

25 January 2017

## TRENCHING AND PUMP TESTING AT LAKE WELLS CONFIRM BRINE PRODUCTION POTENTIAL OF THE SHALLOW AQUIFER

Salt Lake Potash Limited (**SO4** or **the Company**) is pleased to advise that initial pump testing of trial trenches at the Lake Wells Project (**the Project**) has returned excellent results, substantially increasing the Company's confidence in the hydrogeological model for extraction of brine from trenches for production of Sulphate of Potash (**SOP**) by solar evaporation.

### Surface Aquifer Exploration Program Highlights:

- An 8.5 tonne amphibious excavator has completed 207 shallow test pits and 8 trial trenches at the Lake Wells Project.
- Sustained pump tests have been completed on two trenches in the southern part of the Lake. Highlights include:
  - Flow rates above **1 litre per second (L/s) from a 50m long trial trench recorded during the duration of the test.**
  - **Modelled annual flow rates of 1.1 – 1.3L/s** based on a 1 year simulated model of the results recorded during the 50m trial trench pump test.
- The results from these initial trench pump tests have confirmed the potential of trenching to produce sufficiently large volumes of brine and will provide valuable data for the pre-feasibility study.
- The Company gained valuable geotechnical information about the material stability and the competency of the open trenches while brine flowed into them from the surrounding aquifer.
- The trench excavating process also yielded valuable geological, hydrogeological and geotechnical results for siting and designing on-lake evaporation ponds.
- Work is ongoing on both the surface aquifer, and drilling and test pumping of the deeper paleochannel aquifer, to refine the brine production model for the Project.

**CEO Matt Syme commented** "We are very pleased with the results of the initial trenching campaign at Lake Wells. The sustained pump tests results provide a high level of confidence in the potential for substantial brine production from shallow trenches. The test pits and trenches are also providing a wealth of very important geological and geotechnical data which will be very important for the ongoing feasibility studies for the Project."

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## Surface Aquifer Exploration Program

In November 2016, the Company mobilised an 8.5 tonne amphibious excavator to gather further geological and hydrological data about the shallow brine aquifer hosted by the Quaternary Alluvium stratigraphic sequence in the top 20 meters of Lake Wells.

The aim of the program is to evaluate the geology of the shallow Lake Bed Sediments, and to undertake pumping trials to provide estimates of the potential brine yield from trenches in the shallow sediment.

The excavator program is also providing important geological and geotechnical information for potential siting and construction of on-lake brine evaporation ponds.

The program to date included the excavation of 207 test pits in three tranches over the lake playa (refer to Figure 1). The test pits were generally excavated to 1 meter x 1.5 meters and a depth of 4 meters and are representative of the shallow stratigraphy of the Lake playa.

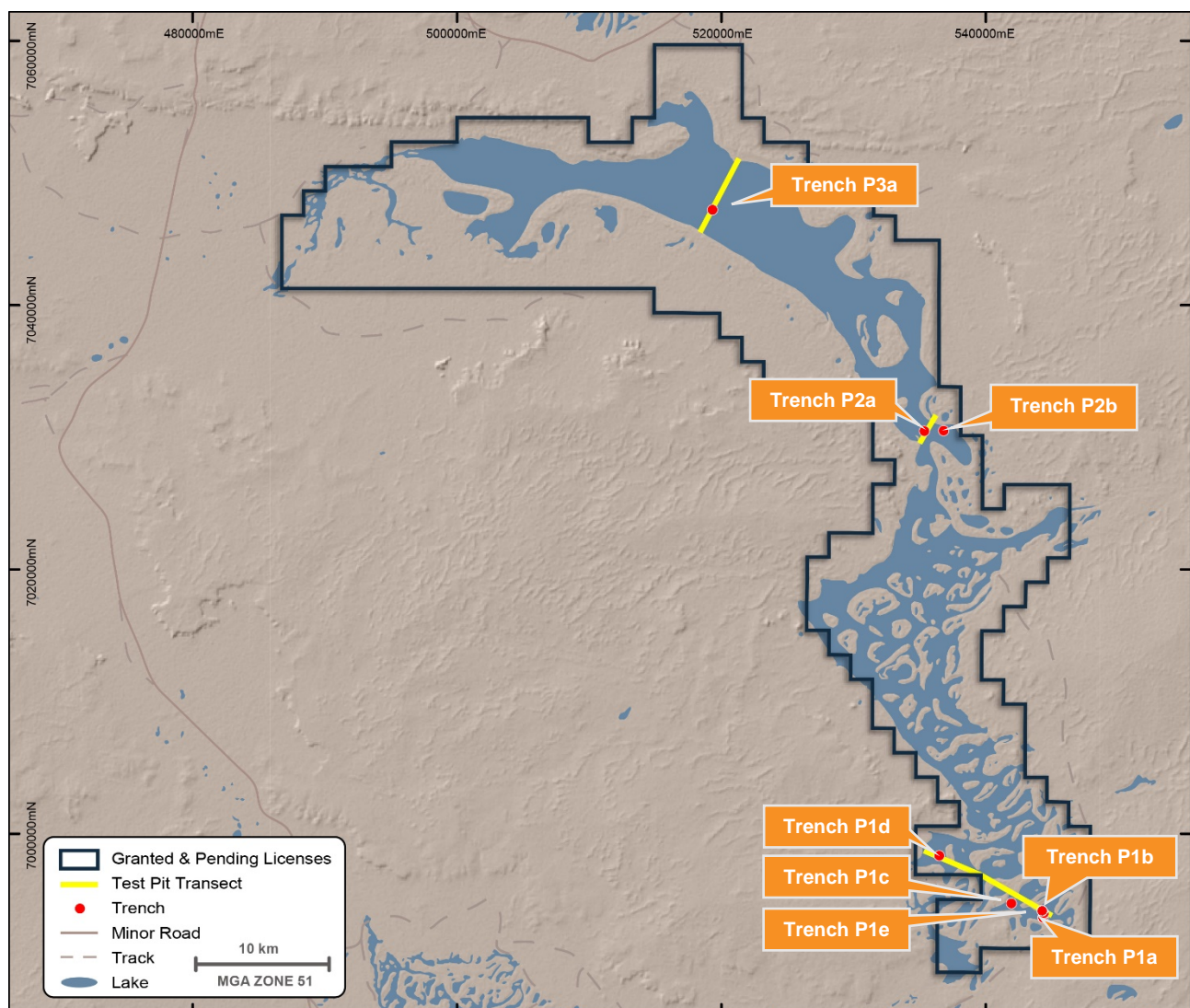


Figure 1: Map of Lake Wells Trench Locations



The test pits were logged for geology, hydrology and brine chemistry during the excavation process. Particle Size Distribution (**PSD**) samples and brine samples were taken from each pit.

The test pits were also subject to short duration pumping tests in order to analyse the recovery of the brine levels in the test pits.

Based on the geology and hydrological information from the test pits, a number of sites for excavation of larger test trenches were chosen, reflecting the variability of the geology and hydrogeology encountered in the lake playa sediments.

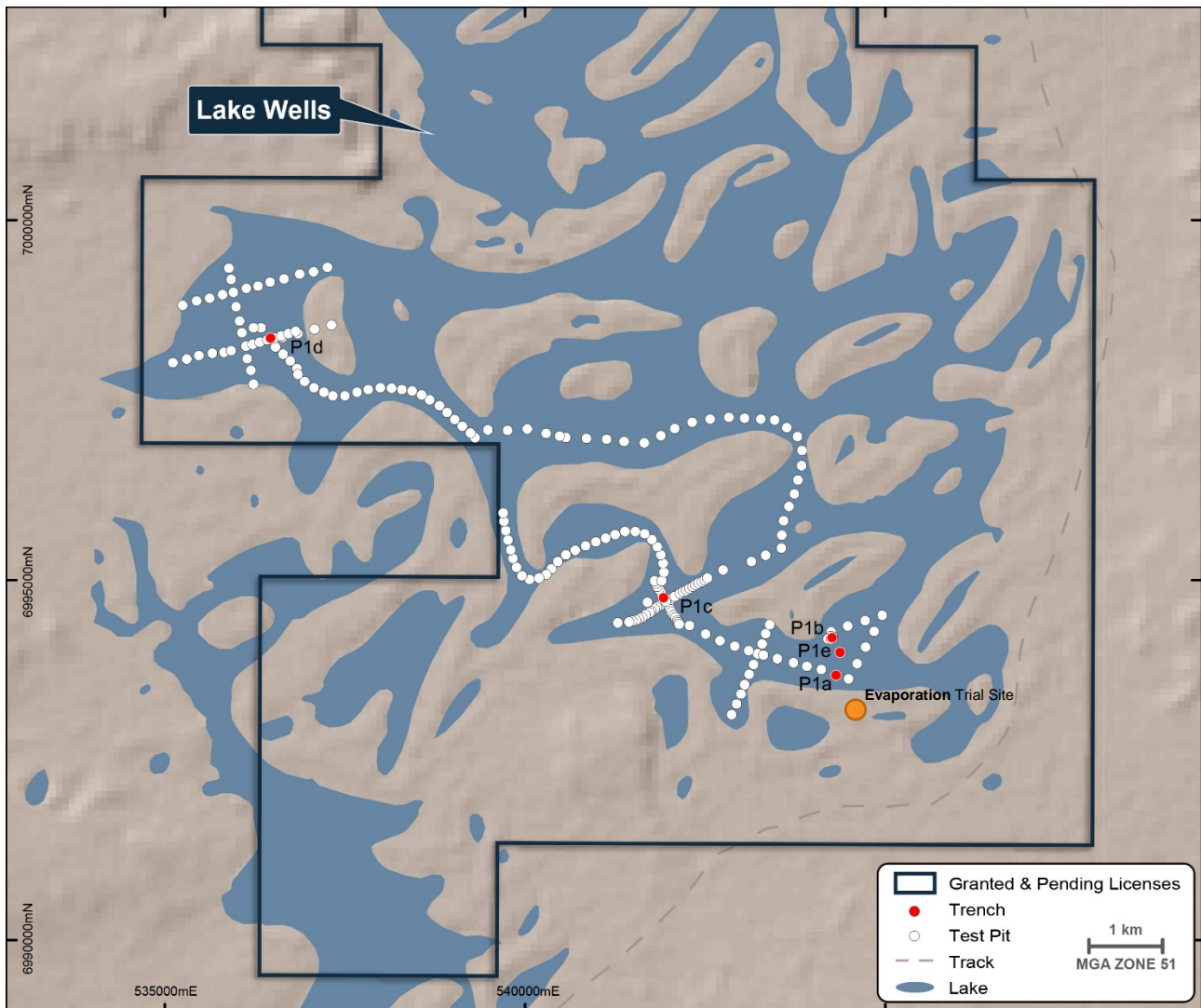
A total of eight trenches were excavated on the chosen sites, each approximately 4.5 meters deep and between 25 meters to 50 meters long. Benching was used to provide geotechnical stability for the trench sidewalls and the resulting trenches are approximately 5m wide at the surface and 1m wide at the base.

Five of the trenches were located in the southern end of the Lake Wells, in close proximity to the Evaporation Trial Site (see Figure 3).

To date two trenches have been test pumped (P1a and P1c in Figure 3).



Figure 2: Test Trench Excavation at Lake Wells



**Figure 3: Trench and Test Pits in the southern part of Lake Wells**

### Geology of the shallow sediments

Based on the widespread test pits the shallow aquifer geology is reasonably uniform across the Lake. The shallow sediment is generally composed of Cenozoic (Quaternary - Holocene) brown to white to red, unconsolidated, gypsiferous sand, silt and clay with a strong overprint of ferric oxides from 0.5 to around 3 – 8m depth. Dominated by sub-angular, well sorted, very fine to medium quartz sand, the sand commonly grades progressively to a more silt and clay dominated sediment with depth, with occasional interbedded sand lenses. Authigenic prismatic and tabular gypsum is common, growing in discontinuous, vein-like structures throughout the unit, with a large variety of crystal sizes. Minor, medium-grained lithic fragments can be found throughout this gypsum.



***Trench P1a (25m)***

The geological sequence in P1a consisted of a 0.7m layer of surficial coarse grained evaporate sand overlying silt and clay with evaporate clasts to 3m depth. Plasticine clays were encountered from 3m to the base of the trench. The trench appears to have average brine flows in visual comparison to other trenches and test pits.



**Figure 4: Trench Pump Testing in Progress at Trench P1a**



***Trench P1c (50m)***

For P1c the geological sequence includes a 0.4m thick layer of surficial coarse-grained evaporite sand overlying silt with evaporite clasts to 2m depth. The interval from 2m to 2.8m comprised a stiff fractured/fissured clay that yielded significant brine. Sediment from 2.8 to 3.6m was soft clay and the underlying interval to total depth of 4.4m was silt and fine grained evaporate sands that also yielded brine.



**Figure 5: Trench P1c at Lake Wells**

## Sustained Test Pumping Results

Trenches were test pumped for several days using a pair of centrifugal suction pumps yielding up to 4L/s each. The test pumping process involved pumping out the trench volume with both pumps until the brine level was drawn down to a predetermined level above the trench floor. The pump yields were then restricted to keep the brine in the trench at this predetermined level. The brine from the trench was disposed away from the test trenches to prevent recycling of brine and creating an artificial recharge boundary.

Observation wells were constructed at distances varying from 10, 20, 50, and 76 meters away from the trenches to measure the water table drawdown in the surrounding aquifer during trench pumping (see Figure 8 model). These wells were logged for geological information and constructed with slotted 50mm casing to the bottom of the well at 6 meters below surface.

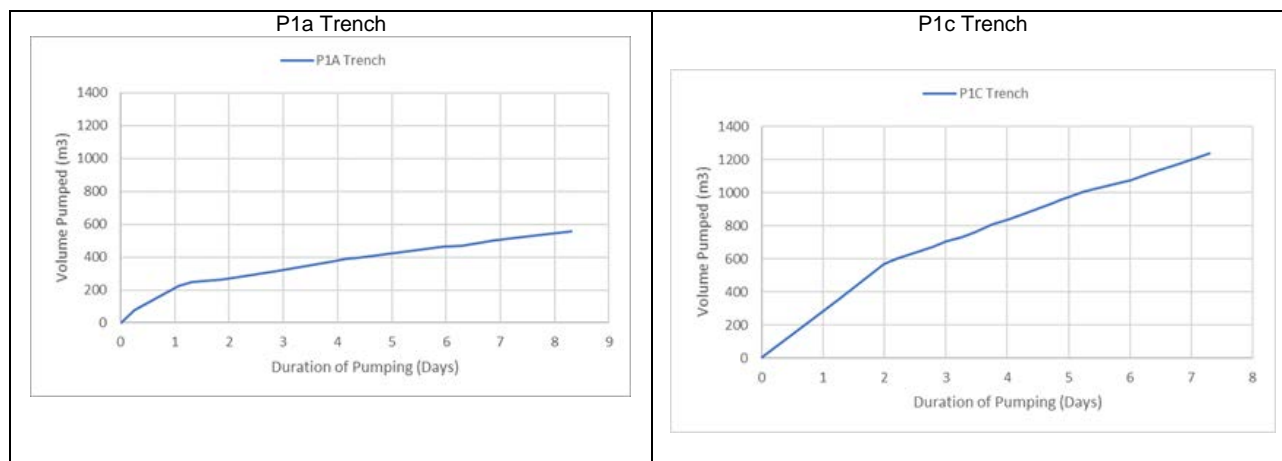
The brine level elevations were measured with water data loggers in both the trench and the observation wells and verified during the test pumping with manual readings. The cumulative brine yield from the pumps were measured with a calibrated flow meter.

Standing water level of the brine was approximately 0.5m below ground surface at each trench and in the observation wells before test pumping started.

## Data Analysis

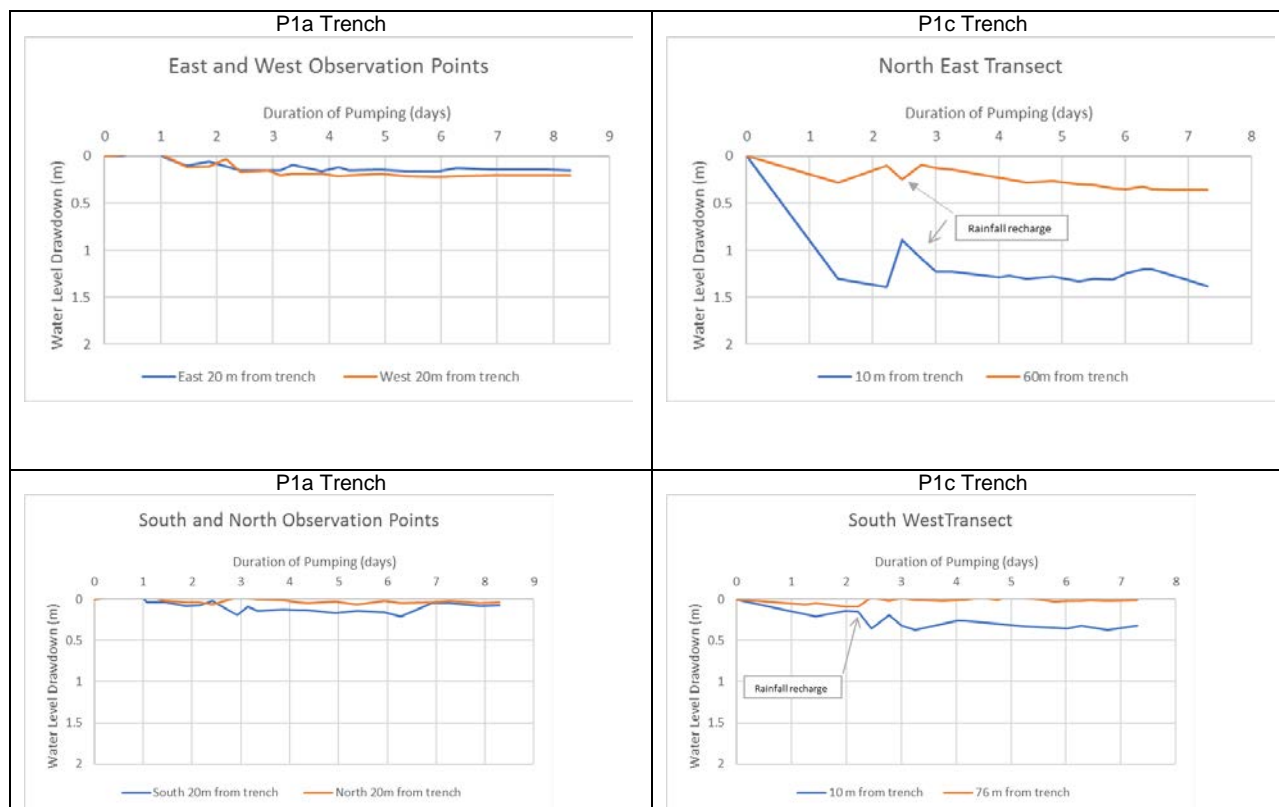
The data from the trench test pumping were analysed and processed based on the measured brine flows, water level readings in the trenches and the observation wells. The results are shown in Figures 6 and 7 below.

Note that the amount of brine pumped daily from the trenches decreased after one day in P1a and two days in P1c. This is due to the removal of the trench storage. After this initial period the inflows were from the surrounding aquifer material.



**Figure 6: Brine flow rate over time**

As expected, the aquifer material surrounding the P1c trench displayed more permeability than the material surrounding the P1a trench and this can be seen in the drawdown measured in the observation wells as shown below in Figure 7.



**Figure 7: Water Level drawdown in observation wells**

### **P1a Detail Analysis**

The brine level in the trench was drawn down by 1.4m to stabilise at approximately 1.7m below ground surface. Pumping was then continued at a lower rate to maintain a constant brine level in the trench and balance brine inflow to the trench with pumping. By the end of the 8.3 day trial the flow rate from the trench had reduced to 38m<sup>3</sup>/day (0.6L/s) as the surrounding material close to the 25 meter long trench was dewatered.

### **P1c Detail Analysis**

The brine level in the trench was drawn down by 2m to stabilise at approximately 2.5m below ground surface, pumping was then continued to maintain a stable water table in the trench, while brine inflow from the surrounding sediment balanced pumping from the trench. By the end of the trial the pumping rate required to maintain a stable brine level had decreased to approximately 130m<sup>3</sup>/day (1.6L/s) as the surrounding material close to the trench was dewatered.

Two rain events occurred during the P1c pumping trial, the first on 3 December 2016 (day 2 of the trial) and the second on 5 December 2016 (day 4 of the trial). The magnitude of each rain event was approximately 20mm, and the effect of rainfall recharge is observed in rising brine levels measured at monitoring bores around the trench.

These observations indicate the importance of recharge on the long-term water balance of the shallow lake bed aquifer.

Observation bores to the northeast of the trench exhibited significantly greater water table drawdown than the observation bores to the southwest indicating that the sediment is more permeable toward the northeast of the trench. Two permeability zones were applied in the model, a high permeability zone to the northeast of the trench and a lower permeability zone to the southwest.



## Numerical Flow modelling

A MODFLOW numerical flow model was constructed for each trench site using Visual Modflow software system (McDonald and Harbaugh (1988)<sup>1</sup>, SWS, 2011<sup>2</sup>) based on the geological and hydrogeological data for each site.

The models were calibrated to the pumping flow rate and water table drawdown measured during each test. These calibrated models provide estimates of the hydraulic properties of the Lake Bed Sediments which will be used to inform the Pre-Feasibility Study for the project.

The models assume consistent hydraulic properties of the Lake Bed Sediment within the zone of influence of pumping. To date insufficient data is available to characterise any extended spatial variability in the geology.

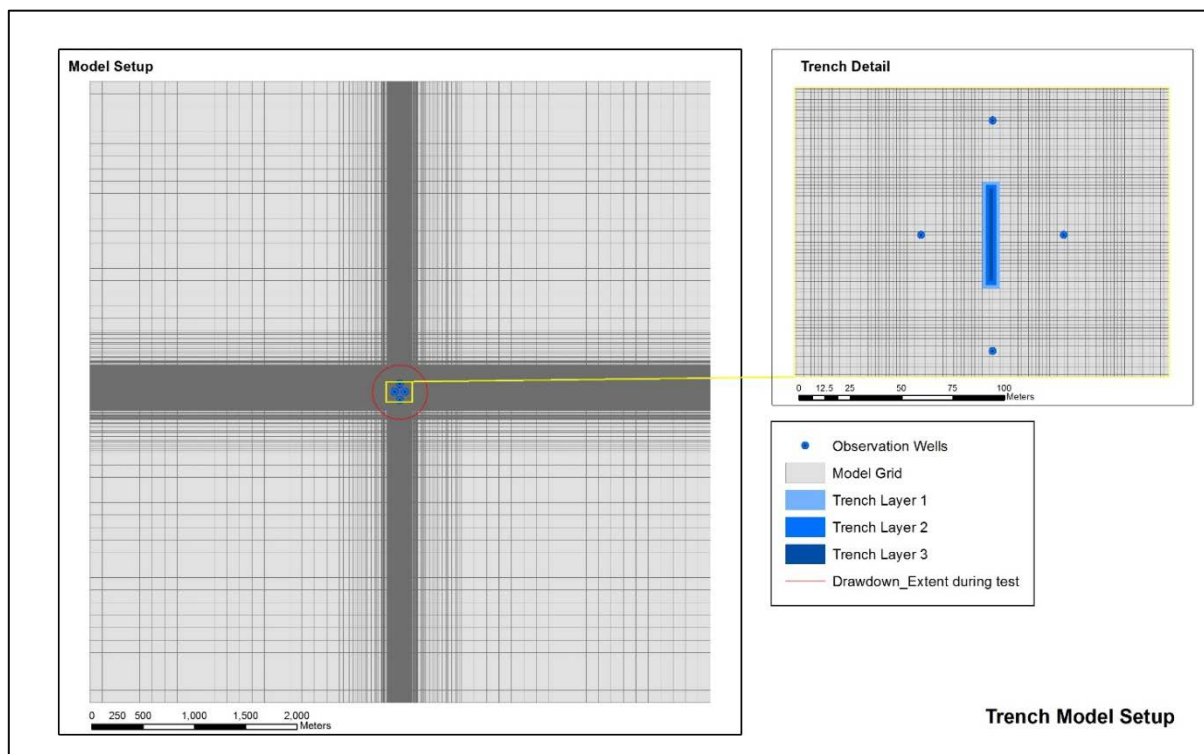


Figure 8: Trench P1a Model Setup

## Modelling results

	P1a	P1c
Trench Depth	4.5 m	4.5 m
Trench Length	25 m	50 m
Total Volume Pumped	557 m <sup>3</sup>	1,240 m <sup>3</sup>
Duration of Pumping	8.3 days	7.3 days
Average Flow Rate	67 m <sup>3</sup> /day	170 m <sup>3</sup> /day
Calibrated Model Aquifer Properties		
• Permeability	3 m/day	0.3 – 40 m/day
• Drainable Porosity	10%	7%

Table 1: Trench Pumping Trial Overview

<sup>1</sup> McDonald and Harbaugh (1988), *A modular three-dimensional finite-difference groundwater flow model*. USGS. Techniques of Water Resources Investigations book 6, chapter A1

<sup>2</sup>, SWS, 2010, *Visual Modflow users Guide*, Schlumberger Water Services

The results shown above indicate that the drainable porosity of the aquifers are very similar while the permeability vary much more due to the different geological settings of the trenches.

### **Longer term brine yield**

The calibrated models developed for each trench were run for an extended duration of 1 year to assess the expected longer term brine yield from a test trench.

For each trench the calibrated model was run for a range of rainfall recharge scenarios:

- a) no recharge,
- b) 10% of annual rainfall (22mm)
- c) 15% of annual rainfall (34 mm).

The total volume pumped for each recharge scenario is presented in Figure 9 and Figure 11. Pumping rate over time is shown as Figure 10 and Figure 12.

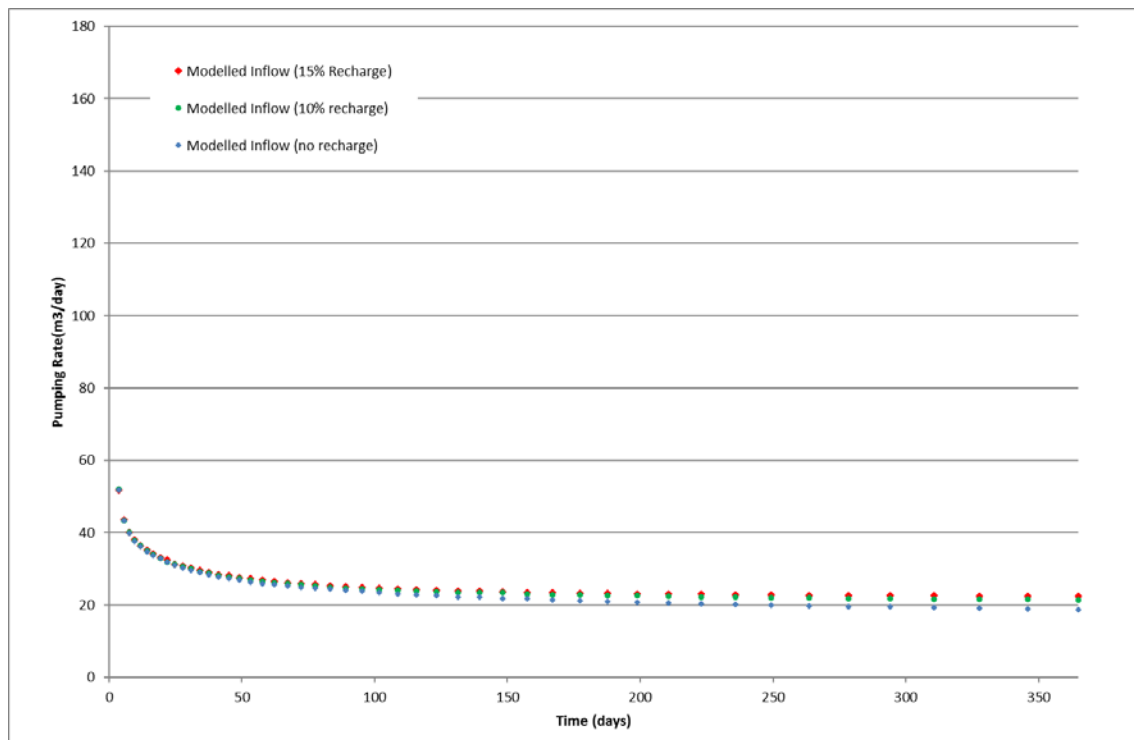
Trench P1a yielded a total of 8,000 to 9,000m<sup>3</sup> (equivalent to 0.23 – 0.28L/s) over the 1 year simulation for the different recharge scenarios while P1c yielded 36,000 to 40,000m<sup>3</sup> (equivalent to 1.1 – 1.3L/s) over the 1 year simulation with the same recharge scenarios. The difference in lengths (P1a = 25m, P1c = 50m) did not account for large difference in pumped volume and it is attributed to the fact that trench 1C is excavated into highly permeable material.

### **P1a Long-term Yield**

The long term yield of brine into trench P1a stabilised at ~20m<sup>3</sup>/day (0.25L/s) for the 25 meter trench as shown in Figure 9.

### **P1c Long-term Yield**

The long term yield of brine into trench P1c stabilised at ~105m<sup>3</sup>/day (1.2L/s) for the 50 meter trench as shown in Figure 11.



**Figure 9: Trench P1a – Modelled Brine flow rate over 1 year simulation.**



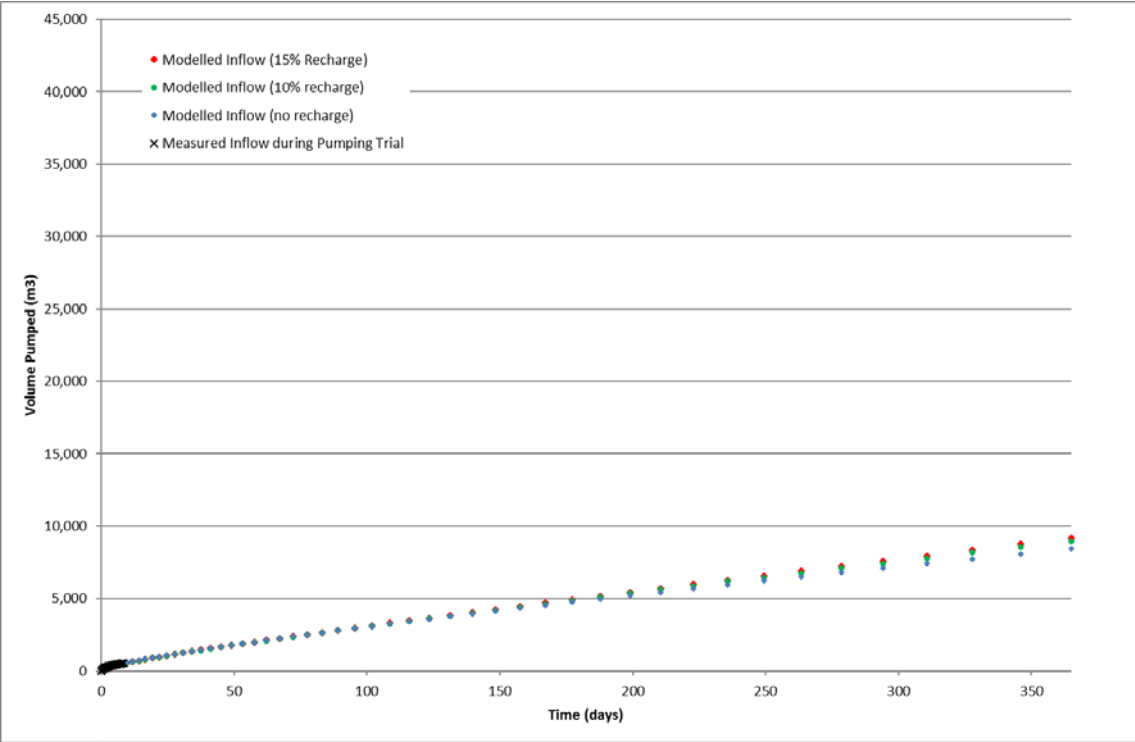


Figure 10: Trench P1a – Total Pumped Volume over 1 year simulation.

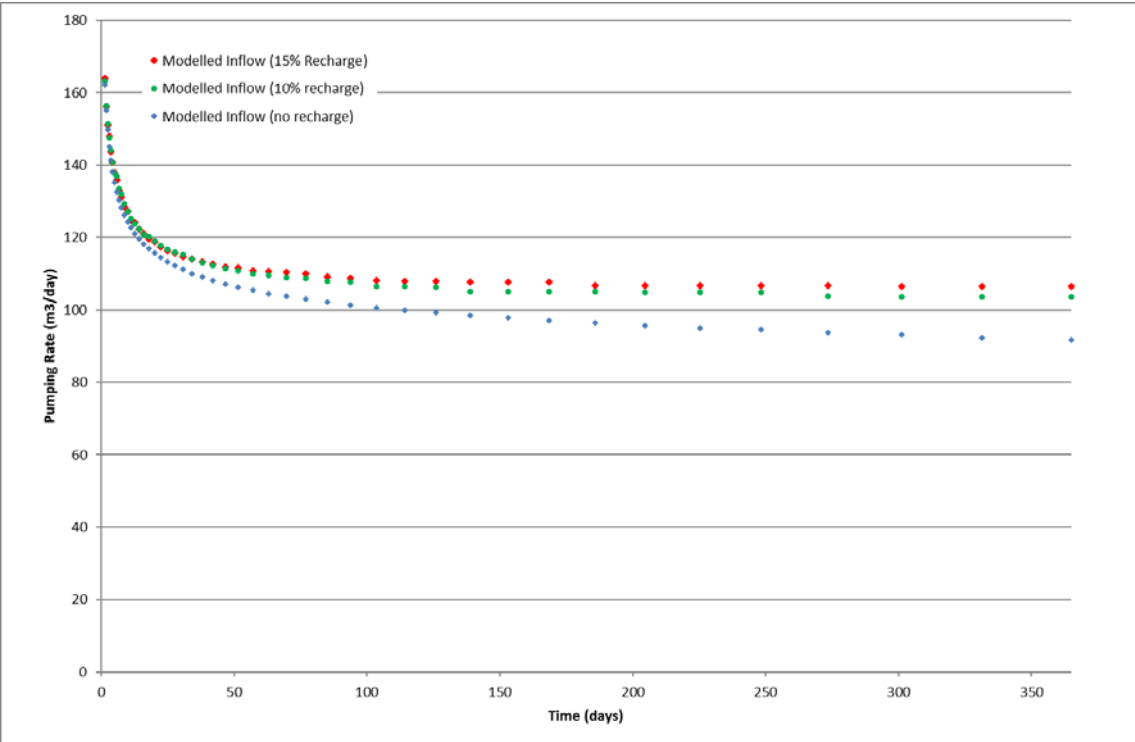


Figure 11: Trench P1c – Modelled Brine flow rate over 1 year simulation

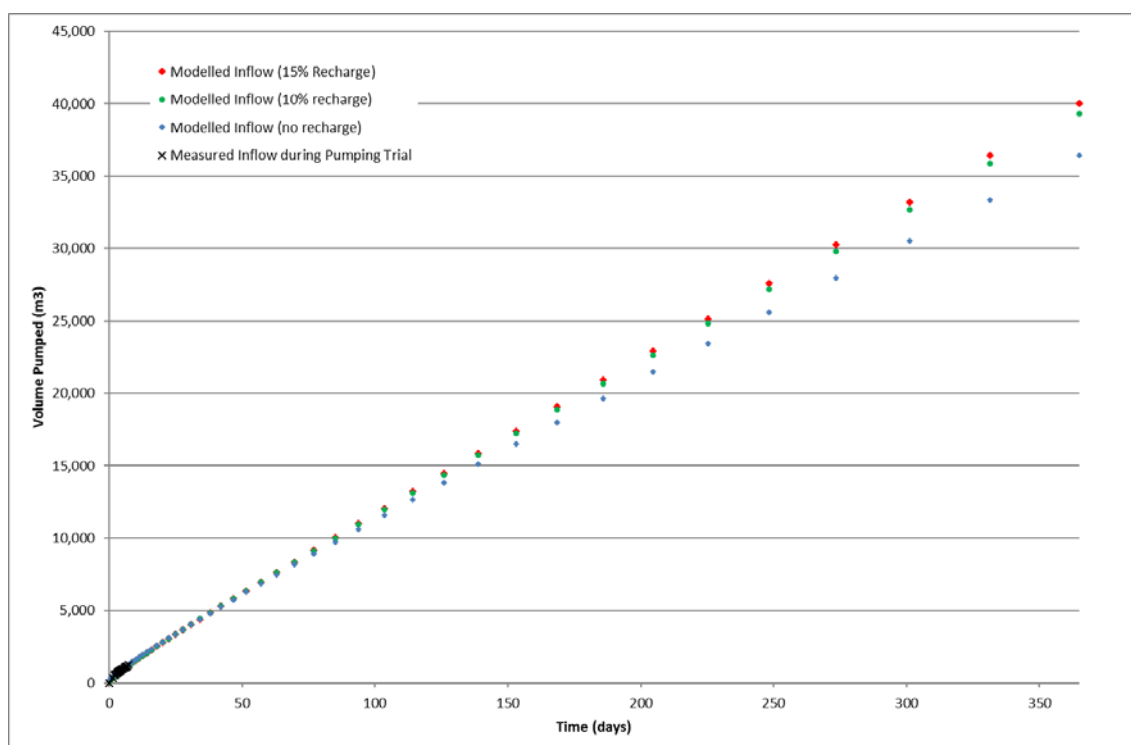


Figure 12: Trench P1c – Total Pumped Volume over 1 year simulation

### Planned work

A further long-term pump test at Trench P1e is currently being installed to provide additional brine extraction data, particularly throughout the high rainfall and recharge seasons. Further test pits and possibly trenches will also be excavated and logged in the middle and northern parts of the Lake.

Meanwhile, off-lake aircore and mud rotary drilling of deeper paleochannel aquifer targets continues. A further on-lake drilling and test pumping program aimed at deeper paleochannel aquifer targets is also planned.

### Competent Persons Statement

*The information in this report that relates to Exploration Results for Lake Well's trench program is based on information compiled by Mr Ben Jeuken, who is a member Australian Institute of Mining and Metallurgy and the International Association of Hydrogeologists. Mr Jeuken is employed by Groundwater Science Pty Ltd, an independent consulting company. Mr Jeuken has sufficient experience, which is relevant to the style of mineralisation and type of deposit under consideration and to the activity, which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Jeuken consents to the inclusion in the report of the matters based on his information in the form and context in which it appears*