Memo

To: Dr Dean Lanyon

Cc: Rick Reinke, Derek Loveday, Larry Henchel

From: **George Munroe**
Agrimin Limited, 2C Loch St
Nedlands, WA, 6009

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Reference: Mackay Potash Project – Infiltrometer Testing

1. INTRODUCTION

This technical memo outlines infiltration test work conducted at CTH and infill drill locations across Lake Mackay.

2. ON-LAKE INVESTIGATION

2.1 Purpose

To characterize the infiltration characteristics and distribution of the surface sediments of Lake Mackay.

2.2 Background

The single ring constant head infiltrometer is an instrument used for determining the rate at which water penetrates the ground surface by measuring the amount of water applied. The constant head of water is achieved with the use of a Mariotte bottle (Appendix A, Figure 1, 2). Infiltration rate is expressed in terms of the volume of water per ground surface and per unit of time (L/T, mm/min).

Single ring falling head infiltration tests were conducted at locations on Lake Mackay where infiltration rates were too high for a Mariotte bottle to maintain a constant head (Appendix A, Figure 4).

2.3 Methodology

2.3.1 Constant Head Infiltrometer

2.3.1.1 Equipment

- Infiltrometer rings (300mm, 310mm, 320mm)
- Mariotte bottle
- Fresh water (40L per test)
- Mariotte bottle mounting frame
- Evaporation cover
- Poly weave cloth
- Elastic straps and wooden mounts
- Rubber mallet

2.3.1.2 Procedure

1. A representative, undisturbed area of lake surface was selected to conduct each test.
2. The infiltrometer ring was then inserted 50mm into the sediment, a rubber mallet was used where the surface was too firm to drive in by hand.
    - To prevent water from leaking, the sediment around the outside of the rings was packed down

when necessary.

3. Poly weave cloth was installed to prevent surface erosion while adding water to ring.
4. The Mariotte was then mounted in the support frame and secure with elastic straps and wooden mount.
5. The remaining infiltrometer rings were positioned at 20m spacing along a North-South line, steps 1 to 4 were repeated for each ring/bottle setup.
6. Each ring was then filled with fresh water from a container up to just below the constant water head height (~90mm)
7. Immediately after filling, the valves on the top and bottom of the Mariotte bottle were opened to allow the bottle to establish the constant water level.

2.3.1.3 Measuring

1. The first readings (time and water level in Mariotte bottle) were taken once the water level in the ring was stable and the head is constant.
2. Appropriate recording time intervals were chosen based on the observed rate of infiltration (between 2 to 15 minutes).
   - Ensure water level in ring remains constant and equalization of the bottle is observed. If water level exceeds ~100mm, this indicates an air leak in the Mariotte bottle. Terminate test, repair leak and restart test on a new section of undisturbed ground.
3. The tests were terminated once all the water had drained from the Mariotte bottle, or after 3 hours. The ground was photographed, and all other observations recorded.

2.3.1.4 Results

Constant head infiltration test results were input into the provided recording and calculation excel file. A lithological log with photographs was also compiled to a depth of 500mm for each test location.

2.3.2 Falling Head Infiltrometer

Single ring falling head infiltration tests were conducted at locations on Lake Mackay where infiltration rates were too high for a Mariotte bottle to maintain a constant head

2.3.2.1 Equipment

- Infiltrometer rings (300mm, 310mm, 320mm)
- Poly weave cloth
- Rubber mallet
- Fresh water (8L per test)
- White plastic bucket

2.3.2.2 Procedure

1. A representative, undisturbed area of lake surface was selected to conduct each test.
2. The infiltrometer ring was then inserted 50mm into the sediment, a rubber mallet was used where the surface was too firm to drive in by hand.
   - To prevent water from leaking, pack down the sediment around the outside of the ring if necessary.
3. Poly weave cloth was installed to prevent surface erosion while adding water to ring.
4. Steps 1 to 4 were repeated for each ring size.

2.3.2.3 Measuring

1. Using the white plastic bucket containing a premeasured volume of water, the rings were filled with

water to 100mm head level as quickly as possible.

2. The first reading (time and water level) was taken immediately after the ring had been filled.
3. The time interval per 10mm drop in water level in the ring was recorded throughout the test.
4. The test was ended when all water had infiltrated the ground. The ground surface was photograph and all other observations were recorded.

2.3.2.4 Results

Falling head infiltration test results were recorded and plotted in the provided excel file. Lithological logs with photographs were compiled to a depth of 500mm for each test location.

2.5 Summary

Infiltration data acquired across Lake Mackay will be used to calibrate the hydrogeological model and characterize infiltration.

3. Comments and Observations

Initial observations made during the infiltration testing programs showed that infiltration rates are highly variable on both a local and regional scale. The surface sediments on the western side of the lake are predominantly clay dominated with a minor <4.0cm surface sequence composed of interbedded fine-medium sand, silt and clay. This predominantly fine-grained surface sequence was reflected in the very low infiltration rates observed during testing. The eastern sediment profile is dominated by hard, brittle cemented crust and a layer of medium to coarse gypsum sand. Infiltration rates in this area were high, with the constant head method being unsuitable due to infiltration exceeding the supply capacity of the Mariotte bottle. In order to quantify the rate in regions of high infiltration, the falling head method was applied.

At several the CTH and infill drilling locations, variations in infiltration rates were observed between each of the three individual tests conducted. This has been partially attributed to variations in composition of the top 50-100mm of the lake sediments. It was observed that within 1m of the hole dug for logging the 500mm section, the top 50mm varied substantially, ranging from interbedded silty clay with low porosity, to high porosity fine to medium gypsum sands.

At all infiltration test locations where the upper sediment profile was not dominated by medium-coarse gypsum sand, tubular pore structures were observed in the clay, giving it a sponge like texture. These structures were observable by gently prying the sediment and were easily destroyed by smearing the clay.

Figure 1: Pore structures observed in clay at infiltration test locations.

Mariotte bottle breather tube – Breather tube was changed from 13mm to 4mm due to air pressure equalizing issues in the bottle. Initial round of CTH tests were completed with a 13mm tube. Subsequent tests were completed with the 4mm tube. Smaller diameter tube increased the accuracy of the water level readings and did not affect the overall operation of the Mariotte bottles.

Falling head – Infiltration rings were inserted to a depth of 100mm at some locations to prevent leakage due to the hard, brittle crust.

Appendix A – Infiltrometer Equipment

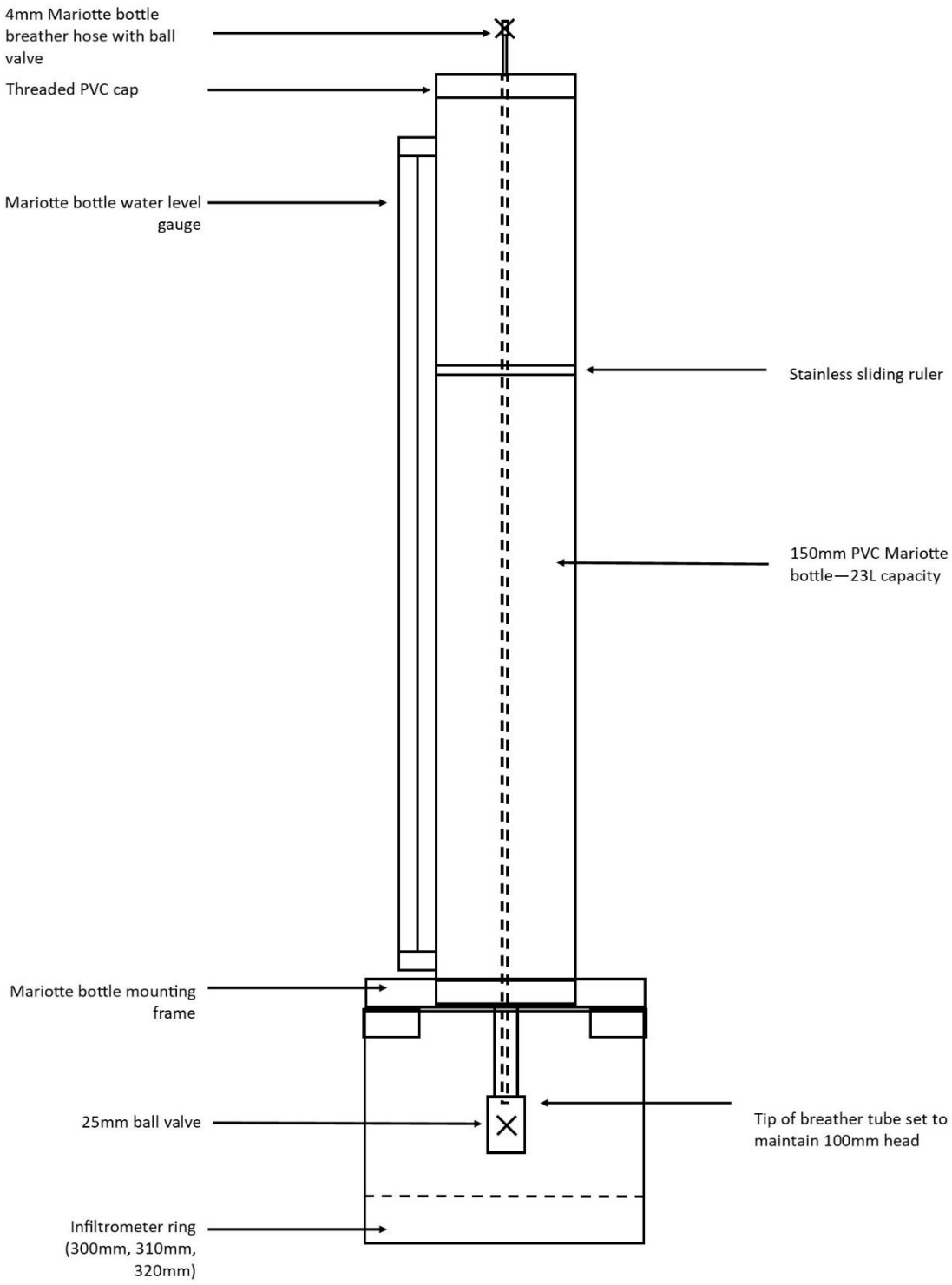

Figure 1. Constant head infiltrometer equipment diagram.

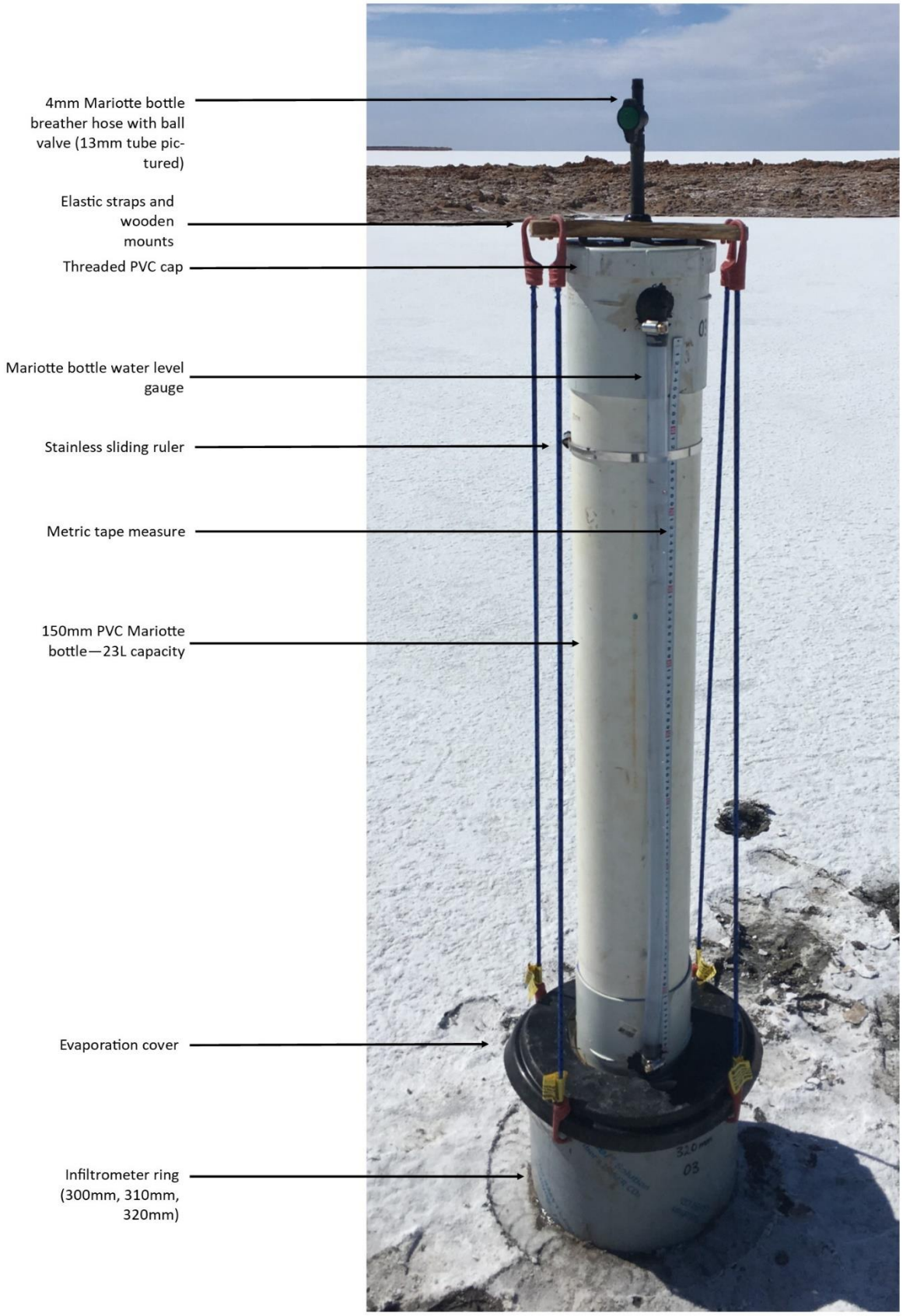

Figure 2. Constant head infiltrometer equipment with securing straps.

Figure 3. Operating constant head infiltration test.

Figure 4. Falling head infiltration test equipment setup.