased to provide you with the following brief report outlining the surface water discharge assessment which has been completed for the Yalyalup Heavy Mineral Sands Operation.

1. INTRODUCTION

1.1 Background

The proposed Doral Yalyalup heavy mineral sands resource is located 10 to 14km south-east of the Busselton CBD, in the south-west region of Western Australia (Figure 1).

A surface water discharge assessment has been completed to determine the runoff volume which may be required to be discharged following a large design storm event. This assessment considers the proposed mining activities within the development disturbance area as shown on Figure 1. It is assumed that any surface water runoff from within disturbed areas of the Yalyalup mine site must be collected and either added as input to the water circuit or discharged off site. The 100-yr, 72-hr rainfall event has been selected for this study. Note that the likelihood of an event of this size occurring during the 3.5-year mining operation is 3.5%.

In addition to this assessment, a surface water assessment (AQ2, 2019a) and a site water balance (AQ2, 2019b) and have been completed for the life of the Yalyalup operations.

The initial surface water assessment (AQ2, 2019a) outlined that all runoff from catchment areas upstream of the mine envelope will be diverted around mining operations and discharged to a downstream water course. Runoff from areas within the mine envelope must be either used in mining operations (typical rainfall) or discharged through a designated location (i.e. following large event, or if water surplus exists).

The site water balance (AQ2, 2019b) indicated that generally the runoff from the operations would be able to be consumed by the process. However, utilizing the synthetic future rainfall data generated from historical records, during the winter of 2023 more than 50% of the model iterations required discharge of surface water from the site, due to large open pit footprints and catchment areas.

1.2 Purpose

This memo has been prepared to support Doral's Environmental Review Document (ERD) submission to the Department of Water and Environmental Regulation (DWER, former Environmental Protection Agency (EPA)).

In addition to typical rainfall conditions, there is a risk associated with the unexpected release of water into the environment, particularly following large rainfall events.

This discharge assessment is completed to conservatively estimate the runoff volume that will be recommended for discharge from Doral's Yalyalup project area.

2. METHODOLOGY

This surface water discharge assessment has estimated the runoff volume that will be expected for emergency discharge from the Process Water Dam (PWD) and Drop Out Dam (DOD) following a 100-yr, 72-hr rainfall event at the Doral mining operations in Yalyalup. Total runoff volume was determined by calculating the total runoff volume generated over the entire disturbance area for the design rainfall depth. The following parameters were used in the calculation:

- Disturbance footprint of 3.61km^2, as shown in Figure 1 which represents the entire mining lease within the proposed flood diversion bund from the surface water assessment (refer AQ2, 2019a).
- 100-yr, 72-hr rainfall event depth of 168mm.
- Runoff Coefficient of 0.75, corresponding to a proportional loss rate of 25% for a 100-yr event in loam soils with 100% clearing (as per ARR Rainfall and Runoff Volume 1, 1998).

The following conservative assumptions were made in the calculation:

- Water generated from the full mine area within the site boundary flood bund, reports to the PWD/DOD.
- All storage capacities on the project site, including mine voids and storage ponds are full and unable to store or attenuate the required runoff rates.
- Other site water inputs (such as dewatering) will meet the mine water demands during the rainfall event, such that no runoff from the rainfall event will be consumed by the mine process.

Note that the site water balance study (AQ2, 2019b) included model iterations with rainfall events that exceeded the 100-yr, 72hr event and estimated overflow volumes from the PWD/DOD. However, the key differences in this assessment compared to the site water balance assessment are that this assessment adopts a significantly larger catchment area and higher runoff coefficient and therefore results in significantly larger runoff estimates.

3. RESULTS

The total runoff volume that may require discharge under emergency situations following a 100-yr event, is approximately 450ML. This estimated volume accounts only for rainfall runoff within the mine lease area and does not include inflows from upstream catchments, all of which are assumed to be diverted around the disturbance footprint and released downstream (as per the Surface Water Assessment, AQ2, 2019a).

Note that this assessment is highly conservative due to the following:

- The likelihood of a 100-yr rainfall event occurring within the 3.5-year mine life is 3.5%.
- The full mine footprint area has been assumed to contribute to the discharge volume. In practice, at any one time there will only be a single mine void open, plus previously mined areas in various stages of backfill and rehabilitation. Undisturbed areas will not be required to pass through the PWD/DOD.
- The site is dissected by a diversion channel which will pass flow from upstream of the mining area to downstream. It is unclear how runoff following a large event will cross the drain to the PWD/DOD, and therefore it is likely that this runoff will discharge via a separate basin.

The runoff from the site which would be required to be discharged from the site following a large, rare rainfall will be returned to the same catchment it would have discharged through prior to mining activities. As such, there is not expected to be any hydrological impacts of discharging this water to the downstream environment. Doral should monitor the quality of the runoff prior to discharge to ensure it meets any discharge water quality requirements.

4. CONCLUSION

The mine life of the Yalyalup Heavy Mineral Sands operation is 3.5 years. Runoff from typical rainfall is expected to be consumed as process water, thus reducing the requirement for pumping from the Yarragadee aquifer. However, in the event of a large, rare rainfall event, an allowance for emergency discharge of all runoff generated from disturbed areas is necessary. Based on this assessment, a recommendation is made to allow discharge of 450ML following the 100-yr, 72-hr event. At these discharge volumes, there is unlikely to be adverse impacts to the downstream hydrological regime, as the discharge from the disturbed areas will be returning to its original downstream catchment below where the mine has been developed.

We trust that this surface water discharge assessment memo meets your requirements. Please contact us if you require additional information regarding this assessment.

Regards,

Mark

Consulting Water Resources Engineer

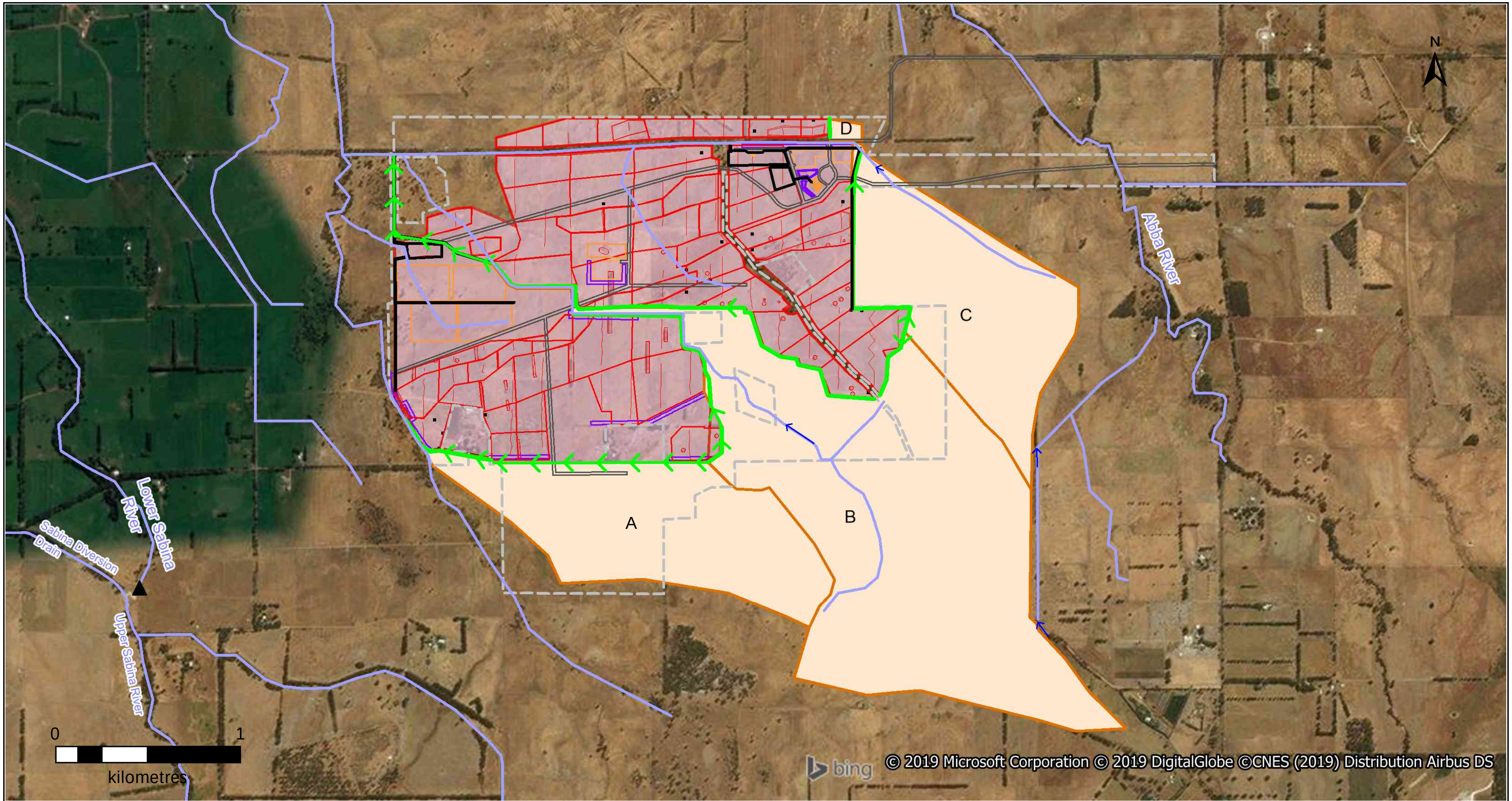
Jeff

Consulting Hydrologist

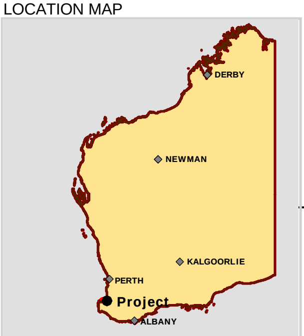
Author: MN (21/10/19)
Checked: BJ (21/10/19)
Reviewed: MN (21/10/19)

Attached

Figure 1: Disturbance Footprint



LOCATION MAP



LEGEND

- Project Mine Envelope (Disturbance Area)
- A Upslope Catchment
- Lower Sabina Catchment
- Drainage Line
- Bund/Diversion
- Clean Water Diversion
- Pit Outline Locations
- Stockpiles (topsoil and overburden)
- Other Infrastructure (workshop/admin/slime tailings)
- Potential Disturbance Envelope
- Haul Road
- Doral Pipes/Drains

AQ2

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NOTES & DATA SOURCES:

Pit Upslope catchment based on Topographic 2m contours from DPIRD - Department of Primary Industries and Regional Development (1999); and local culvert under Yalyalup Road

Pit Locations and Infrastructure from Doral (2019)

FIGURE 1

DISTURBANCE AREAS

Location:F:\136\4.GIS\Figures_Hydrology