Further Information

13 April 2006

This report describes and assesses further information obtained in response to the request received by Compass Resources NL from the Minister for the Environment and Heritage dated 8 March 2006. Information is provided for the five issues identified in that request and as discussed at a meeting at EPA offices on 9 March 2006.

Groundwater Modelling

Consequent to the 9 March 2006 meeting, Coffey Geosciences Pty Ltd has produced a numerical model to provide further assessment of groundwater inflows to the proposed Browns Oxide pit (Coffey, 2006). The outcomes of that modelling are described below.

The modelling considered the possible impact of high transmissivity from the weathered carbonate aquifer and was calibrated against data obtained during bore testing and the extended dewatering of the Browns test pit. Significantly, local geology was required to be taken into account when calibrating the model to fit the data obtained during pump testing of limited (24 hour) duration and long term dewatering of the test pit (71 days). Further information on the understanding of the geology and other pertinent information used to calibrate the model have been progressively provided to the EPA.

The modelling contains several conservative assessments:

- It modelled the pit at its ultimate depth, including the two deeper pockets, from the outset.
- It assumed a worst case with the East Finniss River continuing to flow all year round.
- It assumed a worst case with the water level in the Intermediate Open Cut remaining stable at present levels.

Under these conservative inputs, the numerical model predicts that the total inflow of groundwater to Browns Oxide pit is about 300 L/s. Almost all of this flow (90%) originates from the Coomalie Dolostone (266 L/s), with the remaining inflow (28 L/s) coming from the Whites Formation to the south of the pit. Predicted inflow rates in various sectors of the pit are shown in Figure 9 of Coffey (2006).

Approximately 200 L/s of the inflow to the pit from the Coomalie Dolostone is demonstrated to be seepage from the East Finniss River, with additional significant seepage also occurring from Intermediate Open Cut.

The modelling shows groundwater drawdown to be less than 4 m at a distance greater than 2 km southwest of the Browns oxide pit. It is therefore possible that groundwater users in the irrigation area 1.5 km southwest of the mine could be impacted to a modest degree by pit dewatering.

Should adverse impacts occur to these groundwater users, impacts could be mitigated by supply of suitable alternative water or, alternatively, enhancement of bore capacity to accommodate drawdown.

Groundwater Quality

Additional sampling and analysis of groundwater has been undertaken from five bores in the project area, as recommended by Mr Peter Jolly (DNREA) and Mr Michael Lawton (EPA). The five bores sampled (on 15 March 2006) were the three test pit monitoring bores (TPB1, TPB2 and TPB3) and registered bores RN22107 and RN22108, with the latter bore sampled at two different depths. The test pit bores are located on the southern side of the East Finniss River, i.e., on the same side as the proposed Browns Oxide pit, whereas the registered bores are located on the northern side of the river near Whites Open Cut (RN22107) and Intermediate Open Cut (RN22108).

Groundwater sampling and analyses were undertaken by the NATA-accredited Northern Territory Environmental Laboratories (NTEL). These analyses included: conductivity, pH, alkalinity, major ions (Ca, Mg, Na, K, Cl, SO_4 and NO_3) and multi-element scans (61 elements).

Results for the three test pit bores for selected parameters are presented in Table 1, along with the most recent monitoring data available for the East Finniss River (near GS8150200, as measured during 2003/04 and 2004/05 wet seasons) and Intermediate Open Cut (as measured in depth profiles in 1998).

Concentrations of filtered metals in groundwater from all three test pit bores are generally much lower than the mean filtered concentration in the East Finniss River (near the Rum Jungle bridge) measured during periods of flow in the 2003/04 and 2004/05 wet seasons. The notable exception is iron in TPB3, which is higher than the maximum value measured in the East Finniss River. Manganese and lead in TPB2 and TPB1, respectively, are also above the mean river concentration but are well below the upper limit of the range. Also of note is that although groundwater from TPB2 has high conductivity, as previously reported for this bore in the PER, metal concentrations are low (except for manganese as described above).

It is expected that groundwater inflows modelled as originating from the Coomalie Dolostone (representing 90% of the total inflow) would be comparable to the quality of water recorded from TBP1 and the East Finniss River (Coffey, 2006). Discharge of this water is therefore unlikely to adversely impact the water quality of the East Finniss and Finniss rivers

The quality of groundwater from TPB3 is considered to provide an indication of water quality in Whites Formation to the southwest of Browns Oxide pit (Coffey, 2006). As shown in Table 1, metal concentrations in this water are also less than existing concentrations in the East Finniss River, with the exception of iron, which would be expected to precipitate when exposed to atmospheric conditions.

It is recognised that groundwater in the vicinity of the Intermediate waste rock dump is contaminated with high levels of metals, high salinity and low pH due to leachate from the dump. This water could therefore affect the quality of a portion of the inflow from Whites Formation to Browns pit. The modelling shows that inflow from this region would account for 14 L/s, which is about 50% of the flow attributed to Whites Formation. Should the quality of this water prove to be a concern, water flows from this source could be segregated and preferentially used as make up water for the process plant (which has a demand of 40 L/s).

Analytical results for the two registered bores sampled on 15 March 2006 are presented in Table 2 (attached), along with monitoring data for these two bores obtained in 1983 prior to rehabilitation of the Rum Jungle mine site.

The results show that groundwater at both locations contains high concentrations of metals, and RN22107 (adjacent Whites Open Cut) to be more highly contaminated than RN22108 (adjacent Intermediate Open Cut). The water quality of samples collected at 25 m depth in RN22108 was generally similar to water quality in samples collected at 50 m depth.

There has been little improvement in water quality at RN22107 since rehabilitation of the Rum Jungle mine site. In comparison, there has been a marked improvement in groundwater quality at RN22108 since rehabilitation, however concentrations of some metals remain elevated at environmentally significant levels. Table 1 shows that the quality of water measured in Intermediate Open Cut during 1998 is generally similar to that determined in the East Finniss River during the 2003/04 and 2004/05 wet seasons, and has improved markedly since rehabilitation.

The modelling shows that the seepage of groundwater from the East Finniss River due to mine dewatering will act to limit the influence of water quality from the vicinity of Intermediate Open Cut on inflows to Browns pit (Coffey, 2006). Additionally, given the low rates of inflow which occurred during the mining of the Intermediate and the Whites open cuts, groundwater movement from these storages is not expected to be significant and groundwater adjacent to these pits is not expected to migrate to the Browns Oxide Pit.

<u>Discharge Water</u>

The concern on this issue was that discharge of water to the East Finniss River during the dry season might flush contaminants that have concentrated in pools near the old Rum Jungle mine site down to the Finniss River when it is in recessionary flow.

The numerical model predicts that the total inflow of groundwater to the pit is about 300 L/s, of which about 200 L/s comprises inflow from the East Finniss River. This modelling is very conservative for a dry season scenario, since it is based on the East Finniss River flowing all year round.

However, the model infers that the East Finniss River has the capacity to contain a discharge of 200 L/s during the dry season when there is no natural flow in the river, i.e., water discharged at less than this rate would be drawn to the pit and would therefore not flow down to the Finniss River.

Since the modelling does not consider that the East Finniss ceasing to flow in the dry season, the prediction of 300 L/s inflow to the pit is an overestimate of inflows during the dry season. The 100 L/s inflow excess discharge, i.e., additional to the 200 L/s drawn from and delivered back to the East Finniss River, is therefore a very conservative assessment of the dry season discharge that may flow down the East Finniss River. It also does not consider the volume of water that could be preferentially used in the process plant (which has a demand of about 40 L/s) and water use for dust suppression. However, calculations have been undertaken that indicate losses to evaporation and riverbed infiltration would only be about 5 L/s along the length of the East Finniss River.

One or more of the following management approaches could be implemented to manage any excess water during the dry season, should the discharge be greater than able to be contained within the East Finniss River by the effect of drawdown from pit dewatering:

- Irrigation of land, including the vine forest community that may be impacted by pit dewatering.
- Discharge of the water further downstream in the East Finniss River to avoid flushing of contaminants contained in pools near the old Rum Jungle mine site.
- Pumping the water to Whites and/or Intermediate open cuts.
- Re-injection of water back into the ground.
- Construction of a weir in the East Finniss River to retain water during the dry season.

<u>Drawdown Impacts</u>

The PER Supplement provided further information on the likely impact of lowering of the water table on vine forest patches. While it was considered likely that this vegetation relies more heavily on seasonal rainfall and moisture transferred through the soil from the East Finniss River rather than an underlying watertable, irrigation was proposed as a mitigation measure should drying of the vine forest be observed. At the meeting at EPA offices on 9 March 2006 to discuss the further information required to facilitate assessment of the project, it was elaborated that the concern on this issue was that irrigation may be hindered due to animals chewing the irrigation piping.

The possibility of damage to irrigation equipment would be circumvented by use of large diameter high-density polyethylene (HDPE) piping, which is resilient to such damage. Regular inspections would be undertaken of the condition of the irrigation equipment and repairs undertaken as necessary.

<u>Tailings Storage Facility</u>

At the meeting at EPA offices on 9 March 2006, EPA advised that the following response provided (via email on 3 March 2006) by Compass satisfied its needs regarding this issue:

> Compass has committed in its PER to monitor seepage from the TSF for a period of not less than 3 years from the cessation of operations to establish that TSF design criteria have been met. Compass is seeking input from its TSF design consultants on anything that may be necessary beyond that. Compass has committed to monitor and manage the TSF until closure objectives have been achieved.

References

Coffey. 2006. Browns Oxide Project. Groundwater Modelling. Report prepared by Coffey Geosciences Pty Ltd for Compass Resources NL. B18183/2-AC. 13 April 2006.

Table 1 Analytical results for test pit bores (TPB1, TPB2 and TPB3)

		Test pit bores			East Finniss River			Intermediate Open Cut
	Site	TPB 1	TPB 2	TPB 3	(near GS8150200)			
	Sampling depth	10 m	10 m	10 m				
	Date	15/3/06	15/3/06	15/3/06	2003/04 and 2004/05 wet season†			April 1998‡
Parameter		Weathered carbonate aquifer	Weathered Whites formation/carbonate contact	Fault zone	mean	min	max	range
EC	μS/cm	408	2,970	107	230	149	466	125-161
pH	units	6.8	9.3	7.1	6.1	5.3	6.4	5.3-6.9
Alkalinity	mg/L	45	17	42	-	-	-	-
NO3_N	mg/L	0.735	<0.005	<0.005	-	-	-	-
Cl	mg/L	2.2	56	1.7	-	-	-	-
SO4	mg/L	149	1880	10.1	-	-	-	48-71
Ca	mg/L	20.9	157	4.4	-	-	-	4-6
Mg	mg/L	34.5	384	9.1	-	-	-	9-12
Na	mg/L	4.3	34.1	1.5	-	-	-	-
K	mg/L	1.2	8.3	1.6	-	-	-	-
Filtered metals								
Ag	μg/L	0.1	<0.5	<0.05	-	-	-	-
Al	μg/L	0.5	<1	2.2	43	15	191	150-220
As	μg/L	2.35	3.55	8.2	-	-	-	-
Cd	μg/L	0.16	<0.2	<0.02	0.4	0.2	1.3	-
Co	μg/L	5.93	0.82	1.48	157	85	372	-
Cr	μg/L	0.1	<2	<0.1	-	-	-	-
Cu	μg/L	48.4	0.38	0.07	162	68	341	100-300
Fe	μg/L	<20	<200	**3,320**	26	3	72	20-380
Hg	μg/L	<0.02	<0.2	<0.02	-	-	-	-
Mn	μg/L	15.3	**757**	248	623	272	1,520	380-910
Ni	μg/L	51.3	0.71	1.48	133	75	308	80-150
Pb	μg/L	0.29	0.14	0.31	0.2	0.01	0.9	-
U	μg/L	0.07	0.02	0.08	8	4	24	-
Zn	μg/L	31.8	6.2	1.9	168	75	506	20-60

† Results from 11 samples collected during periods of flow (Charles Darwin University studies reported in PER Appendix 2).
‡ Results from 7 samples at depths between 0 to 30 m (Lawton and Overall (2002b) studies, cited in Section 7.8.4 of PER).

Table 2 Analytical results for registered bores (RN22107 and RN22108)

Parameter		Registered bores (March 2006)				Registered bores (1983)†			
	Site	RN22107	RN22108	RN22108		RN22107		RN22108	
	Sampling depth	15 m	25 m	50 m					
	Date	15/3/06	15/3/06	15/3/06		18/8/83	30/11/83	22/8/83	30/11/83
		Adjacent Whites Open Cut	Adjacent Intermediate Open Cut			Adjacent Whites Open Cut		Adjacent Intermediate Open Cut	
EC	μS/cm	2,110	4,480	4,710		4,940	5,330	3,660	3,640
pH	units	6.0	6.5	6.5		6.8	5.7	6.0	6.3
Alkalinity	mg/L	55	229	251		71	-	30	-
NO3_N	mg/L	1.93	<0.005	<0.005		-	-	-	-
Cl	mg/L	19.5	75	79.7		110	105	50	55
SO4	mg/L	1300	2990	3180		3,685	3,770	2,615	2,330
Ca	mg/L	163	347	362		390	391	285	260
Mg	mg/L	232	649	720		684	724	488	486
Na	mg/L	22.1	58.1	61.7		46	100	35	32
K	mg/L	3.6	6.9	7		3	5	7	6
Filtered metals									
Ag	μg/L	<0.5	<0.5	<0.5		-	-	-	-
Al	μg/L	108	3.6	3.2		-	-	-	-
As	μg/L	2.65	171	412		-	-	-	-
Cd	μg/L	4.18	0.48	0.38		-	-	-	-
Co	μg/L	4,720	1,780	1,700		3,500	3,900	5,200	46,000
Cr	μg/L	<2	<2	<2		-	-	-	-
Cu	μg/L	3,040	15.6	14.3		2,800	7,600	10,000	8,500
Fe	μg/L	1,560	4,060	9,440		-	-	-	-
Hg	μg/L	<0.2	<0.2	<0.2		-	-	-	-
Mn	μg/L	49,000	13,200	14,500		108,000	113,000	24,000	20,000
Ni	μg/L	3,450	846	794		3,400	4,400	4,600	47,000
Pb	μg/L	28.9	4.05	4.5		-	-	-	-
U	μg/L	17	65.6	101		-	-	-	-
Zn	μg/L	2,220	181	152		3,100	2,400	2,240	2,300

† Results from bore data file provided by P. Jolly (by email on 13 March 2006)