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22 March, 2016

Catherine Maddox
Sell & Parker
11 Meadow Way
BANKSMEADOW, NSW 2019
AUSTRALIA

Our Reference: 0313442_Water Reuse RA.DOCX

Dear Catherine,

RE: 45 TATTERSALL ROAD, KINGS PARK - WATER REUSE RISK ASSESSMENT

This letter report aims to provide clarification regarding the risks associated with water reuse as required by Condition B6(f) of the development approval (DA) dated 12th Nov 2015. The condition states that the site must operate a Water Management System including *"water reuse based on a risk assessment of environment and human health impacts"*.

ERM has adopted risk assessment methodology consistent with current best practice guidance for assessment of health and environmental risks from chemical exposure[1]. This includes 4 key stages as follows:

1. Issues identification - the key issue is whether water reuse on site presents a risk to human or ecological health

2. Hazard assessment - this is achieved by comparison of the chemical analytical results for the water to be reused to published guideline values that are relevant to the exposure scenarios identified (Table 1).

3. Exposure assessment - this is achieved by identification of source - pathway - receptor linkages that exist or may exist when the proposed water reuse occurs

4. Risk characterisation - this is achieved using a qualitative assessment based on Sell & Parker's severity-probability matrix.

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[1] NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Measure 1999, Schedule B4 Site Specific Risk Assessment;

enHealth (2012) Environmental Health Risk Assessment

The proposed water reuse on site is:

- Water from the site stormwater retention basin will be used in the hammermill which requires damping to prevent explosion. Steam is generated, and this will be extracted via the emissions control system (wet scrubber and cyclone) to a stack in the centre of the site. The emissions were modelled in ERM (2015) Air Quality Assessment report and emissions were found to be compliant with the applicable air quality criteria. Atmospheric emissions from this source are therefore not considered as a relevant exposure pathway. Opportunities for site staff to be directly exposed to the retention basin water by this route are considered extremely limited since no people are present inside the hammermill. There is a small amount of run-off of water from this reuse, which Sell & Parker estimates at approximately 5% of the water used. The run-off drains to the site stormwater drainage system back to the retention basin.

- Water from the site stormwater retention basis may be used for damping down to control dust on operational areas. Incidental contact exposure is a potentially complete pathway for site staff. Run off would be directed back to the retention basin via the site stormwater drainage system.

- Water from rainwater collection tanks may be used in the site wheel wash, for dust control, washing down and general outdoor non-potable requirements on site. Incidental direct contact exposure is possible for site staff. Run off would be directed to the retention basin via the stormwater drainage system.

- There is no grey water proposed for reuse on site.

- There is no complete exposure pathway to environmental receptors because there is no discharge of reused water from the site except via the retention basin treatment system. Environmental risk associated with stormwater discharge is not part of the scope of this risk assessment.

The identified potentially complete source-pathway-receptor linkage is therefore only incidental direct contact exposure for site workers related to uses of retention basin water and collected rainwater. Rainwater may be collected in tanks direct from the roofs. No chemical analysis is available, however it is reasonable to assume that it does not contain substances hazardous to health, or potentially harmful pathogens. Therefore, only risks from exposure to retention basin water are considered.

Chemical results from the retention basin samples are presented in Table 1. Analytes that were present at concentrations below the laboratory limit of reporting were considered to pose negligible risk and were not carried forward in this assessment.

For analytes that were detected, screening levels protective of dermal exposure and incidental ingestion were derived by multiplying drinking water guidelines by a factor of 20 (NEPC, 1999)[2]. This approach is commonly used for assessment of direct contact exposure where drinking is not likely, and it is highly conservative (in comparison to the likely possible exposure on site, these screening levels assume much higher exposures than would actually be possible). Drinking water guidelines were taken from the following sources:

- National Health and Medical Research Council (NHMRC) (2011) Australian Drinking Water Guidelines;
- World Health Organization (WHO) (2005) Petroleum Products in Drinking Water (note: where both an aromatic and an aliphatic screening level was available, the lower of the two was used);
- United States Environmental Protection Agency (USEPA) RSLs for Tap Water;
- USEPA (2009) Provisional Health Advisories for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS)

Perfluoroctane sulphonate (PFOS) was the only analyte that exceeded the applicable screening level in the retention basin water , with two of the measured values greater than the screening level of 4 µg/L. This relates to the current operation; following the site redevelopment and clean out of the retention basin PFOS concentrations are likely to drop.

PFOS is an "emerging contaminant" and research into its health effects is ongoing. There is acknowledged significant uncertainty in the toxicological literature on its effects on people at environmental levels. Adopting the precautionary principle, USEPA considers PFOS likely to be carcinogenic to humans, since animal studies have demonstrated hepatic and endocrine effects, as well as reproductive and developmental toxicity (USEPA, 2014)[3].

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[2] National Environment Protection Council (NEPC) (1999) National Environment Protection (Assessment of Site Contamination) Measure.

[3] USEPA, 2014. Emerging Contaminants – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid. March 2014.

The main exposure pathways for PFOS are consumption of contaminated food, in particular fish, and drinking water (USEPA, 2014). For on-site workers and off-site residents, dermal contact with water from the retention basin is more likely to occur than ingestion.

ERM completed a risk assessment using the severity – probability matrix method resulting in qualitative assessment of risks as high, medium or low.

Exposure to retention basin water with PFOS concentrations exceeding the screening level is possible, but likely to be at very low frequency. The consequence of any on-site PFOS exposure to workers will be insignificant relative to their off-site PFOS exposure via diet or drinking water. This yields a Risk Ranking of Low with a score of 22 for on-site workers.

Given the distance between the site and the nearest homes, it is considered rare that residents would be exposed to PFOS from the site and that the consequences of exposure to trace amounts of PFOS carried on fine water droplets would be insignificant, yielding a Risk Ranking of 25.

In conclusion, the risks associated with the proposed water reuse are low and acceptable.

Yours sincerely,
for Environmental Resources Management Australia Pty Ltd

Sophie Wood
Partner

Attachment A

DATA SCREENING

ERM

			Inorganics										MNA			PFOS and PFOA				Field			Organic	TRH NEPM (1999)					TRH NEPM (2013)					
			Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Electrical Conductivity @ 25°C	Carbonate_CaCO3 (Filtered)	Silicon (Filtered)	Sulphur as S	Sulphur as S (Filtered)	Suspended Solids (SS)	TDS	TSS	BOD	COD	Sulphur (Total Oxidised as SO4)	6:2 Fluorotelomer Sulfonate (6:2 FtS)	8:2 Fluorotelomer sulfonate	Perfluorooctanoate	PFOS	pH (Lab)	Dissolved Oxygen	Redox	Oil and Grease	TRH C6-C9 Fraction	TRH >C10-C14 Fraction	TRH >C15-C28 Fraction	TRH >C29-C36 Fraction	TRH >C10-C36 Fraction	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C10-C16 Fraction	TRH >C10-C16 Fraction less N	TRH >C16-C34 Fraction	TRH >C34-C40 Fraction
			mg/L	mg/L	µS/cm	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pH units	mg/L	mV	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			1	1	1	1	50	1	1	5	10	5	2	5	1000	0.01	0.01	0.002	0.002	0.01	0.1	0.1	5	20	50	100	50	50	20	20	100	100	100	100
Drinking Water Screening Level																		0.4	0.2											10		100	90	90
Source																		5	5											3		3	3	3
Stormwater Screening Level [1]																		**8**	**4**											**200**		**2000**	**1800**	**1800**
Field ID	**Sampled_Date-Time**	**Area**																																	
Pond 2	1/09/2014	Retention Pond	-	-	-	-	-	-	-	-	-	64	-	-	-	-	-	-	-	-	-	-	-	40	310	1500	290	2100	40	30	540	540	1410	220
POND_1	1/09/2014	Retention Pond	-	-	-	-	-	-	-	-	-	102	-	-	-	-	-	-	-	-	-	-	-	40	380	1260	250	1890	40	30	580	580	1110	<100
HOLDING POND	12/12/2014	Retention Pond	<1	161	779	-	6630	-	-	32	-	32	10	101	129,000	0.68	<0.1	0.486	10.4	7.76	7.2	195	8	<20	<50	380	<50	380	<20	<20	<100	<100	380	<100
POND_1	22/04/2015	Retention Pond	-	-	-	223	-	-	-	-	410	19	7	70	148,000	0.34	0.02	0.266	5	-	-	-	6	<20	<50	-	100	550	<20	<20	<100	<100	470	<100
PRE_A_3L./SEC	23/11/2015	Retention Pond	-	-	-	-	-	-	-	-	-	-	14	155	-	7.66	0.09	0.459	3.15	-	-	-	5	40	170	820	<50	990	50	50	360	360	630	<100
PRE_A_6L./SEC	23/11/2015	Retention Pond	-	-	-	-	-	-	-	-	-	-	12	149	-	9.27	0.1	0.365	3.62	-	-	-	6	40	170	1240	60	1470	40	40	460	460	970	<100

1) Drinking water screening levels multiplied by 10 (NEPM, 1999) to generate screening levels for incidental ingestion and dermal contact stormwater
2) NHMRC (2011) Australian Drinking Water Guidelines
3) World Health Organization (2005) Petroleum Products in Drinking Water (note: where both aromatic and a aliphatic screening levels were available, the lower of the two was used)
4) US EPA RSLs for Tap Water
5) EPA (2009) Provisional Health Advisories for Perfluorooctanoic Acid (PFOA) and Perfluorooctyl Sulfonate (PFOS)

			BTEX							Naphthalene	Metals							
			Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX	Naphthalene	Lead	Lead (Filtered)	Aluminium	Aluminium (Filtered)	Arsenic	Arsenic (Filtered)	Cadmium	Cadmium (Filtered)
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/l	µg/l	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			1	2	2	2	2	2	1	1	1	1	10	10	1	1	0.1	0.1
Drinking Water Screening Level			1	800	300			600		0.14		10		20,000		10		2
Source												2		4		2		2
Stormwater Screening Level [1]			**20**	**16,000**	**6000**			**12,000**		**2.8**		**200**		**400,000**		**200**		**40**
Field ID	**Sampled_Date-Time**	**Area**																
Pond 2	1/09/2014	Retention Pond	<1	6	<2	3	4	7	13	<1	164	-	-	-	3	-	1.1	-
POND_1	1/09/2014	Retention Pond	<1	6	<2	4	4	8	14	<5 - 1.1	257	-	-	-	4	-	1.7	-
HOLDING POND	12/12/2014	Retention Pond	<1	<2	<2	<2	<2	<2	<1	<2	27	-	360	-	2	-	0.3	-
POND_1	22/04/2015	Retention Pond	<1	<2	<2	<2	<2	<2	<1	<1	-	<1	-	20	-	<1	-	<0.1
PRE_A_3L/SEC	23/11/2015	Retention Pond	<1	<2	<2	<2	<2	<2	<1	<5	-	14	-	40	-	1	-	<0.1
PRE_A_6L/SEC	23/11/2015	Retention Pond	<1	<2	<2	<2	<2	<2	<1	<5	-	13	-	30	-	1	-	<0.1

			Metals															
			Chromium	Chromium (Filtered)	Cobalt	Cobalt (Filtered)	Copper	Copper (Filtered)	Iron	Iron (Filtered)	Lithium	Lithium (Filtered)	Manganese	Manganese (Filtered)	Mercury	Mercury (Filtered)	Molybdenum	Molybdenum (Filtered)
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			1	1	1	1	1	1	50	50	0.001	0.001	1	1	0.1	0.1	1	1
Drinking Water Screening Level				50				2000		14,000				500		1		50
Source				2				2		4				2		2		2
Stormwater Screening Level [1]				**1000**				**40,000**		**280,000**				**10,000**		**20**		**1000**
Field ID	**Sampled_Date-Time**	**Area**																
Pond 2	1/09/2014	Retention Pond	6	-	-	-	35	-	-	-	-	-	-	-	0.1	-	-	-
POND_1	1/09/2014	Retention Pond	12	-	-	-	57	-	-	-	-	-	-	-	0.2	-	-	-
HOLDING POND	12/12/2014	Retention Pond	2	-	<1	-	10	-	1320	-	0.088	-	125	-	<0.1	-	36	-
POND_1	22/04/2015	Retention Pond	-	1	-	<1	-	<1	-	-	-	0.066	-	206	-	<0.1	-	44
PRE_A_3L/SEC	23/11/2015	Retention Pond	-	1	-	-	-	2	-	1180	-	-	-	352	-	<0.1	-	85
PRE_A_6L/SEC	23/11/2015	Retention Pond	-	1	-	-	-	1	-	1110	-	-	-	326	-	<0.1	-	74

			Metals																	
			Nickel	Nickel (Filtered)	Phosphorus	Selenium	Selenium (Filtered)	Silver	Silver (Filtered)	Strontium	Strontium (Filtered)	Thallium	Tin	Tin (Filtered)	Titanium	Titanium (Filtered)	Vanadium	Vanadium (Filtered)	Zinc	Zinc (Filtered)
			µg/L	µg/L	mg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L
EQL			1	1	0.01	10	10	0.001	0.001	0.001	0.001	0.001	1	1	0.01	0.01	0.01	0.01	5	5
Drinking Water Screening Level				20																3000
Source				2																2
Stormwater Screening Level [1]				**400**																**60,000**
Field ID	**Sampled_Date-Time**	**Area**																		
Pond 2	1/09/2014	Retention Pond	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	670	-
POND_1	1/09/2014	Retention Pond	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	974	-
HOLDING POND	12/12/2014	Retention Pond	11	-	0.26	<10	-	<0.001	-	0.419	-	<0.001	<1	-	<0.01	-	<0.01	-	203	-
POND_1	22/04/2015	Retention Pond	-	<1	-	-	<10	-	<0.001	-	0.492	-	-	<1	-	<0.01	-	<0.01	-	91
PRE_A_3L/SEC	23/11/2015	Retention Pond	-	18	0.16	-	-	-	-	-	0.89	-	-	-	-	-	-	-	-	32
PRE_A_6L/SEC	23/11/2015	Retention Pond	-	18	0.21	-	-	-	-	-	0.808	-	-	-	-	-	-	-	-	43

1) Drinking water screening levels multiplied by 10 (NEPM, 1999) to generate screen
2) NHMRC (2011) Australian Drinking Water Guidelines
3) World Health Organization (2005) Petroleum Products in Drinking Water (note: w
4) US EPA RSLs for Tap Water
5) EPA (2009) Provisional Health Advisories for Perfluorooctanoic Acid (PFOA) and

Attachment B

RISK MATRIX

Severity-Probability Matrix

Step 1 – Consider the consequences of exposure to the hazard

Table 1 – Consequence Descriptors

Severity Level	Injury / Illness	Environment	Commercial/ Brand Exposure	Financial Loss ($AUS)	Plant / Equipment Damage
1 Insignificant	**First Aid Injury (FAI):** Any injuries requiring first aid treatment onsite only. *E.g. Superficial burn; lacerations; abrasions*	• No environmental damage • Environmental hazard identified • On site release of pollutant (less than 20 litres/Kg)	• *Public concern restricted to local complaints.* • Disruption to contract	• *$0 – $1,000*	• No Machine Downtime
2 Minor	***Medical Treatment Injury (MTI):*** E.g. Any injury requiring further treatment from a Medical Practitioner or any administration of a drug requiring the approval of a Medical Practitioner	• Onsite release of pollutant (less than 200 litres / kg) that is immediately contained without causing land or waterways contamination AND does not migrate offsite to land or waterways.	• Reputation loss (local media attention) • Disruption to contract	• $ 1,000 - $5,000	• 1 day Machine Downtime
3 Moderate	**Minor Lost Time Injury (LTI):** Work injury that results in the worker being impaired and unable to return to the workplace for < 2 weeks **Restricted Work Injury (RWI):** Any work injury that results in the worker being deemed unfit to return to full duties by a medical practitioner.	• Onsite release of pollutant (less than 200 litres/kg) that is mostly contained but causes moderate contamination (refer to financial loss) OR offsite release of pollutant (less than 200 litres/kg) to land or waterways.	• Reputation loss (State/National media attention) • Disruption to contract	• $5,000 - $20,000	• 2-5 days Machine Downtime
4 Major	**Serious LTI:** Work injury that results in the worker being impaired and unable to return to work > 2 weeks; Permanent disability < 30% E.g. Total loss of a digit.	• Onsite release of pollutant (200 to 2,000 litres/kg) that causes major contamination (refer to financial loss) OR offsite release of pollutant (200 to 2,000 litres/kg) to land or waterways.	• Reputation loss (National media attention) • Disruption to contract	• $20,000- $100,000	• 5-20 days Machine Downtime
5 Catastrophic	**One or more Fatalities** **Permanent Disability > 30%** E.g. Loss of limb	• Onsite release of pollutant (more than 2,000 litres/kg) that causes catastrophic land or waterways contamination (refer to financial loss) OR offsite release of pollutant (more than 2,000 litres/kg) to land or waterways.	• Reputation loss, (International media attention) • Serious public or media outcry. • Disruption to contract	• more than $100,000	• Machine Unrepairable

Severity-Probability Matrix

Step 2 – Consider the likelihood of the exposure to the hazard occurring

Table 2 – Likelihood Descriptor

Descriptor	Description	Frequency
Almost Certain	The event is expected to occur in most circumstances	Once every week
Likely	The event will probably occur in most circumstances	Once every month
Possible	The event should occur at some time	Once every year
Unlikely	The event could occur at some time	Once every 10 years
Rare	The event may occur in exceptional circumstances	Once every 100 years

Step 3: Using the Two Tier Risk Matrix table below, determine the Risk Rating from the consequence and likelihood descriptors.

To use the Two Tier Risk Matrix:

- Identify the consequence descriptor that best describes the consequences of the exposure to the hazard.
- Identify the likelihood descriptor that best describes the likelihood of exposure to the hazard resulting in the consequence determined in Step 1.
- The Risk Rating is provided in the box where the Likelihood row and Consequence column meet.

Table 3 - Risk Matrix

		Likelihood (L)				
Consequences (c)		Almost Certain	Likely	Possible	Unlikely	Rare
	Catastrophic	Extreme 1	Extreme 2	Extreme 4	High 7	Medium 11
	Major	Extreme 3	Extreme 5	High 8	Medium 12	Medium 16
	Moderate	High 6	High 9	Medium 13	Medium 17	Low 20
	Minor	High 10	Medium 14	Medium 18	Low 21	Low 23
	Insignificant	Medium 15	Medium 19	Low 22	Low 24	Low 25