Outback Water Project Update April 2018

The first results are in and confirm that central Australia contains some of the freshest water on the planet. This might seem hard to believe when the Red Centre is best known for arid landscapes, dry riverbeds and sparkling white salt lakes. However, the first results from water samples collected from December, 2017, through to February, 2018, indicate that some waterholes in Watarrka National Park and the East MacDonnell Ranges have salinity levels (measured as EC, electrical conductivity), below 0.20 mS/cm (Table 1).

Table 1 Waterhole conductivities Dec 2017-Feb 2018

Site	Conductivity (mS/cm)
Watarrka National Park- Penny Springs	0.09
Chain of Ponds-John Hayes Rockhole	0.10
Watarrka National Park- Penny Springs	0.11
Tributary (5km north of Palmer River), Stuart Hwy	0.15
Wiggly's Waterhole	0.15
Chain of Ponds- John Hayes Rockhole	0.16
Watarrka National Park - Wanya Rockhole	0.17
Watarrka National Park - Wanya Rockhole	0.22
Trephina Gorge	0.27
Jay Creek - Fish Hole	0.34
Ellery Creek Big Hole (Outback Elite Tours)	0.35
Todd River, Alice Springs	0.38
Yulara Tap Water	0.40
Ormiston Gorge (Outback Elite Tours)	0.46
Watarrka National Park -Stokes Creek	0.70
Reedy Rockhole	0.76
Watarrka National Park -Stokes Creek	0.77
Clay pans	0.77
Simpson's Gap	1.16
Simpson's Gap (Outback Elite Tours)	1.39
Kings Canyon Tap Water	1.50
Finke River	1.54
Three Mile H6NBWR7	1.80
Glen Helen Gorge (Outback Elite Tours)	3.26
Drinking water guideline	0.8
Finke River -Two Mile (Outback Elite Tours)	10.7
Finke River -Two Mile (Outback Elite Tours)	11.6
Finke River - Two Mile	15.0
Pioneer Creek Waterhole	15.8
Pioneer Creek Waterhole	17.6
Big Salty H6NBWR7	18.4

For comparison, seawater has an EC of 55 mS/m. Drinking water guidelines require water to be 0.8 mS/cm or lower to be fit for human consumption. Measurement of tap water from Yulara and Kings Canyon revealed that both sites contain fresh drinking water, at 0.4 and 1.5 mS/cm, respectively. Why is the water so fresh in these arid places? There are several reasons. At some sites the dominant water source is groundwater. This is water that has fallen as rain a long time ago, often hundreds, and possibly thousands of years ago. Rain falls on rocky ranges, such as the George Gill Range, in Watarrka National Park (Fig. 1) and moves through cracks and fissures to be stored deep within the layers of inert sandstone.

Fig. 1 Aerial view of sandstone escarpment, Watarrka National Park.

As water moves slowly through the rocky substrata, salts are filtered out in much the same way that charcoal or clay filters remove impurities in commercial water filters. If the water comes into contact with a denser layer of rock it will move laterally and, in some cases, it is discharged at the surface. Sites where this occurs act as long-lasting (perennial) waterbodies and are often called springs. Freshwater springs are enormously valuable for water dependant plants (such as ferns), for animals, and for humans. Not all springs contain freshwater. For example, water samples collected from Two Mile Waterhole on the Finke River, and from Pioneer Creek (a tributary of the Finke River, near Two Mile) ranged from 10.7 to 17.6 mS/cm. These sites are fed by a salty aquifer associated with the Pioneer mound spring (one of the few mound springs that occur in central Australia). These sites support a range of fish species, although the Finke River goby tends to be the only species present at the saltiest sites. Humans can taste salt in water from about 8 ms/cm, so water from these sites would definitely taste salty to us.

Not all freshwater sites are fed by groundwater. Two of the freshest samples (0.1 and 0.16 mS/cm) recorded in this study, so far, were from the Chain of Ponds at John Hayes Rockhole, in the East MacDonnell Ranges. The isotope plot (Fig. 2) revealed that these water samples

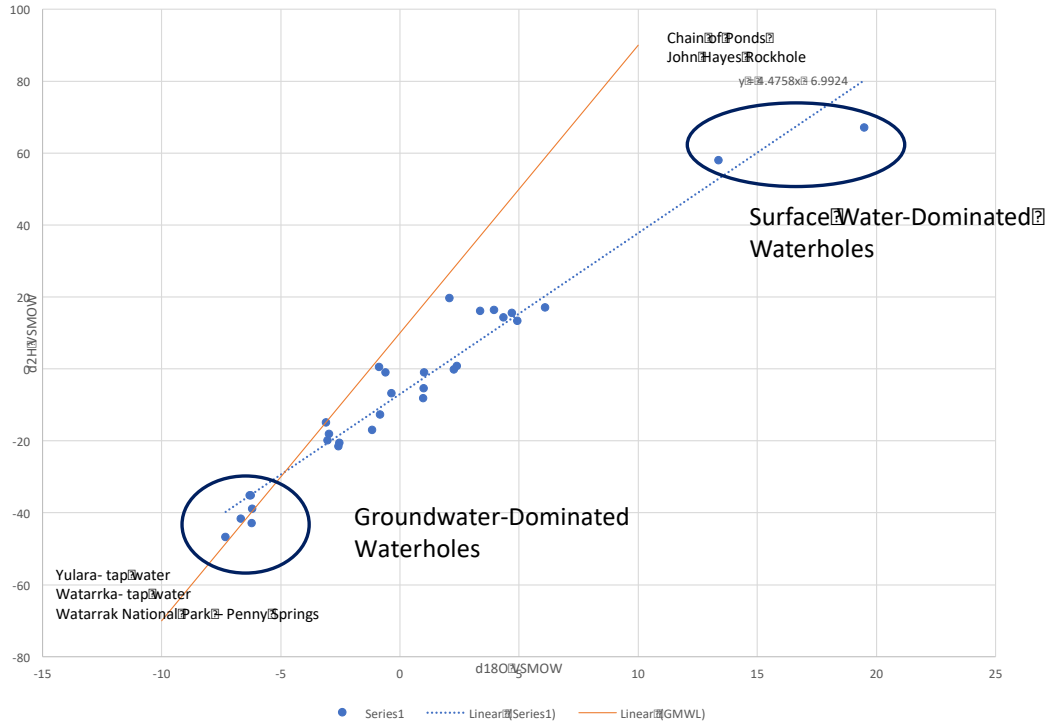

Fig. 2 Stable isotope composition of central Australian waterholes recorded from samples collected Dec 2017-Feb 2018.

were not from a groundwater-fed spring, but rather from a waterbody fed by a very recent rainfall event. The position of these samples high on the meteoric water line (the upper RHS of the plot) tells us that these sites are wholly surface-water dominated, were subject to high evaporation rates and will dry out soon, unless more rain falls at that location. The water samples with the lowest isotope ratios (on the lower LHS of the plot) represent the sites that are almost wholly dominated by groundwater. These sites will persist into the future, regardless of whether rain occurs or not. Samples spread across the middle region of the plot are from sites that contain a mixture of groundwater and recent rains. The old-fashioned concept of a shandy (beer mixed with lemonade) applies to these sites. Many of these sites are waterholes in the beds of the Finke (Fig. 3) and other rivers, and they receive groundwater from the shallow alluvial aquifers that lie beneath the sandy watercourses. They also receive water from local rainfall and from rain that falls higher up in the catchment delivered to lower reaches by floods). As more water samples are collected from these sites we will be able to track changes in the relative importance of groundwater and recent rains. The sites that will dry out most quickly, if rain does not fall, are those with little or no groundwater inputs. As more water samples are collected and analysed we will build up a picture of where the freshest, saltiest, most long-lasting and most ephemeral sites are.

Fig. 3 Aerial view of Two Mile waterhole on the Finke River. This waterhole receives salty groundwater from a saline aquifer in addition to freshwater from rainfall.

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