APPENDIX A

Groundwater and Water Supply Management
The Wiluna Project water supply is based on both fresh to brackish water from West Creek borefield, and saline water from mine dewatering.

Toro’s baseline hydrogeological modelling and barrier trials suggest that the quantity of fresh to brackish water that can be delivered sustainably from West Creek (0.7 GLpa) is sufficient for the project’s high quality water needs. However the quantity of saline water available from mine dewatering, both with and without water barriers is insufficient to meet project demands after year 1, as shown in Figure 1, below. The shortfall in saline water ranges from about 0.1 GL pa where no barriers are installed to 1.7 GL pa where installed barriers are fully effective.

Figure 1: Low quality water requirement – Wiluna uranium project [See note]

Note: the total project water requirement is 2.5 GLpa. The “water required” shown in Figure 3 is over and above the 0.7 GLpa of water that can be sourced from the West Creek borefield.

Toro initially proposed dewatering the Lake Way deposit from Year Six of the Project. By advancing dewatering of the Lake Way deposit to Year Three, the water requirements of the Project can be met for the first six years as shown in Figure 2.
As mine dewatering will occur six to nine months ahead of processing, temporary storage of mine water will be required. Storage will be in purpose built, temporary storage facilities constructed within the future mining path as shown in Figure 3.

Figure 2: Mine dewatering Lake Way - Year 6 and Year 3
To further ensure that there is sufficient water to meet the demand for the whole of mine life, Toro has conducted desktop studies to investigate alternatives for supplies of groundwater in the Wiluna region. The most suitable alternatives are shown in Figure 4, and a description of each of these is provided below, (Aquaterra, 2010 – note at the time of the preparation of these studies RPS had not acquired Aquaterra, so the author is Aquaterra, not RPS Aquaterra).
**Wiluna Gold Mine Southern Borefield:** The Apex (Wiluna Gold Mine) Southern Borefield is located 9.5km south of Wiluna town and taps the shallow calcrete aquifer in this area, some 4.5 km downstream of production bore P62 in the West Creek borefield. The borefield comprises five production bores, XP1 to XP5, which provided water to the Wiluna Gold Mine up until early 2008. The borefield was previously licensed to abstract up to a maximum of 1.13GL/year and is currently not being utilized by Apex Gold.

**Ward Well Aquifer:** The Ward Well aquifer (described by some as a palaeochannel) lies to the south and west of the West Creek/ Wiluna South system. There have been no known hydrogeological investigations along the Ward Well inferred palaeochannel, therefore further work would be required to assess the extent, depth and supply potential of this aquifer system. Groundwater quality is expected to be similar to West Creek (<4000 mg/L TDS) in the upper sediments, but hypersaline in the basal sediments.

**KH Morgan Palaeochannel:** KH Morgan (Morgan 2006a) conducted water exploration drilling in 2006 along a valley approximately 5kms north of the proposed Wiluna West Iron ore mine. Drilling locations were selected to investigate shallow aquifer systems within palaeochannel sediments. The exploration holes failed to locate basal sands or significant yields. Based on the knowledge and experience in the area, it is believed that further drilling 5-10 km north of these sites, to greater depths (100m), may encounter the palaeochannel basal sands thought to extend north-west from Lake Way – extension of the Wiluna West Palaeochannel. This aquifer would be expected to be hypersaline.

**Abercromby Palaeochannel:** Historic investigations of the Abercromby palaeochannel have found that water salinity in the shallow calcrete aquifer (TDS 750-4,000mg/l) was markedly less than in the underlying deeper sand aquifer (TDS 16,000-29,000mg/l). The annual recharge to the calcrete aquifer was computed to be 1.95 GL (~5300KL/d) which was presented as maximum potential production rate of aquifer supply, without aquifer storage depletion. Production potential for the system depends on the strike length exploited, but rates per bore of 3.5L/s were suggested, with bores spaced 800m apart. For a 25km system length, this corresponds to a maximum abstraction rate of 109 L/s (3.4 GL/annum or 51 GL over 15 years). This assessment indicates recoverable resources of about 50% of the aquifer storage (Rockwater, 1980). Abstraction from an Abercromby borefield would, however, be limited by allowable drawdown not by the aquifer supply potential. Allowable drawdown in the aquifer will likely be constrained by stygofauna expected to exist in the calcrete aquifer, as well as by the need to maintain water to support groundwater dependent vegetation that may exist along the palaeochannel.

**Boo Boo Palaeochannel:** Past investigations (Resource Investigations, 1989; Resource Investigations, 1991; Aquaterra, 2005) have identified an upper alluvial aquifer and a basal sand aquifer referred to as the Boo Boo palaeochannel, located approximately 30 km southeast of the Centipede deposit. The aquifer is known to exist over a distance of at least 8km. The aquifer width is up to 450m wide and consists of an upper duricrust aquifer and a deeper, more sporadic, basal sand aquifer. Modelling suggests that it may be possible to achieve a sustainable abstraction rate around 26L/s (0.8 GLpa) from the Boo Boo palaeochannel.

Water quality varies throughout the Boo Boo system, with some areas (especially the downstream bores in the deeper aquifer) having water quality above 5,000mg/L TDS. Generally, the shallow duricrust aquifer has a TDS of approximately 1,000mg/L, while the deeper aquifer varies between 1,000 and 3,000mg/L. Long term abstraction from Mt Keith’s production bores (~6kms to the south-west) has shown a consistent water quality of approximately 1200mg/L TDS.
Apex Mine Dewatering Discharge: Toro understands that the Apex Gold Mine currently discharges in the order of 0.8 GL pa of excess water from its mining operations to Lake Way. The average salinity of the discharge water is in the order of 180,000 mg/L TDS. It may be possible to use a proportion of this water for Toro’s water supply by blending up to about 0.3 GL pa of the discharge water with water from one or more of the better quality water sources listed above.

References


