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MEMO

To:	Jonathon Barker, MBS Environmental
From:	Stewart McCallion
cc:	Matt Shackleton, Kristy Sell, Jess Li
Date:	20/04/2018
Re:	Lake Wells Potash Project – Hydrology Study Summary

A feasibility-level hydrology assessment was recently completed for the Lake Wells Potash Project (LWPP) by Golder Associates (Ref. 1667336-003-R-Rev0, *Lake Wells Potash Hydraulic Study,* December 2017). The following is a summary of the assessment and its results as they pertain to the Environmental Impact Assessment.

To evaluate the likely impact to surface water run-off and extent of flooding in the LWPP area, the following work was completed:

- Review of previously derived flood estimates applied in the initial hydraulic modelling
- Delineation of catchment boundaries and characterisation of natural (existing) surface water drainage patterns
- Revision of contour plan for the study area to incorporate the detailed topographic (LiDAR) survey and development of and updated digital elevation model (DEM) for the project area
- Hydraulic analysis and flood risk assessment based on quantifying extents and depths of flooding for a range of design floods associated with various annual exceedance probabilities (AEP) from 0.05 (i.e. 1 in 20-year storm event) to 0.01 (i.e. 1 in 100-year storm event) followed by preparation of flood maps detailing estimated peak flood levels and flow velocities.

In the absence of local, long-term rainfall and evaporation records, a daily data climate sequence for the LWPP area was downloaded from the SILO database. SILO is an enhanced climate database hosted by the Science Delivery Division of the Department of Science, Information Technology and Information (DSTII) containing Australian climate data from 1889 to the day prior to present. The daily time series of data at a point location is based entirely on interpolated estimates from gridded datasets available over the land area of Australia. Rainfall intensity-frequency-duration (IFD) data were developed using the Bureau of Meteorology (BOM) Computerised Design IFD Rainfall System (CDIRS). This approach is compatible with the procedures described in *Australian Rainfall and Runoff* (ARR, 2016).

The catchments in the region of the LWPP playa area were delineated with the DEM: two major catchments, totalling approximately 5,600 km^2, flow into the playa area from the north and south and, smaller catchments in the immediate vicinity of the LWPP playa contribute an additional 500 km^2.

Flood hydrographs (i.e. flow or discharge against time) were developed for the both the north and south tributaries, and peak flood levels for various AEPs were modelled by applying the Flavell method. The peak floods were increased by 50% due to the lack of any recorded local flood data and associated uncertainties in the flood estimates. The time to peak flood was calculated to be approximately 18 hours, which is the approximate time of concentration of both the northern and southern catchments. Furthermore, rain falling directly on the LWPP playa area and in the smaller, adjacent catchments over an 18-hour storm event was also added to the peak flood levels.

The flood modelling was conducted on existing (pre-project) conditions and following construction of the proposed on-playa evaporation ponds and other local infrastructure by overlaying engineering designs on the existing topography. Stormwater runoff collects in the LWPP's central playa area and only in extreme storm events (i.e. greater than a 1 in 50-year), does the stormwater runoff flow out of the LWPP playa area into the adjacent playa area to the east (a continuation of the Lake Wells system) via a topographic saddle. In both pre- and post-construction conditions, the storm flow velocities are very low. Flood conditions for the existing and post-construction conditions are illustrated as Figures 1 to 4.

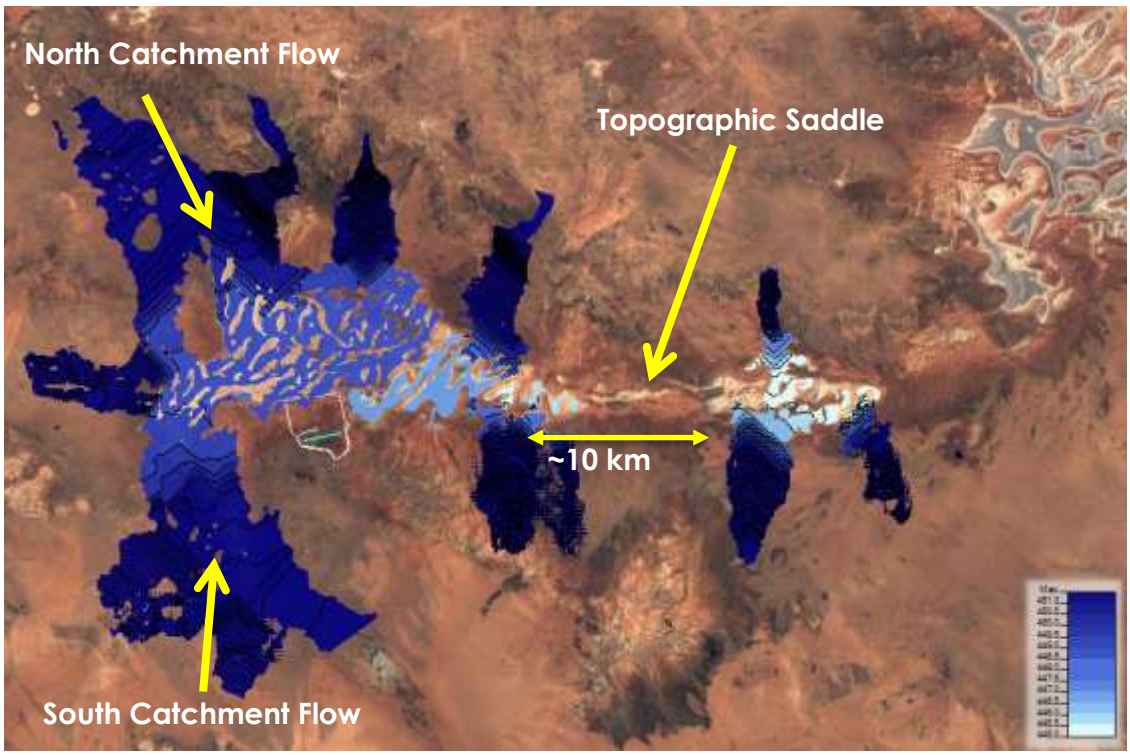

Figure 1: Estimated Maximum Flood Levels (m AHD) 0.02 AEP Flood – Existing Conditions

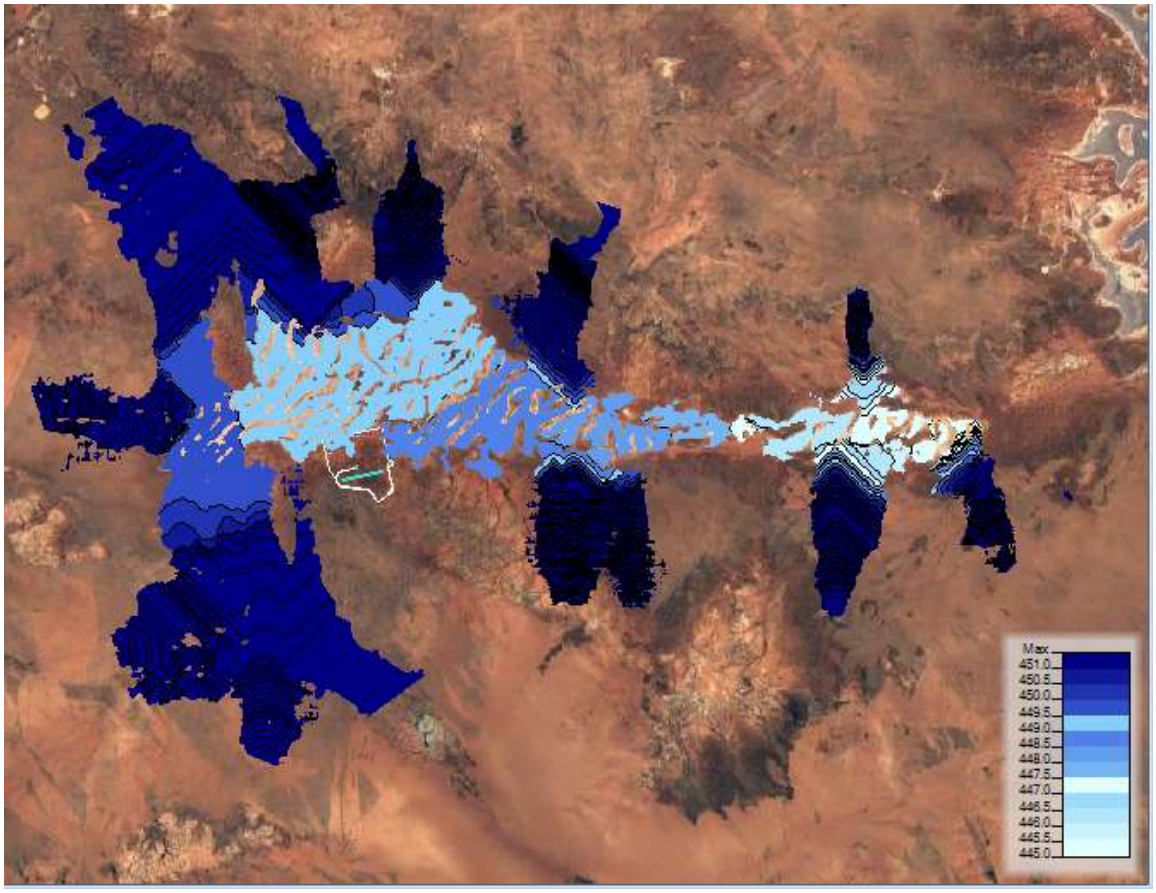

Figure 2: Estimated Maximum Flood Levels (m AHD) 0.01 AEP Flood – Existing Conditions

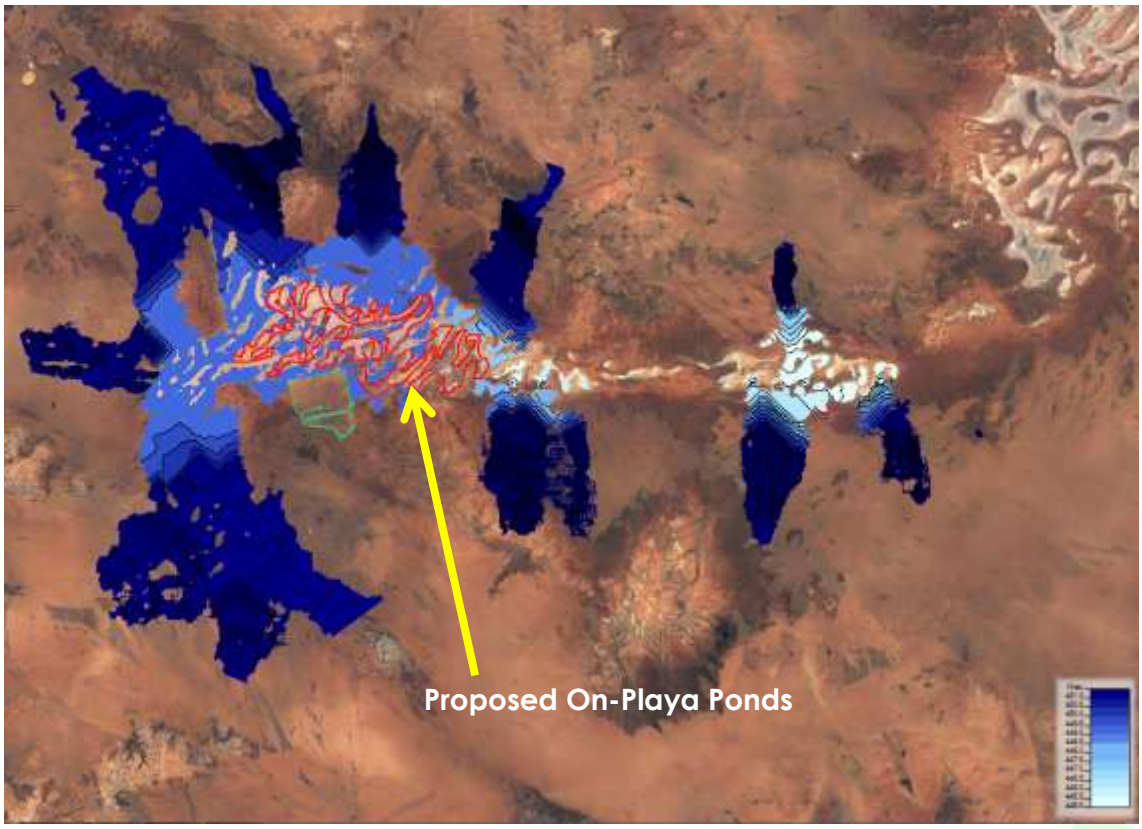

Figure 3: Estimated Maximum Flood Levels (m AHD) 0.02 AEP Flood – With Project Infrastructure

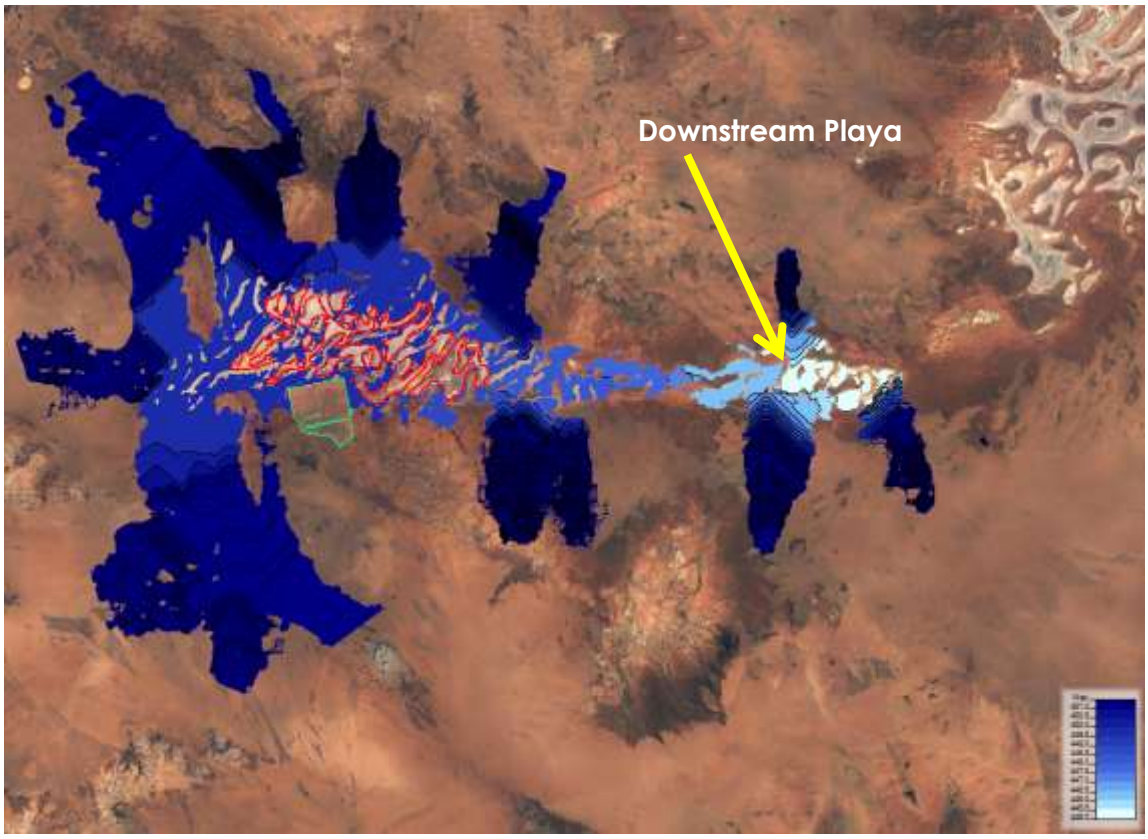

Figure 4: Estimated Maximum Flood Levels (m AHD) 0.01 AEP Flood – With Project Infrastructure

The assessment indicates that following construction of the project infrastructure there may be a small increase in flood levels to the playa system downstream of the project area, but only for floods exceeding the 0.02 AEP event (i.e. greater than a 1 in 50 year). This marginal increase is unlikely to have a measurable impact on either volumes or of surface run-off draining into the larger lake systems to the east of the Project. Furthermore, flow velocities remain very low in flood events following construction of project infrastructure, indicating that excessive erosion or sedimentation is unlikely to exceed what may occur in existing (pre-construction) conditions.