EYR3008

Part 3A Approval 10_0040

Amendment: Treatment and Discharge of Contaminated Groundwater

Tarcutta Street Former Gasworks Remediation

Wagga Wagga

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REVISION STATUS

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1.0 Introduction

Enviropacific Service Pty Ltd (EPS) have been engaged by Wagga Wagga City Council (WWCC) to undertake the remediation of the former Tarcutta Street Gasworks Site (the Site). The remediation works at the Site are the subject of a Part 3A Approval No. 10_0040, dated 9 March 2012.

As a component of the remediation works, EPS is required to collect and treat contaminated ground water produced during the excavation.

A Geotechnical, Hydrogeological and Environmental Investigation[1] was prepared for the site and provided a number of potential options for the management of recovered contaminated groundwater. **Table 1** below provides these options along with reasons why they have or have not been selected:

Table 1: Groundwater Management

Option	Reasoning
Off-site Disposal	Not viable to due to the potential for generation of large volumes of water
Disposal to sewer	Discharges to Trade waste are limited by network capacity in the vicinity of the Site to less than 2 L/s
Disposal to Murrumbidgee River	Following treatment the water will be suitable for disposal to stormwater. There is no limit on the volumes that stormwater system can accept.
Disposal to stormwater	Following treatment the water will be suitable for disposal to stormwater. There is no limit on the volumes that stormwater system can accept. Disposal to stormwater is not possible during flood conditions as flood gates will be closed.
Irrigation	No suitable area is available for irrigation within the vicinity of the site
Site Uses	Following treatment, the water will be suitable for re-use on site during compaction and for dust control Only a limited amount of water can be reused on site
Aquifer reinjection	Aquifer reinjection would increase the seepage into the remediation

[1] Report for Tarcutta Street Gasworks: Geotechnical, Hydrological and Environmental Investigation GHD February 2012.

Option	Reasoning
	excavation and, in turn, generate larger volume of contaminated groundwater requiring treatment

Following review of the above options the following is proposed for the discharge of treated water:

- On-site Re-use during compaction and for dust control
- Disposal to stormwater when river is not in flood condition
- Disposal to Murrumbidgee river when flood gates are closed

EPS understands that discharge of treated water to the Murrumbidgee River is considered a variation to the Part 3A Approval. This document outlines the proposed treatment and discharge methods that will be employed by EPS, for consideration in a Section 75W Modification. The modifications include:

- Onsite treatment of Groundwater;
- Atmospheric emissions resulting from onsite water treatment; and
- Discharge of treated groundwater to Stormwater and the Murrumbidgee River

The Terms of the Part 3A Approval (EA, RAP, Site plans, Statement of Commitments and Conditions of the approval) are still applicable to this amendment.

2.0 DISCHARGE OF POLLUTANTS TO WATER

2.1 Description of Pollutants in Water

The untreated water will be comprised of excavation water encountered during the remediation works. The water will be a combination of groundwater seepage and rain water that falls directly into the excavation during the works. Stockpile water and runoff from other contaminated areas of the Site will also require treatment. The primary source of contamination of the untreated water is groundwater contamination originating from the gasworks waste. Separation of clean and contaminated areas will be maintained to minimise the generation of contaminated water and comply with the terms of the project approval.

Groundwater quality at the site was documented in previous reports, including the Environmental Assessment[2],(EA). EPS has also collected bulk groundwater samples for the purpose of treatability trials on 24th October 2012. EPS unfiltered bulk sample comprised 30L of groundwater extracted from boreholes BH35, BH47 and BH33. The well locations are spread across the remediation area. The samples were composited to produce an estimation of the groundwater encountered during bulk excavation. Both the EA and EPS sample results are presented in **Appendix A.** Laboratory certificates are included in **Appendix C.**

The concentrations of contaminants were reviewed against the ANZECC 95% fresh water Ecosystem Protection levels. **Table 2** below outlines the contaminant concentrations that exceeded the ANZECC Criteria.

Table 2: Contaminants Exceeding ANZECC

Contaminant	Unit	Average groundwater concentration	ANZECC 95% Freshwater Ecosystem Protection Levels
Conductivity	µS/cm	5200	125 - 2200
Ammonia (as N)	µg/L	144,675	900
Turbidity	NTU	2035	6-50
Aluminum	µg/L	2850	55
Benzene	µg/L	11640	950
Cyanide (free CN)	µg/L	588	7
Manganese	mg/L	2	1.9
Naphthalene	µg/L	7925	16
Nickel	µg/L	35	11
Phenol	µg/L	37402	320
o – xylene	µg/L	363	350
p – xylene	µg/L	575	200

The volume of water requiring treatment at the site depends on several factors:

- River levels during the excavation: the height of groundwater at the site is known to fluctuate in response to River levels. Groundwater during the time of sampling was about 8m below ground surface (mbgs) in the remediation area;

[2] Tarcutta Street Former Gasworks Site Remediation, Environmental Assessment, GHD April 2011

- The remediation excavation is targeting material to depths of 10 mbgs. The size and depth of the excavation will influence the volume of water that is required to be removed and treated by the WTP.

GHD used numerical and analytical approaches to estimate potential construction inflow in February 2012[3]. Both approaches were considered estimates and required wide assumptions regarding variations in lithological conditions, depth and diameter of remediation excavation, retaining system design, and initial transient inflows.

The calculations considered a 20 x 40m excavation to a depth 172mAHD (8 mbgs) and a targeted excavation to a depth of 171mAHD (9 mbgs). Inflows were calculated for groundwater levels at 173m AHD (7mbgs) in low river conditions to 181m AHD (0mbgs) in flood conditions. EPS has adjusted the GHD calculated inflows by 150% to allow for our anticipated excavation footprint of 30 x 40m. The inflow calculations are presented in **Table 4**.

2.2 Background Conditions – Murrumbidgee River

EPS collected a surface water grab sample from the Murrumbidgee River to provide indicative background concentrations of contaminants of concern. The sample was collected from Wagga Wagga Beach Caravan Park, approximately 500m downstream of the Site, on 24th October 2012. The results of the sample analysis are presented in **Appendix 1**. Laboratory certificates are included in **Appendix 3.** The concentrations of the contaminants of concern were below the ANZECC criteria.

2.3 Proposed Treatment Methodology

Based on the groundwater results outlined above, Enviropacific have designed a Water Treatment Plant (WTP) to primarily treat the contaminated groundwater to reduce suspended solids, heavy metals, cyanide, turbidity, hydrocarbon content, and ammonia. The proposed WTP is included in **Appendix 3**.

2.3.1 Plans and Specifications

Sludge removal:

[3] Report for Tarcutta Street Gasworks: Geotechnical, Hydrological and Environmental Investigation GHD February 2012

Untreated water will be separated from heavy tars and sediment in a primary sedimentation stage. Once removed from the treatment stream, heavy tars will be incorporated into the soil removal stream.

Sediment knockout:

A high capacity settling tank (SiltBuster FB50) for roughing will be located close to the excavation, for the purpose of reducing sediment load. Wet sludge (mud) will be drained back into the excavation. Water will be pumped via a submersible to the WTP high capacity settling tank (SiltBuster HB50) before storage in the balance tank.

Balance tank:

100 kL storage capacity at the head of the plant to buffer input variability in terms of water quality and quantity. The balance tank capacity may be increased to 260 KL if project scheduling, and works after weekends require short term capacity increases.

Chemical dosing:

Chemical dosing and flocculation system to adjust the pH and add coagulant and flocculant for removing colloidal particles by gravity separation.

Settling Tanks:

Two settling tanks will allow gravity separation of heavy metals, cyanide, Total Suspended Solids, and turbidity will be reduced. The sludge waste stream will be incorporated into the solid waste removal stream.

Air Stripper:

A forced aeration system is used to strip volatile hydrocarbons and some ammonia. Airborne volatiles will be collected in an activated carbon bed for separate disposal. The air stripper will consist of 2 x 2m 3 granular activated carbon beds in series. Each bed will achieve 95% removal of volatiles, resulting in 99.75% removal. The air stripper will operate at 2,000m^3/hr, providing a 7 second residence time. Further details of discharges to air are outlined below in **Section 3.0**.

Zeolite and Carbon Filtration:

Ammonium levels are further reduced by ion exchange using a 2-stage zeolite filtration system, which is also designed for fine particulate filtration to reduce turbidity. Granulated

activated carbon adsorption is used as a final polishing stage to remove organics to very low levels, and will also remove complexed cyanide that has not been effectively gravity separated. The final storage tank allows buffer capacity to meter the discharge water to the Stormwater discharge point at a steady rate.

The operation of the plant is considered semi-continuous, with a steady maximum flow rate of up to 10L/s during plant operation. The average daily discharge (based on groundwater being at 8mbgl) is estimated to be 26kL/ day however 24 hour operation of the plant may be required during times of high flow, such as when the river is in flood conditions, which could result in a maximum daily discharge of up to 864kL. Discharge from the plant will be mainly between 7am and 5pm Monday to Friday, generally the plant will not operate on weekends.

2.3.2 Design Considerations

The WTP design is considered generally appropriate for reducing concentrations of the contaminants of concern to below the ANZECC 95% freshwater ecosystem protection levels with the exception of conductivity and ammonia.

The following additional treatment processes were considered to address further ammonia removal, as outlined in **Table 3** below:

Table 3: Treatment Options

Contaminant	Treatment Alternative	Advantages	Disadvantages
Ammonia	Chemical Oxidation, including using the hydroxyl radical and ozone	Easily adjustable for variability of flowrate	Uncertainty in achieving sufficient ammonia removal. Slow reaction kinetics. Competing demand for oxidant, hence high chemical consumption rates.
	Steam stripping	Proven technology, high effective	High capital cost, high energy consumption and chemical hazards.
	Ion exchange by zeolite	Proven Technology	Difficult given saline water (high TDS), and competing cations present, organic fouling, concentrated brine disposal
	Biological contacting reactor, including Moving	Proven technology,	System sensitive to fluctuations in input concentrations.

	Bed Bio Reactor (MBBR) and Membrane Bio Reactor (MBR)		Long treatment time required, Large plant footprint , not suited to intermittent plant operation.
	Membrane ultra filtration	Modular process	Not well proven, restrictive throughput rates, prone to biological fouling

Rejected Options:

Biological treatment for the treatment of ammonia requires the bacteria to be acclimatised for the waste. This option also involves the addition of additional carbon and phosphate source and a consistent water quality, which will not be the case on this site. The other major drawback is the requirement for a large denitrification tank to provide for the 7-14 day residence time. The volume of water storage required could not be accommodated on Site.

Selected Options:

Ion exchange of ammonium by Zeolite has the advantage that it is a proven technology for the removal of ammonia. Again, the difficulty in this treatment option is the variability of the wastewater composition.

Air stripping of ammonia and other volatiles creates an air emission stream. The air emission stream is managed by activated carbon filtration. Spent activated carbon can be managed as a solid waste stream. Emissions to air, downstream of the activated carbon filtration can be monitored in real time for volatile organic compounds (VOCs) and ammonia in air. Odour monitoring will be included in the Air quality Monitoring Program for the Site, that incorporates odour assessment using a Nasal Ranger.

The analyses of the various treatment options concluded that treatment of ammonia via air stripping and zeolite ion exchange was the most viable approach for this project, due to storage and space restrictions, input variability and cost. This ammonium removal efficiency has been increased by including a second stage of zeolite ion exchange.

It is proposed to discharge the treated water into the Murrumbidgee River either directly or via the existing stormwater pipe network. The discharge has the potential to include concentrations of ammonia and conductivity above the ANZECC 95% freshwater ecosystem protection levels.

The following treatment processes were considered to address cyanide removal, as outlined in **Table 3**a below:

Table 4a: Treatment Options

Contaminant	Treatment Alternative	Advantages	Disadvantages
Cyanide	Alkaline oxidation	Proven treatment process	Difficulty of controlling the process given variability of feed concentration and intermittent plant operation.
	Ozone oxidation	Proven technology,	High capital cost, competing demand for oxidant from organics.
	Biological contacting reactor, including Moving Bed Bio Reactor (MBBR) and Membrane Bio Reactor (MBR)	Proven technology,	System sensitive to fluctuations in input concentrations. Long treatment time required, Large plant footprint , not suited to intermittent plant operation.
	Elevated pH, co-precipitation of heavy metal complexed cyanide	Scalable process	Requires intermittent process testing to verify effectiveness. Dependent upon effective sediment separation. Contaminated sludge disposal.
	Granulated activated carbon (GAC) adsorption, including impregnated GAC	Scalable, modular process	GAC disposal

Rejected Options:

Biological treatment for the treatment of cyanide requires specific bacteria to be acclimatised for the waste. The volume of water storage required could not be accommodated on Site.

Selected Options:

Two methods of removal are employed in the plant, and it is anticipated that cyanide levels will be reduced to <1 µg/L. The first method involves co-precipitation and removal as sludge, of the complexed cyanide with heavy metals in the flocculation process of the plant. The solubility of cyanide decreases with increasing salinity (our water has a high salinity, conductivity approximately 4000µS/cm. The second means of polishing any remaining cyanide from the water is by adsorption with standard activated carbon. A fall-back position is to use an impregnated activated carbon to increase the efficiency of cyanide adsorption.

2.4 Discharges of Pollutants to Water

EPS propose to generally adopt the ANZECC 95% freshwater Ecology protection levels as the discharge criteria with the following exceptions:

- Ammonia discharge concentration maximum discharge concentration of 50 mg/L
- Conductivity of 5,000µS/cm

EPS has undertaken some preliminary calculations on the proposed ammonia load on the Murrumbidgee River. The calculations are based on the following assumptions:

- Ammonia concentrations in the Murrumbidgee are based on a single grab sample collected by EPS 24/10/12.
- Flow rates from the Murrumbidgee were estimated on Bureau of Meteorology data obtained from http://waterinfo.nsw.gov.au/drr/murrumbidgee.shtml
- EPS have assessed lower River flow rates as a worst case scenario. Dewatering of the excavation, water treatment and discharge from the WTP will be below capacity when the river is low, due to the corresponding groundwater infiltration.
- EPS have assessed the maximum discharge volume, based on 24 hour discharge. Again this is a worst case scenario, and would only be required in the event that the River is flood and much greater dilution is achieved.
- Mixing at the discharge point will not be instant or complete. Mixing has not been allowed for in this basic calculation.
- The calculation converted ammonia discharge and flow rates to a flux in kg per day.
- This preliminary calculation does not constitute an assessment of environmental impact.

Table 5: Discharge Considerations - dilution

River Height	Groundwater level on Site	Murrumbidgee			WTP			Combined River and WTP		
		Flow rate	Ammonia Conc.	Net Ammonia	Flow rate	Ammonia Conc	Net Ammonia	Flow rate	Ammonia Conc.	Net Ammonia
	UNITS	kL/day	µg/L	kg/day	kL/day	µg/L	kg/day	kL/day	µg/L	kg/day
3m	8mbgs [3] (172.5m AHD)	15,000,000	13	195	26[2]	50,000	1.3	15,000,024	**13.09**	196.3
7.3 (minor flood[1])	3.7 mbgs (176.8)	50,000,000	13	650	360	50,000	18	50,000,360	**13.36**	668.0
8.69 (October 2010 Flood) [1]	Ground surface (180.5m AHD)	90,000,000	13	1,170	864 (24 hr capacity)	50,000	43.2	90,000,864	**13.48**	1,213.2
9.66 major flood[1]		200,000,000			N/A[4]					

1. Flood definitions obtained from NSW Office of Water, August 2011 'Review of water management during the 2010 flood events in the Tumut River and Murrumbidgee River'
2. WTP Flowrate based on calculated inflows: Report for Tarcutta Street Gasworks: Geotechnical, Hydrological and Environmental Investigation GHD February 2012
3. Groundwater levels observed during sampling, October 2012
4. In the event of a major flood, dewatering will cease.

When the river is in low conditions (3m), it is estimated that 26kL of water will be produced by the excavation, treated and discharged. A discharge limit of 50 mg/l of ammonia would result in a negligible contribution of 0.6% of the ammonia concentrations already present in the River.

Similarly, when the river is in flood, and the WTP is operating at full capacity, 24hrs a day, the dilution effect of the river is more pronounced. The impact on WTP ammonia concentration in the river is 3.7% of the ammonia already in the River. The combined ammonia concentration (River and WTP) is well below the adopted ANZECC 95% Freshwater Ecosystem protection limits..

In both discharge scenarios, ammonia concentrations in the Murrumbidgee River remain well below the ANZECC criteria.

2.5 Operation, Maintenance and Monitoring Details

The water treatment plant equipment will be operated and maintained by EPS. Daily inspections and plant monitoring will be carried out and operating logs will be maintained. The plant will be serviced to ensure ongoing performance is maintained to meet discharge criteria. The discharge water quality will be monitored continuously and results will be recorded using a data logger. The analyser will monitor pH, temperature, turbidity, conductivity, total flow rate, and instantaneous flow rate.

In addition to data logging, water will be sampled and analysed by a NATA accredited laboratory on the frequency required to ensure compliance with our discharge arrangement.

The proposed laboratory sampling frequency may include 'batch' based sampling during the commissioning of the plant. Following demonstration of consistent achievement of discharge criteria, or less frequent sampling regime may be adopted. A proposed sampling frequency is outlined below in **Table 5**:

Table 6: Discharge Sampling

Stage	Analytes	Frequency	Duration
Commissioning	TPH, BTEX, PAHs, Ammonia, Cyanide, 8 heavy metals, Phenols	1 sample per 260 kL	First 5 batches
Operation	TPH, BTEX, PAHs, Ammonia, Cyanide, 8 heavy metals, Phenols	1 per week	Duration of operation
Operation	VOC's in air at air stripper outlet	weekly	Duration of operation

Stage	Analytes	Frequency	Duration
Operation	Ammonia in Air	Weekly	Duration of operation
Operation	Odour	Daily	Durtion of remediation

2.5.1 Discharge Location

The WTP will discharge to a stormwater pit 200m to the south of the site via a temporary polyethylene pipe. The pit is located above a 1.8m diameter stormwater outlet into the Murrumbidgee. The stormwater outlet incorporates a flood gate and scour protection. Engineering drawings of the flood gate and scour protection are presented in Appendix D.

Discharge would be measured using an inline flow meter. The flow meter will be located at the end of the treatment train. This location, point 1, is also the sampling location.

One alternative discharge location, Point 3, is a direct discharge to the Murrumbidgee River via a temporary line. Point 3 would only be used in the event that the flood gates were closed to isolate the stormwater system from the Murrumbidgee River.

3.0 DISCHARGES TO AIR

3.1 Description of Pollutants in Air:

The pre-treatment composition of pollutants to air was calculated using the predicted concentrations of volatiles in the pre-treated water (summarised in **Appendix A**) and the manufacturer's specification for the air stripper. The composition of volatile pollutants in the untreated water are summarised below:

- C6- C9 – 22,250 µg/L
- Benzene – 11,640 µg/L
- Toluene - 4,600 µg/L
- Ethyl Benzene - 750 µg/L
- Xylene - 1,801 µg/L
- TOTAL - 41,040 µg/L

Volatile hydrocarbons (C6-C9 fraction) and BTEX compounds were selected as the most significant contributor to pollutants in air. Ammonia concentrations were not considered, as the high solubility of ammonia will result in negligible ammonia being stripped into air at the operating temperatures. The

The air stripping process is predicted to strip 99.6% of volatiles from water at an operating temperature of air - 25˚C and water - 22˚C.

The discharges to air from the GAC air filter are summarised below:

Table 7: Discharges to air

Contaminant	Concentration	Flow rate L/s	Contaminant flow rate g/s
VOCs in Water PRE- Air Stripper	41,040 µg/L (VOCs)	10 (Water)	0.414 (VOCs in Water)
Air stripper			
VOCs in AIR PRE-GAC	Removal from water to air = 99.6% = 0.409 grams/ sec	555 (Air)	226.9 (VOCs in Air)
GAC			
VOCs in air, POST-GAC	Volatile removal by GAC = 99.75% removal	555 (Air)	0.567 (VOCs in Air, post GAC)

Emissions after GAC at the stack are as follow::

- Concentrations of volatiles in air 0.567 g/s
- Temperature - 25˚C
- Maximum velocity – 18 m/s
- Flow rate – 555 L/s – 2,000m^3/hour

3.1.1 Control of Fugitive Emissions

Fugitive emissions from the entire WTP will be controlled by the following:

- Vessels that have the highest potential to generate fugitive emission (air strippers and GAC) will be sealed vessels with water tight fittings;
- Routine inspection for water leaks will be undertaken on a daily basis. Leaks will be repaired immediately.

APPENDIX A – WATER RESULTS SUMMARY

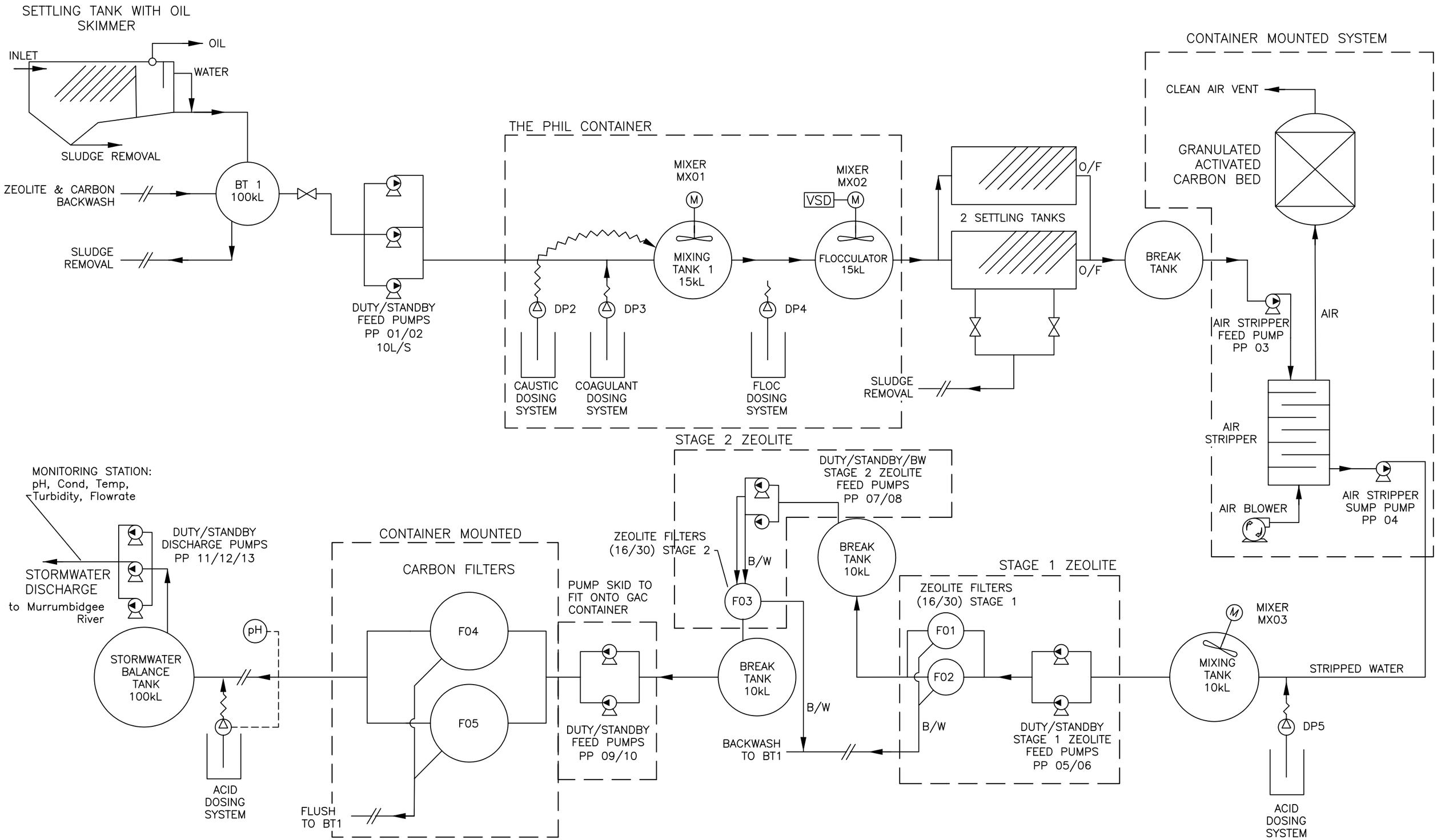
Wagga Wagga - Gasworks site

Table 1.1: Anticipated Water Quality and Discharge Criteria

Analyte	Units (unless otherwise specified)	Historical BH1_OS [1]	Historical BH2_OS[1]	Historical BH3_OS[1]	Historical BH4_OS[1]	UNTREATED Recent water analysis results Water 1[2]	UNTREATED Recent water analysis results Water 2[2]	BH35 [3]	BH47 [3]	BH33 [3]	GW Composite [3]	UNTREATED AVERAGE [all data]	UNTREATED [RAW WATER] Treatment Trial #1	TREATED [Coag/Floc] Treatment Trial #1	TREATED [High pH/aerated] Treatment Trial #1	TREATED [Post Zeolite] Treatment Trial #1 (5 min contact time)	TREATED [Post GAC] Treatment Trial #1	Treatment Trial #2 [Raw Water]	Treatment Trial #2 [1st Pass Zeolite]	Treatment Trial #2 [Post GAC]	Treatment Trial #2 [2nd Pass Zeolite]	Anticipated treated water concentration	ANZECC 2000 Freshwater Ecosystem Protection (95%)	Background Murrmbidgee River [SW]
Date sampled		11/10/2011	11/10/2011	11/10/2011	11/10/2011	19/09/2012	19/09/2012	24/10/2012	24/10/2012	24/10/2012	24/10/2012		1/11/2012	1/11/2012	1/11/2012	1/11/2012	1/11/2012	20/11/2012	20/11/2012	20/11/2012	20/11/2012			24/10/2012
Lab Batch No.		314906-W	314906-W	314906-W	314906-W	79332	79332	88072	88072	88072	88072		81075	81075	81075	81075	81075	81853	81853	81853	81853			88072
pH	pH units	6.6	6.8	6.9	6.7	7.7	7.2				6.9	7.0	7.1	7.3	9.5	7.8	8.1					7.5	6.5 - 8.0	8
TDS	mg/L	440	215	3710	290							1164	2,700				2,300					<1071	NA	
Temperature	°C																					20-25		
Conductivity	µS/cm					6,000	4,400				4,000	4,800	4,700	4,100	4,700	5,400	4,100					**3900**	125 - 2200	130
Ammonia (as N)	µg/L	1900	100	600	900	680,000	470,000				400,000	221,929	540,000	390,000	230,000	120,000	**82,000**	360,000	94,000	88,000	28,000	**50000**	900	13
Ammonium (as N)	µg/L											-										49100	14200	
Turbidity	NTU					3600	470				1,600	1,890	790	100	17	14	14					50	6 - 50	29
Aluminium	µg/L					4700	1000				960	2,220	1,100				350					2.9	55	440
Arsenic (III/V)	µg/L					<50	<50				24	8	21				32	78	10	83	79	<0.05	24/13 µg/L	<1
Barium	mg/L					200	80				51	110	50				340					0.14	NA	20
Benzene	µg/L	<1	<1	<1	<1	9300	6300				4800	6800	4,400		3		<1					<0.03	950	<1
Benzo(a)pyrene	µg/L	<0.5	<0.5	<0.5	<0.5	16	63				<10	40	<100				<0.1					<0.03	ID	<1
Calcium	µg/L	28	24	300	34						100	97	92				89					NA	NA	9
Cadmium	µg/L										<0.1		<0.1				<0.1	0.9	0.2	<0.1	<0.1	0	0.2	<0.1
Total Chlorine	µg/L																					<1	3	
Chloride	mg/L	100	31	32	60	18	24				21	41	20				620					21		9
Chromium (VI)	mg/L					<0.05	<0.05				<0.025	<0.05		<0.1	<0.1							**<0.05**	1 µg/L	<0.005
Chromium Total	µg/L					10	<10				4	0.01	5				1	76	2	4	4	0.01		<1
Cyanide (free CN)	µg/L					2300	51				<0.004	1175.50	<0.001	<0.001	<0.001		<0.001					<7 µg/L	7 µg/L	<0.004
Cyanide (Total)	µg/L										0.11													<0.004
Copper	µg/L					10	10				3	7.67	19				11	95	120	1	25	<<0.01	1.4 µg/L	2
Ethylbenzene	µg/L	<2	<2	<2	<2	<100	<100				190	38.00	<100		<1		<1					<1	ID	<1
Fluoride	µg/L					820	1100				680	866.67	1				2					960	NA	<0.1
Iron	µg/L	10	880	120	180	6100	1800				6400	2212.86	46,000				260					4	ID	680
Lead	µg/L					<30	<30				4	1.33	6	2	<1		<1	150	<1	<1	<1	<0.03	3.4 µg/L	<1
Magnesium	µg/L	21000	29000	320000	25000	140000	150000				92	97870.29	90				53					145	NA	5
Manganese	mg/L	380	190	12000	2500	400	1700				3900	3010.00	4,500				44					1	1.9	41
Mercury	µg/L					<0.05	<0.05				<0.5	<0.0005	<0.05				<0.05	0.1	<0.05	<0.05	<0.05	<0.5 µg/L	0.6 µg/L	<0.05
Naphthalene	µg/L	<1	<1	<1	<1	1300	4200				7100	4200.00	1,800				<0.1					<30	16	<1
Nickel	µg/L					<20	50				59	54.50	94				6	240	21	8	5	0.035	11 µg/L	1
Nitrate	mg/L	<0.1	<0.1	<0.1	<0.1	<0.25	<0.25				<0.025	<0.025	0				0					<0.25	0.7	<0.005
Nitrite (as N)	mg/L					<0.005	<0.005				<0.025	<0.025	0				0					<0.005	0.04	0
Phenol	µg/L	<0.01	<0.01	<0.01	<0.01	64000	79000				130000	91000.00	68,000				<10					<200	320	<10
Phosphorous	µg/L												0				2					<2		
2 Chlorophenol	µg/L					<100	<100				<100	<100	<100				<10					<100	490	<10
2,4 - Dichlorophenol	µg/L					<100	<100				<100	<100	<100				<10					<100	160	<10
2,4,6 - Trichlorophenol	µg/L					<100	<100				<100	<100	<100				<10					<100	20	<10
2,3,4,6 - Tetrachlorophenol	µg/L					<100	<100				<100	<100	<100				<10					<100	20	<10
Pentachlorophenol	µg/L					<1000	<1000				<1000	<1000	<1000				<100					<100	10	<100
Selenium	µg/L					<120	<120				2	2	0	0	0	0	0					<0.1	11 µg/L	<1
Silver	µg/L					<20	<20				<1	<0.02	<0.001	<0.001	<0.001	<0.001	<0.001					<0.02	0.05 µg/L	<1
Sodium	mg/L	105	19	440	41	91	140				64	128.57	74				610					140	NA	8
Sulfate (as SO4)	mg/L	42	3	2200	17	390	600				1,100	621.71	1,600				690					<500	NA	4
Toluene	µg/L	<1	<1	<1	<1	3100	1300				2,700	2366.67	1,600		5		<1					<1	ID	<1
TPH (C6 - C36)	µg/L	>34		>610	>34	207000	570600				472,460	416686.67	366,200		286,120		303					<40	ID	0
TPH C6-C9	µg/L	<25	<25	<25	<25	20000	13000				11,000	14666.67	7,900		120		<10					<10	-	<10
TPH C10-C36	µg/L	34	<25	290	34	187000	557600				461,460	201069.67	358,300		286,000		293					<30	-	0
o – xylene	µg/L					220	250				1,200	557	260		2		<1					<0.1	350	<2
m & p – xylene	µg/L					430	430				590	483	410		3		<2					<0.1		<1
p – xylene	µg/L																					<0.1	200	
Total Xylene	µg/L	<1	<1	<1	<1	650	680				1,790	1,040	670		5		3					<0.1	ID	
Zinc	µg/L										23		93	68	17		12	1,100	24	1	2	NA	8	3
Additional tests																								
Formaldehyde	mg/L					0.1	0.5				0.2	0.27										0.3		<0.2
Boron	mg/L					<0.2	2.9				1,100	551	1				0					1.5		7
Bromine	µg/L					390	780					585										585		
BOD5	mg of O_2/L								7	2600	2,100	1,569										<100		<4
COD	mg of O_2/L					2100	3600	3600	<50	3200	2,300	2,960										<1000		<50
TKN	mg/L					790	490					640						560	160	220	79	<80		
Oil and Grease	mg/L							18	<5	150	45	71												<5
MBAS (detergents)	mg/L					0.91	2.3					2										1.6		
Molybdenum	mg/L					<0.03	<0.03					<0.03										<0.03		
Tin	mg/L					<0.05	<0.05					<0.05										<0.05		
Cobalt	mg/L					<0.02	<0.02					<0.02										<0.02		
TOC	mg/L					540	1,000	1,200	5	870	710	721	820	670	640	630	23					<8		5
Colour																						none		
Petroleum Hydrocarbons	mg/L																					<1		
PAH	µg/L	<1.6	<1.6	1.8	<1.6																	<1		
General pesticides	mg/L																							
Pesticides (organochlorins)	mg/L																							
Pesticides (organophosphorous)	mg/L																							

LEGEND
ID = insufficient data
NA = not available
ND = not detectable
[ ] = sample ID

APPENDIX B – WATER TREATMENT PLANT PROCESS FLOW DIAGRAM AND LAYOUT



WAGGA WAGGA WTP
WATER TREATMENT PLANT - PFD

ENVIROPACIFIC SERVICES

TARCUTTA ST & CROSS ST

WAGGA WAGGA

NEW SOUTH WALES

Drawn: N.R.	Document: 2–Process diag		
Checked: P.A.	Rev: 20 November 2012	Ref:	
Scale: NTS	DRG No. N0520.dwg	I.D. No.: EYR3008–120	FIG. 2

APPENDIX C – LABORATORY CERTIFICATES

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 79332

Client:

Enviropacific Services (Chatswood) Pty Ltd
1/28 Barcoo St
Chatswood
NSW 2067

Attention: Rhys Blackburn

Sample log in details:

Your Reference:	**EYR3008/120, Wagga Gasworks**
No. of samples:	2 Waters
Date samples received / completed instructions received	25/09/2012 / 25/09/2012

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	3/10/12 / 3/10/12
Date of Preliminary Report:	Not issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Nancy Zhang
Chemist

Rhian Morgan
Reporting Supervisor

Nick Sarlamis
Inorganics Supervisor

Jeremy Faircloth
Chemist

vTRH & BTEX in Water			
Our Reference:	UNITS	79332-1	79332-2
Your Reference	----------	Water 1	Water 2
Date Sampled	----------	19/09/2012	19/09/2012
Type of sample		Water	Water
Date extracted	-	25/09/2012	25/09/2012
Date analysed	-	26/09/2012	26/09/2012
TRH C_6 - C_9	µg/L	20,000	13,000
Benzene	µg/L	9,300	6,300
Toluene	µg/L	3,100	1,300
Ethylbenzene	µg/L	<100	<100
m+p-xylene	µg/L	430	430
o-xylene	µg/L	220	250
Surrogate Dibromofluoromethane	%	80	80
Surrogate toluene-d8	%	108	103
Surrogate 4-BFB	%	100	99

sTRH in Water (C10-C36)			
Our Reference:	UNITS	79332-1	79332-2
Your Reference	----------	Water 1	Water 2
Date Sampled	----------	19/09/2012	19/09/2012
Type of sample		Water	Water
Date extracted	-	26/09/2012	26/09/2012
Date analysed	-	27/09/2012	27/09/2012
$TRHC_{10}$ - C_{14}	µg/L	170,000	500,000
$TRHC_{15}$ - C_{28}	µg/L	16,000	55,000
$TRHC_{29}$ - C_{36}	µg/L	<1,000	2,600
Surrogate o-Terphenyl	%	#	#

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	79332-1 Water 1 19/09/2012 Water	79332-2 Water 2 19/09/2012 Water
Date extracted	-	26/09/2012	26/09/2012
Date analysed	-	26/09/2012	26/09/2012
Naphthalene	µg/L	1,300	4,200
Acenaphthylene	µg/L	52	160
Acenaphthene	µg/L	<10	58
Fluorene	µg/L	42	140
Phenanthrene	µg/L	96	330
Anthracene	µg/L	25	96
Fluoranthene	µg/L	50	200
Pyrene	µg/L	45	170
Benzo(a)anthracene	µg/L	21	79
Chrysene	µg/L	19	59
Benzo(b+k)fluoranthene	µg/L	22	85
Benzo(a)pyrene	µg/L	16	63
Indeno(1,2,3-c,d)pyrene	µg/L	12	29
Dibenzo(a,h)anthracene	µg/L	<10	<10
Benzo(g,h,i)perylene	µg/L	10	24
Surrogate p-Terphenyl-d_{14}	%	#	#

Speciated Phenols in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	79332-1 Water 1 19/09/2012 Water	79332-2 Water 2 19/09/2012 Water
Date extracted	-	26/09/2012	26/09/2012
Date analysed	-	26/09/2012	26/09/2012
Phenol	µg/L	64,000	79,000
2-Chlorophenol	µg/L	<100	<100
2-Methylphenol	µg/L	46,000	110,000
3/4-Methylphenol	µg/L	44,000	130,000
2-Nitrophenol	µg/L	<100	<100
2,4-Dimethylphenol	µg/L	12,000	49,000
2,4-Dichlorophenol	µg/L	<100	<100
2,6-Dichlorophenol	µg/L	<100	<100
2,4,5-Trichlorophenol	µg/L	<100	<100
2,4,6-Trichlorophenol	µg/L	<100	<100
2,4-Dinitrophenol	µg/L	<1,000	<1,000
4-Nitrophenol	µg/L	<1,000	<1,000
2,3,4,6-Tetrachlorophenol	µg/L	<100	<100
2-methyl-4,6-dinitrophenol	µg/L	<1,000	<1,000
Pentachlorophenol	µg/L	<1,000	<1,000
Surrogate 2-fluorophenol	%	95	125
Surrogate Phenol-d_6	%	45	70
Surrogate 2,4,6-Tribromophenol	%	110	125
Surrogate p-Terphenyl-d_{14}	%	90	115

Metals in Waters - Acid extractable			
Our Reference:	UNITS	79332-1	79332-2
Your Reference	----------	Water 1	Water 2
Date Sampled	----------	19/09/2012	19/09/2012
Type of sample		Water	Water
Date prepared	-	26/09/2012	26/09/2012
Date analysed	-	26/09/2012	26/09/2012
Arsenic - Total	mg/L	<0.05	<0.05
Aluminium - Total	mg/L	4.7	1.0
Barium - Total	mg/L	0.2	0.08
Copper - Total	mg/L	0.01	0.01
Chromium - Total	mg/L	0.01	<0.01
Iron - Total	mg/L	6.1	1.8
Magnesium - Total	mg/L	140	150
Manganese - Total	mg/L	0.4	1.7
Mercury - Total	mg/L	<0.0005	<0.0005
Nickel - Total	mg/L	<0.02	0.05
Lead - Total	mg/L	<0.03	<0.03
Selenium - Total	mg/L	<0.1	<0.1
Silver - Total	mg/L	<0.02	<0.02
Sodium - Total	mg/L	91	140

Miscellaneous Inorganics Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	79332-1 Water 1 19/09/2012 Water	79332-2 Water 2 19/09/2012 Water
Date prepared	-	26/09/2012	26/09/2012
Date analysed	-	26/09/2012	26/09/2012
pH	pH Units	7.7	7.2
Electrical Conductivity	µS/cm	6,000	4,400
Turbidity	NTU	3,600	470
Ammonia as N in water	mg/L	680	470
Chloride, Cl	mg/L	18	24
Fluoride, F	mg/L	0.82	1.1
Nitrate as N in water	mg/L	<0.25	<0.25
Nitrite as N in water	mg/L	<0.005	<0.005
Sulphate, SO4	mg/L	390	600
Hexavalent Chromium, Cr^{6+}	mg/L	<0.05	<0.05
Free Cyanide in Water	mg/L	2.3	0.051

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell and dedicated meter, in accordance with APHA 22nd ED 2510 and Rayment & Lyons.
Inorg-022	Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA 22nd ED, 2130-B.
Inorg-057	Ammonia - determined colourimetrically based on EPA350.1 and APHA 22nd ED 4500-NH3 F, Soils are analysed following a KCl extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA 22nd ED, 4500-F-C.
Inorg-055	Nitrate - determined colourimetrically based on EPA353.2 and APHA 22nd ED NO3- F. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on EPA353.2 and APHA 22nd ED NO2- B. Soils are analysed following a water extraction.
Inorg-024	Hexavalent Chromium (Cr6+) - determined colourimetrically based upon APHA 22nd, 3500-Cr-B.
Inorg-013	Cyanide - total determined colourimetrically after distillation, based on APHA 22nd ED, 4500-CN_C,E. Free cyanide determined colourimetrically after filtration and confirmed by diffusion.

QUALITY CONTROL vTRH & BTEX in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			25/09/2012	[NT]	[NT]	LCS-W1	25/09/2012
Date analysed	-			26/09/2012	[NT]	[NT]	LCS-W1	26/09/2012
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	108%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	109%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	109%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	106%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	107%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	108%
Surrogate Dibromofluoromethane	%		Org-016	122	[NT]	[NT]	LCS-W1	106%
Surrogate toluene-d8	%		Org-016	106	[NT]	[NT]	LCS-W1	99%
Surrogate 4-BFB	%		Org-016	77	[NT]	[NT]	LCS-W1	102%
QUALITY CONTROL sTRH in Water (C10-C36)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/09/2012	[NT]	[NT]	LCS-W4	26/09/2012
Date analysed	-			27/09/2012	[NT]	[NT]	LCS-W4	27/09/2012
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W4	82%
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W4	105%
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W4	99%
Surrogate o-Terphenyl	%		Org-003	98	[NT]	[NT]	LCS-W4	89%
QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/09/2012	[NT]	[NT]	LCS-W3	26/09/2012
Date analysed	-			26/09/2012	[NT]	[NT]	LCS-W3	26/09/2012
Naphthalene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	97%
Acenaphthylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	102%
Phenanthrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	104%
Anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	98%
Pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	103%
Benzo(a)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Chrysene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	101%
Benzo(b+k)fluoranthene	µg/L	2	Org-012 subset	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W3	100%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%		Org-012 subset	84	[NT]	[NT]	LCS-W3	112%
QUALITY CONTROL Speciated Phenols in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/09/2012	[NT]	[NT]	LCS-W1	26/09/2012
Date analysed	-			26/09/2012	[NT]	[NT]	LCS-W1	26/09/2012
Phenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	46%
2-Chlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	101%
2-Methylphenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
3/4-Methylphenol	µg/L	20	Org-012	<20	[NT]	[NT]	[NR]	[NR]
2-Nitrophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dimethylphenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,6-Dichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4,5-Trichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4,6-Trichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dinitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
4-Nitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	LCS-W1	51%
2,3,4,6-Tetrachlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-methyl-4,6-dinitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
Pentachlorophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
Surrogate 2-fluorophenol	%		Org-012	68	[NT]	[NT]	LCS-W1	81%
Surrogate Phenol-d_6	%		Org-012	41	[NT]	[NT]	LCS-W1	56%
Surrogate 2,4,6-Tribromophenol	%		Org-012	82	[NT]	[NT]	LCS-W1	95%
Surrogate p-Terphenyl-d_{14}	%		Org-012	110	[NT]	[NT]	LCS-W1	119%

QUALITY CONTROL Metals in Waters - Acid extractable	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			26/09/2012	79332-1	26/09/2012 || 26/09/2012	LCS-W1	26/09/2012
Date analysed	-			26/09/2012	79332-1	26/09/2012 || 26/09/2012	LCS-W1	26/09/2012
Arsenic - Total	mg/L	0.05	Metals-020 ICP-AES	<0.05	79332-1	<0.05 || <0.05	LCS-W1	95%
Aluminium - Total	mg/L	0.1	Metals-020 ICP-AES	<0.1	79332-1	4.7 || 4.7 || RPD: 0	LCS-W1	92%
Barium - Total	mg/L	0.01	Metals-020 ICP-AES	<0.01	79332-1	0.2 || 0.2 || RPD: 0	LCS-W1	101%
Copper - Total	mg/L	0.01	Metals-020 ICP-AES	<0.01	79332-1	0.01 || <0.01	LCS-W1	98%
Chromium - Total	mg/L	0.01	Metals-020 ICP-AES	<0.01	79332-1	0.01 || 0.01 || RPD: 0	LCS-W1	99%
Iron - Total	mg/L	0.02	Metals-020 ICP-AES	<0.02	79332-1	6.1 || 6.2 || RPD: 2	LCS-W1	96%
Magnesium - Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	79332-1	140 || 140 || RPD: 0	LCS-W1	93%
Manganese - Total	mg/L	0.01	Metals-020 ICP-AES	<0.01	79332-1	0.4 || 0.4 || RPD: 0	LCS-W1	102%
Mercury - Total	mg/L	0.0005	Metals-021 CV-AAS	<0.0005	79332-1	<0.0005 || <0.0005	LCS-W1	88%
Nickel - Total	mg/L	0.02	Metals-020 ICP-AES	<0.02	79332-1	<0.02 || <0.02	LCS-W1	98%
Lead - Total	mg/L	0.03	Metals-020 ICP-AES	<0.03	79332-1	<0.03 || <0.03	LCS-W1	97%
Selenium - Total	mg/L	0.12	Metals-020 ICP-AES	<0.1	79332-1	<0.1 || <0.1	LCS-W1	93%
Silver - Total	mg/L	0.02	Metals-020 ICP-AES	<0.02	79332-1	<0.02 || <0.02	LCS-W1	95%
Sodium - Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	79332-1	91 || 92 || RPD: 1	LCS-W1	98%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			26/09/2012	[NT]	[NT]	LCS-W1	26/09/2012
Date analysed	-			26/09/2012	[NT]	[NT]	LCS-W1	26/09/2012
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-W1	98%
Electrical Conductivity	µS/cm	1	Inorg-002	<1	[NT]	[NT]	LCS-W1	106%
Turbidity	NTU	0.1	Inorg-022	<0.1	[NT]	[NT]	LCS-W1	92%
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	[NT]	[NT]	LCS-W1	96%
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	LCS-W1	93%
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	[NT]	[NT]	LCS-W1	95%
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	LCS-W1	102%
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	LCS-W1	93%
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	LCS-W1	97%
Hexavalent Chromium, Cr^{6+}	mg/L	0.005	Inorg-024	<0.005	[NT]	[NT]	LCS-W1	92%
Free Cyanide in Water	mg/L	0.004	Inorg-013	<0.004	[NT]	[NT]	LCS-W1	117%

QUALITY CONTROL Metals in Waters - Acid extractable	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	79332-2	26/09/2012
Date analysed	-	[NT]	[NT]	79332-2	26/09/2012
Arsenic - Total	mg/L	[NT]	[NT]	79332-2	96%
Aluminium - Total	mg/L	[NT]	[NT]	79332-2	90%
Barium - Total	mg/L	[NT]	[NT]	79332-2	98%
Copper - Total	mg/L	[NT]	[NT]	79332-2	97%
Chromium - Total	mg/L	[NT]	[NT]	79332-2	97%
Iron - Total	mg/L	[NT]	[NT]	79332-2	87%
Magnesium - Total	mg/L	[NT]	[NT]	79332-2	#
Manganese - Total	mg/L	[NT]	[NT]	79332-2	94%
Mercury - Total	mg/L	[NT]	[NT]	[NR]	[NR]
Nickel - Total	mg/L	[NT]	[NT]	79332-2	94%
Lead - Total	mg/L	[NT]	[NT]	79332-2	95%
Selenium - Total	mg/L	[NT]	[NT]	79332-2	92%
Silver - Total	mg/L	[NT]	[NT]	79332-2	92%
Sodium - Total	mg/L	[NT]	[NT]	79332-2	#

Report Comments:

Total Recoverable Hydrocarbons in water (volatile):
PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.

Total Recoverable Hydrocarbons in water:(semivolatile)PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.
Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference.

PAH's in water: PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.
Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference.

Speciated phenol's in water: PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.

Nitrate\Hexavalent Chromium:PQL raised due to sample matrix.

Metals in Waters - Total: # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
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PRELIMINARY CERTIFICATE OF ANALYSIS

Client:
Enviropacific Services (Chatswood) Pty Ltd
1/28 Barcoo St
Chatswood
NSW 2067

Attention: Rhys Blackburn

Sample log in details:

Envirolab Reference:	80772
Your Reference:	EYR3008/120, Wagga Gasworks
No. of samples:	5 Waters
Date samples received:	26/10/12
Date completed instructions received:	26/10/12

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client.
Results are reported on a dry weight basis for soils and on an as received basis for other matrices.
PAH(in water)PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.

BOD analysed by NMI. Report No.RN941090.

Total mercury: PQL has been raised due to matrix interferences.

Formaldehyde analysed by LABPOINT report number NAA12-2026

Phenol's in water by Scan: PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.

Report Details:

Date results requested by:	2/11/12
Date of Preliminary Report:	5/11/12

NATA accreditation number 2901. This document shall not be reproduced except in full.
Tests not covered by NATA are denoted with *.

INS:	Insufficient sample for this test	NT:	Not tested
NR:	Not requested	PQL:	Practical Quantitation limit
<:	Less than	>:	Greater than

LCS: Laboratory Control Sample

Contact Details:
Please direct any queries to Tania Notaras, Jacinta Hurst or David Springer
ph: 02 9910 6200 fax: 02 9910 6201
email: tnotaras@envirolabservices.com.au

Tania Notaras

Jacinta Hurst

vTRH & BTEX in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	80772-1 SW 24/10/2012 Water	80772-5 GW Composite 24/10/2012 Water
Date extracted	-	26/10/2012	26/10/2012
Date analysed	-	29/10/2012	29/10/2012
TRHC$_6$ - C$_9$	µg/L	<10	11,000
Benzene	µg/L	<1	4,800
Toluene	µg/L	<1	2,700
Ethylbenzene	µg/L	<1	190
m+p-xylene	µg/L	<2	1,200
o-xylene	µg/L	<1	590
Surrogate Dibromofluoromethane	%	101	98
Surrogate toluene-d8	%	99	95
Surrogate 4-BFB	%	99	102

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sTRH in Water (C10-C36)			
Our Reference:	UNITS	80772-1	80772-5
Your Reference	----------	SW	GW Composite
Date Sampled	----------	24/10/2012	24/10/2012
Type of sample		Water	Water
Date extracted	-	29/10/2012	29/10/2012
Date analysed	-	29/10/2012	29/10/2012
TRHC$_{10}$ - C$_{14}$	µg/L	<50	430,000
TRHC$_{15}$ - C$_{28}$	µg/L	<100	31,000
TRHC$_{29}$ - C$_{36}$	µg/L	<100	460
Surrogate o-Terphenyl	%	97	101

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PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	80772-1 SW 24/10/2012 Water	80772-5 GW Composite 24/10/2012 Water
Date extracted	-	29/10/2012	29/10/2012
Date analysed	-	30/10/2012	30/10/2012
Naphthalene	µg/L	<1	7,100
Acenaphthylene	µg/L	<1	110
Acenaphthene	µg/L	<1	50
Fluorene	µg/L	<1	70
Phenanthrene	µg/L	<1	55
Anthracene	µg/L	<1	14
Fluoranthene	µg/L	<1	<10
Pyrene	µg/L	<1	<10
Benzo(a)anthracene	µg/L	<1	<10
Chrysene	µg/L	<1	<10
Benzo(b+k)fluoranthene	µg/L	<2	<20
Benzo(a)pyrene	µg/L	<1	<10
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<10
Dibenzo(a,h)anthracene	µg/L	<1	<10
Benzo(g,h,i)perylene	µg/L	<1	<10
Surrogate p-Terphenyl-d_{14}	%	105	97

Tania Notaras Jacinta Hurst

Client Reference: EYR3008/120, Wagga Gasworks **Envirolab Reference:** 80772

Speciated Phenols in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	80772-1 SW 24/10/2012 Water	80772-5 GW Composite 24/10/2012 Water
Date extracted	-	29/10/2012	29/10/2012
Date analysed	-	31/10/2012	31/10/2012
Phenol	µg/L	<10	130,000
2-Chlorophenol	µg/L	<10	<100
2-Methylphenol	µg/L	<10	120,000
3/4-Methylphenol	µg/L	<20	220,000
2-Nitrophenol	µg/L	<10	<100
2,4-Dimethylphenol	µg/L	<10	80,000
2,4-Dichlorophenol	µg/L	<10	<100
2,6-Dichlorophenol	µg/L	<10	<100
2,4,5-Trichlorophenol	µg/L	<10	<100
2,4,6-Trichlorophenol	µg/L	<10	<100
2,4-Dinitrophenol	µg/L	<100	<1,000
4-Nitrophenol	µg/L	<100	<1,000
2,3,4,6-Tetrachlorophenol	µg/L	<10	<100
2-methyl-4,6-dinitrophenol	µg/L	<100	<1,000
Pentachlorophenol	µg/L	<100	<1,000
Surrogate 2-fluorophenol	%	66	65
Surrogate Phenol-d_6	%	40	55
Surrogate 2,4,6-Tribromophenol	%	87	130
Surrogate p-Terphenyl-d_{14}	%	111	128

Tania Notaras

Jacinta Hurst

Client Reference: **EYR3008/120, Wagga Gasworks** **Envirolab Reference:** **80772**

Metals in Waters - Acid extractable			
Our Reference:	UNITS	80772-1	80772-5
Your Reference	----------	SW	GW Composite
Date Sampled	----------	24/10/2012	24/10/2012
Type of sample		Water	Water
Date prepared	-	29/10/2012	29/10/2012
Date analysed	-	29/10/2012	29/10/2012
Calcium - Total	mg/L	8.9	100
Magnesium - Total	mg/L	4.8	92
Sodium - Total	mg/L	8.4	64

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All metals in water - total Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	80772-1 SW 24/10/2012 Water	80772-5 GW Composite 24/10/2012 Water
Date prepared	-	29/10/2012	29/10/2012
Date analysed	-	29/10/2012	29/10/2012
Aluminium-Total	µg/L	440	960
Arsenic-Total	µg/L	<1	24
Barium-Total	µg/L	20	51
Boron-Total	µg/L	7	1,100
Cadmium-Total	µg/L	<0.1	<0.1
Chromium-Total	µg/L	<1	4
Copper-Total	µg/L	2	3
Iron-Total	µg/L	680	6,400
Lead-Total	µg/L	<1	4
Manganese-Total	µg/L	41	3,900
Mercury-Total	µg/L	<0.05	<0.5
Nickel-Total	µg/L	1	59
Selenium-Total	µg/L	<1	2
Silver-Total	µg/L	<1	<1
Zinc-Total	µg/L	3	23

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Miscellaneous Inorganics Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	80772-1 SW 24/10/2012 Water	80772-2 BH35 24/10/2012 Water	80772-3 BH47 24/10/2012 Water	80772-4 BH33 24/10/2012 Water	80772-5 GW Composite 24/10/2012 Water
Date prepared	-	qw	26/10/2012	26/10/2012	26/10/2012	26/10/2012
Date analysed	-	26/10/2012	26/10/2012	26/10/2012	26/10/2012	26/10/2012
pH	pH Units	7.6	[NA]	[NA]	[NA]	6.9
Electrical Conductivity	µS/cm	130	[NA]	[NA]	[NA]	4,000
Turbidity	NTU	29	[NA]	[NA]	[NA]	1,600
Ammonia as N in water	mg/L	0.013	[NA]	[NA]	[NA]	400
Chloride, Cl	mg/L	9	[NA]	[NA]	[NA]	21
Fluoride, F	mg/L	<0.1	[NA]	[NA]	[NA]	0.68
Free Cyanide in Water	mg/L	<0.004	[NA]	[NA]	[NA]	<0.004
Total Cyanide	mg/L	<0.004	[NA]	[NA]	[NA]	0.11
Nitrate as N in water	mg/L	0.29	[NA]	[NA]	[NA]	<0.025
Nitrite as N in water	mg/L	<0.005	[NA]	[NA]	[NA]	<0.025
Sulphate, SO4	mg/L	4	[NA]	[NA]	[NA]	1,100
Hexavalent Chromium, Cr^{6+}	mg/L	<0.005	[NA]	[NA]	[NA]	<0.025
BOD5	mg/L	<4		7	2,600	2,100
COD	mg O_2/L	<50	3,600	<50	3,200	2,300
Total Organic Carbon	mg/L	5	1,200	5	870	710
Oil & Grease (LLE)	mg/L	<5	18	<5	150	45
Formaldehyde	mg/L	<0.2	[NA]	[NA]	[NA]	0.2

Tania Notaras Jacinta Hurst

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell and dedicated meter, in accordance with APHA 22nd ED 2510 and Rayment & Lyons.
Inorg-022	Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA 22nd ED, 2130-B.
Inorg-057	Ammonia - determined colourimetrically based on EPA350.1 and APHA 22nd ED 4500-NH3 F, Soils are analysed following a KCl extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA 22nd ED, 4500-F-C.
Inorg-013	Cyanide - total determined colourimetrically after distillation, based on APHA 22nd ED, 4500-CN_C,E. Free cyanide determined colourimetrically after filtration and confirmed by diffusion.
Inorg-055	Nitrate - determined colourimetrically based on EPA353.2 and APHA 22nd ED NO3- F. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on EPA353.2 and APHA 22nd ED NO2- B. Soils are analysed following a water extraction.
Inorg-024	Hexavalent Chromium (Cr6+) - determined colourimetrically based upon APHA 22nd, 3500-Cr-B.
Ext-020	Analysis subcontracted to Australian Government - National Measurement Institute. NATA Accreditation No: 198
Inorg-067	Samples are digested in acid with a known excess of potassium dichromate then titrated against ammonium ferrous sulphate in accordance with APHA 22nd ED 5310B.
Inorg-079	TOC determined using a TOC analyser using the combustion method. DOC is filtered prior to determination. Analysis using APHA 22nd ED 5310B.
Inorg-003	Oil & Grease - determine gravimetrically following extraction with Hexane, in accordance with APHA 22nd ED, 5220-B.

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Method ID	Methodology Summary
Ext-044	Analysed by LabPoint NATA accreditation 11111.

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QUALITY CONTROL vTRH & BTEX in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Date extracted	-			26/10/2012	[NT]	[NT]	LCS-W1	26/10/2012
Date analysed	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
TRHC$_6$ - C$_9$	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	105%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	102%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	104%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	106%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	106%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	105%
Surrogate Dibromofluoromethane	%		Org-016	99	[NT]	[NT]	LCS-W1	98%
Surrogate toluene-d8	%		Org-016	100	[NT]	[NT]	LCS-W1	100%
Surrogate 4-BFB	%		Org-016	100	[NT]	[NT]	LCS-W1	102%

QUALITY CONTROL sTRH in Water (C10-C36)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Date extracted	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
Date analysed	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
TRHC$_{10}$ - C$_{14}$	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	84%
TRHC$_{15}$ - C$_{28}$	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	109%
TRHC$_{29}$ - C$_{36}$	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	96%
Surrogate o-Terphenyl	%		Org-003	86	[NT]	[NT]	LCS-W1	95%

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Date extracted	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
Date analysed	-			30/10/2012	[NT]	[NT]	LCS-W1	30/10/2012
Naphthalene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	108%
Acenaphthylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	103%
Phenanthrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	104%
Anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	103%

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Client Reference: EYR3008/120, Wagga Gasworks **Envirolab Reference:** 80772

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	105%
Benzo(a)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	109%
Benzo(b+k)fluoranthene	µg/L	2	Org-012 subset	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	108%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%		Org-012 subset	85	[NT]	[NT]	LCS-W1	111%

QUALITY CONTROL Speciated Phenols in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Date extracted	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
Date analysed	-			31/10/2012	[NT]	[NT]	LCS-W1	31/10/2012
Phenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	47%
2-Chlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	101%
2-Methylphenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
3/4-Methylphenol	µg/L	20	Org-012	<20	[NT]	[NT]	[NR]	[NR]
2-Nitrophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dimethylphenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,6-Dichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	92%
2,4,5-Trichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4,6-Trichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dinitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
4-Nitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	LCS-W1	41%
2,3,4,6-Tetrachlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-methyl-4,6-dinitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
Pentachlorophenol	µg/L	100	Org-012	<100	[NT]	[NT]	LCS-W1	81%
Surrogate 2-fluorophenol	%		Org-012	69	[NT]	[NT]	LCS-W1	68%
Surrogate Phenol-d_6	%		Org-012	46	[NT]	[NT]	LCS-W1	46%
Surrogate 2,4,6-Tribromophenol	%		Org-012	77	[NT]	[NT]	LCS-W1	102%
Surrogate p-Terphenyl-d_{14}	%		Org-012	100	[NT]	[NT]	LCS-W1	106%

Tania Notaras

Jacinta Hurst

QUALITY CONTROL Metals in Waters - Acid extractable	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Date prepared	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
Date analysed	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
Calcium - Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	91%
Magnesium - Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	87%
Sodium - Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	96%

QUALITY CONTROL All metals in water - total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Date prepared	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
Date analysed	-			29/10/2012	[NT]	[NT]	LCS-W1	29/10/2012
Aluminium-Total	µg/L	10	Metals-022 ICP-MS	<10	[NT]	[NT]	LCS-W1	107%
Arsenic-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	82%
Barium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	95%
Boron-Total	µg/L	5	Metals-022 ICP-MS	<5	[NT]	[NT]	LCS-W1	114%
Cadmium-Total	µg/L	0.1	Metals-022 ICP-MS	<0.1	[NT]	[NT]	LCS-W1	83%
Chromium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	89%
Copper-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	88%
Iron-Total	µg/L	10	Metals-022 ICP-MS	<10	[NT]	[NT]	LCS-W1	89%
Lead-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	94%
Manganese-Total	µg/L	5	Metals-022 ICP-MS	<5	[NT]	[NT]	LCS-W1	90%
Mercury-Total	µg/L	0.05	Metals-021 CV-AAS	<0.05	[NT]	[NT]	LCS-W1	96%
Nickel-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	88%
Selenium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	95%
Silver-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	111%
Zinc-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	85%

Tania Notaras

Jacinta Hurst

Client Reference: EYR3008/120, Wagga Gasworks **Envirolab Reference:** 80772

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Date prepared	-			26/10/2012	80772-1	qw || 26/10/2012	LCS-W1	26/10/2012
Date analysed	-			26/10/2012	80772-1	26/10/2012 || 26/10/2012	LCS-W1	26/10/2012
pH	pH Units		Inorg-001	[NT]	80772-1	7.6 || [N/T]	LCS-W1	103%
Electrical Conductivity	µS/cm	1	Inorg-002	<1	80772-1	130 || [N/T]	LCS-W1	103%
Turbidity	NTU	0.1	Inorg-022	<0.1	80772-1	29 || [N/T]	LCS-W1	93%
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	80772-1	0.013 || 0.008 || RPD: 48	[NR]	[NR]
Chloride, Cl	mg/L	1	Inorg-081	<1	80772-1	9 || 9 || RPD: 0	LCS-W1	92%
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	80772-1	<0.1 || [N/T]	LCS-W1	122%
Free Cyanide in Water	mg/L	0.004	Inorg-013	<0.004	80772-1	<0.004 || [N/T]	[NR]	[NR]
Total Cyanide	mg/L	0.004	Inorg-013	<0.004	80772-1	<0.004 || [N/T]	[NR]	[NR]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	80772-1	0.29 || 0.29 || RPD: 0	[NR]	[NR]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	80772-1	<0.005 || <0.005	[NR]	[NR]
Sulphate, SO4	mg/L	1	Inorg-081	<1	80772-1	4 || [N/T]	LCS-W1	100%
Hexavalent Chromium, Cr^{6+}	mg/L	0.005	Inorg-024	<0.005	80772-1	<0.005 || <0.005	[NR]	[NR]
BOD5	mg/L	4	Ext-020	<4	80772-1	<4 || [N/T]	LCS-W1	116%
COD	mg O_2/L	50	Inorg-067	<50	80772-1	<50 || <50	LCS-W1	95%
Total Organic Carbon	mg/L	1	Inorg-079	<1	80772-1	5 || 5 || RPD: 0	[NR]	[NR]
Oil & Grease (LLE)	mg/L	5	Inorg-003	<5	80772-1	<5 || [N/T]	[NR]	[NR]
Formaldehyde	mg/L	0.2	Ext-044	<0.2	80772-1	<0.2 || [N/T]	LCS-W1	91%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
Date prepared	-	[NT]	[NT]	80772-5	26/10/2012
Date analysed	-	[NT]	[NT]	80772-5	26/10/2012
pH	pH Units	[NT]	[NT]	[NR]	[NR]
Electrical Conductivity	µS/cm	[NT]	[NT]	[NR]	[NR]
Turbidity	NTU	[NT]	[NT]	[NR]	[NR]
Ammonia as N in water	mg/L	[NT]	[NT]	[NR]	[NR]
Chloride, Cl	mg/L	[NT]	[NT]	80772-5	93%
Fluoride, F	mg/L	[NT]	[NT]	[NR]	[NR]
Free Cyanide in Water	mg/L	[NT]	[NT]	[NR]	[NR]
Total Cyanide	mg/L	[NT]	[NT]	[NR]	[NR]
Nitrate as N in water	mg/L	[NT]	[NT]	[NR]	[NR]
Nitrite as N in water	mg/L	[NT]	[NT]	[NR]	[NR]
Sulphate, SO4	mg/L	[NT]	[NT]	80772-5	#
Hexavalent Chromium, Cr^{6+}	mg/L	[NT]	[NT]	[NR]	[NR]
BOD5	mg/L	[NT]	[NT]	[NR]	[NR]

Tania Notaras

Jacinta Hurst

Client Reference: **EYR3008/120, Wagga Gasworks** **Envirolab Reference:** **80772**

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery
COD	mg O_2/L	[NT]	[NT]	[NR]	[NR]
Total Organic Carbon	mg/L	[NT]	[NT]	[NR]	[NR]
Oil & Grease (LLE)	mg/L	[NT]	[NT]	[NR]	[NR]
Formaldehyde	mg/L	[NT]	[NT]	80772-5	91%

Tania Notaras

Jacinta Hurst

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CERTIFICATE OF ANALYSIS 81075

Client:
Enviropacific Services (Chatswood) Pty Ltd
1/28 Barcoo St
Chatswood
NSW 2067

Attention: Rhys Blackburn

Sample log in details:

Your Reference:	**Wagga Gasworks**		
No. of samples:	5 Waters		
Date samples received / completed instructions received	02/11/12	/	02/11/12

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	6/11/12	/	6/11/12
Date of Preliminary Report:	Not issued		

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

Nancy Zhang
Chemist

Nick Sarlamis
Inorganics Supervisor

Jeremy Faircloth
Chemist

vTRH & BTEX in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	81075-1 Raw Water 01/11/12 Water	81075-3 High PH aerated - Water	81075-5 Post GAC 01/11/12 Water
Date extracted	-	05/11/2012	05/11/2012	05/11/2012
Date analysed	-	05/11/2012	05/11/2012	05/11/2012
TRHC$_6$ - C$_9$	µg/L	7,900	120	<10
Benzene	µg/L	4,400	3	<1
Toluene	µg/L	1,600	5	<1
Ethylbenzene	µg/L	<100	<1	<1
m+p-xylene	µg/L	410	3	<2
o-xylene	µg/L	260	2	<1
Surrogate Dibromofluoromethane	%	108	88	108
Surrogate toluene-d8	%	97	124	98
Surrogate 4-BFB	%	97	98	96

sTRH in Water (C10-C36) Our Reference: Your Reference	UNITS ----------	81075-1 Raw Water	81075-3 High PH aerated	81075-5 Post GAC
Date Sampled	----------	01/11/12	-	01/11/12
Type of sample		Water	Water	Water
Date extracted	-	05/11/2012	05/11/2012	05/11/2012
Date analysed	-	06/11/2012	06/11/2012	06/11/2012
TRHC$_{10}$ - C$_{14}$	µg/L	330,000	270,000	53
TRHC$_{15}$ - C$_{28}$	µg/L	27,000	15,000	140
TRHC$_{29}$ - C$_{36}$	µg/L	1,300	<1,000	<100
Surrogate o-Terphenyl	%	#	#	93

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	81075-1 Raw Water 01/11/12 Water	81075-5 Post GAC 01/11/12 Water
Date extracted	-	05/11/2012	05/11/2012
Date analysed	-	06/11/2012	06/11/2012
Naphthalene	µg/L	1,800	<0.1
Acenaphthylene	µg/L	<100	<0.1
Acenaphthene	µg/L	<100	<0.1
Fluorene	µg/L	100	<0.1
Phenanthrene	µg/L	220	<0.1
Anthracene	µg/L	<100	<0.1
Fluoranthene	µg/L	130	<0.1
Pyrene	µg/L	110	<0.1
Benzo(a)anthracene	µg/L	<100	<0.1
Chrysene	µg/L	<100	<0.1
Benzo(b+k)fluoranthene	µg/L	<200	<0.2
Benzo(a)pyrene	µg/L	<100	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<100	<0.1
Dibenzo(a,h)anthracene	µg/L	<100	<0.1
Benzo(g,h,i)perylene	µg/L	<100	<0.1
Surrogate p-Terphenyl-d_{14}	%	#	73

Speciated Phenols in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ---------- 	81075-1 Raw Water 01/11/12 Water	81075-5 Post GAC 01/11/12 Water
Date extracted	-	05/11/2012	05/11/2012
Date analysed	-	06/11/2012	06/11/2012
Phenol	µg/L	68,000	<10
2-Chlorophenol	µg/L	<100	<10
2-Methylphenol	µg/L	81,000	<10
3/4-Methylphenol	µg/L	140,000	<20
2-Nitrophenol	µg/L	62,000	<10
2,4-Dimethylphenol	µg/L	<100	<10
2,4-Dichlorophenol	µg/L	<100	<10
2,6-Dichlorophenol	µg/L	<100	<10
2,4,5-Trichlorophenol	µg/L	<100	<10
2,4,6-Trichlorophenol	µg/L	<100	<10
2,4-Dinitrophenol	µg/L	<1,000	<100
4-Nitrophenol	µg/L	<1,000	<100
2,3,4,6-Tetrachlorophenol	µg/L	<100	<10
2-methyl-4,6-dinitrophenol	µg/L	<1,000	<100
Pentachlorophenol	µg/L	<1,000	<100
Surrogate 2-fluorophenol	%	61	40
Surrogate Phenol-d_6	%	34	29
Surrogate 2,4,6-Tribromophenol	%	101	127
Surrogate p-Terphenyl-d_{14}	%	121	106

Metals in Waters - Acid extractable			
Our Reference:	UNITS	81075-1	81075-5
Your Reference	----------	Raw Water	Post GAC
Date Sampled	----------	01/11/12	01/11/12
Type of sample		Water	Water
Date prepared	-	05/11/2012	05/11/2012
Date analysed	-	05/11/2012	05/11/2012
Calcium - Total	mg/L	92	89
Magnesium - Total	mg/L	90	53
Phosphorus - Total	mg/L	0.3	1.5
Sodium - Total	mg/L	74	610

All metals in water - total Our Reference: Your Reference	UNITS ----------	81075-1 Raw Water	81075-2 Coag/Floc	81075-3 High PH aerated	81075-5 Post GAC
Date Sampled	----------	01/11/12	-	-	01/11/12
Type of sample		Water	Water	Water	Water
Date prepared	-	05/11/2012	05/11/2012	05/11/2012	05/11/2012
Date analysed	-	06/11/2012	06/11/2012	06/11/2012	06/11/2012
Aluminium-Total	µg/L	1,100	[NA]	[NA]	350
Arsenic-Total	µg/L	21	[NA]	[NA]	32
Barium-Total	µg/L	50	[NA]	[NA]	340
Cadmium-Total	µg/L	<0.1	[NA]	[NA]	<0.1
Chromium-Total	µg/L	5	[NA]	[NA]	1
Copper-Total	µg/L	19	[NA]	[NA]	11
Iron-Total	µg/L	46,000	[NA]	[NA]	260
Lead-Total	µg/L	6	2	<1	<1
Manganese-Total	µg/L	4,500	[NA]	[NA]	44
Mercury-Total	µg/L	<0.05	[NA]	[NA]	<0.05
Nickel-Total	µg/L	94	[NA]	[NA]	6
Selenium-Total	µg/L	1	1	1	1
Silver-Total	µg/L	<1	<1	<1	<1
Zinc-Total	µg/L	93	68	17	12
Boron-Total	µg/L	1,000	[NA]	[NA]	30

Miscellaneous Inorganics Our Reference: Your Reference	UNITS ----------	81075-1 Raw Water	81075-2 Coag/Floc	81075-3 High PH aerated	81075-4 Post Zeclite	81075-5 Post GAC
Date Sampled	----------	01/11/12	-	-	01/11/12	01/11/12
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	05/11/2012	05/11/2012	05/11/2012	05/11/2012	05/11/2012
Date analysed	-	05/11/2012	05/11/2012	05/11/2012	05/11/2012	05/11/2012
pH	pH Units	7.1	7.3	9.5	7.8	8.1
Total Dissolved Solids (grav)	mg/L	2,700	[NA]	[NA]	[NA]	2,300
Electrical Conductivity	µS/cm	4,700	4,100	4,700	5,400	4,100
Ammonia as N in water	mg/L	540	390	230	120	82
Turbidity	NTU	790	100	17	14	14
Chloride, Cl	mg/L	20	[NA]	[NA]	[NA]	620
Hexavalent Chromium, Cr^{6+}	mg/L	<0.1	<0.1	<0.1	[NA]	<0.005
Fluoride, F	mg/L	0.98	[NA]	[NA]	[NA]	2.1
Free Cyanide in Water	mg/L	<0.001	<0.001	<0.001	[NA]	<0.001
Nitrate as N in water	mg/L	0.24	[NA]	[NA]	[NA]	0.083
Nitrite as N in water	mg/L	0.031	[NA]	[NA]	[NA]	0.086
Sulphate, SO4	mg/L	1,600	[NA]	[NA]	[NA]	690
Total Organic Carbon	mg/L	820	670	640	630	23

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-5oC.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell and dedicated meter, in accordance with APHA 22nd ED 2510 and Rayment & Lyons.
Inorg-057	Ammonia - determined colourimetrically based on EPA350.1 and APHA 22nd ED 4500-NH3 F, Soils are analysed following a KCl extraction.
Inorg-022	Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA 22nd ED, 2130-B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.
Inorg-024	Hexavalent Chromium (Cr6+) - determined colourimetrically based upon APHA 22nd, 3500-Cr-B.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA 22nd ED, 4500-F-C.
Inorg-013	Cyanide - total determined colourimetrically after distillation, based on APHA 22nd ED, 4500-CN_C,E. Free cyanide determined colourimetrically after filtration and confirmed by diffusion.
Inorg-055	Nitrate - determined colourimetrically based on EPA353.2 and APHA 22nd ED NO3- F. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on EPA353.2 and APHA 22nd ED NO2- B. Soils are analysed following a water extraction.
Inorg-079	TOC determined using a TOC analyser using the combustion method. DOC is filtered prior to determination. Analysis using APHA 22nd ED 5310B.

QUALITY CONTROL vTRH & BTEX in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			05/11/2012	[NT]	[NT]	LCS-W1	05/11/2012
Date analysed	-			05/11/2012	[NT]	[NT]	LCS-W1	05/11/2012
TRHC$_6$ - C$_9$	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	104%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	104%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	106%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	103%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	104%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	103%
Surrogate Dibromofluoromethane	%		Org-016	107	[NT]	[NT]	LCS-W1	100%
Surrogate toluene-d8	%		Org-016	101	[NT]	[NT]	LCS-W1	100%
Surrogate 4-BFB	%		Org-016	102	[NT]	[NT]	LCS-W1	95%
QUALITY CONTROL sTRH in Water (C10-C36)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			05/11/2012	[NT]	[NT]	LCS-W1	05/11/2012
Date analysed	-			06/11/2012	[NT]	[NT]	LCS-W1	06/11/2012
TRHC$_{10}$ - C$_{14}$	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	84%
TRHC$_{15}$ - C$_{28}$	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	110%
TRHC$_{29}$ - C$_{36}$	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	100%
Surrogate o-Terphenyl	%		Org-003	103	[NT]	[NT]	LCS-W1	119%
QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			05/11/2012	[NT]	[NT]	LCS-W1	05/11/2012
Date analysed	-			06/11/2012	[NT]	[NT]	LCS-W1	06/11/2012
Naphthalene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	92%
Acenaphthylene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	91%
Phenanthrene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	92%
Anthracene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	95%
Pyrene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	96%
Benzo(a)anthracene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Chrysene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	91%
Benzo(b+k)fluoranthene	µg/L	0.2	Org-012 subset	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	98%
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%		Org-012 subset	104	[NT]	[NT]	LCS-W1	111%
QUALITY CONTROL Speciated Phenols in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			05/11/2012	[NT]	[NT]	LCS-W1	05/11/2012
Date analysed	-			06/11/2012	[NT]	[NT]	LCS-W1	06/11/2012
Phenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	129%
2-Chlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	109%
2-Methylphenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	104%
3/4-Methylphenol	µg/L	20	Org-012	<20	[NT]	[NT]	[NR]	[NR]
2-Nitrophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dimethylphenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,6-Dichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	87%
2,4,5-Trichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4,6-Trichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dinitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
4-Nitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	LCS-W1	94%
2,3,4,6-Tetrachlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-methyl-4,6-dinitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
Pentachlorophenol	µg/L	100	Org-012	<100	[NT]	[NT]	LCS-W1	86%
Surrogate 2-fluorophenol	%		Org-012	44	[NT]	[NT]	LCS-W1	101%
Surrogate Phenol-d_6	%		Org-012	33	[NT]	[NT]	LCS-W1	111%
Surrogate 2,4,6-Tribromophenol	%		Org-012	77	[NT]	[NT]	LCS-W1	126%
Surrogate p-Terphenyl-d_{14}	%		Org-012	78	[NT]	[NT]	LCS-W1	122%

QUALITY CONTROL Metals in Waters - Acid extractable	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			05/11/2012	[NT]	[NT]	LCS-W2	05/11/2012
Date analysed	-			05/11/2012	[NT]	[NT]	LCS-W2	05/11/2012
Calcium - Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W2	86%
Magnesium - Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W2	83%
Phosphorus - Total	mg/L	0.05	Metals-020 ICP-AES	<0.05	[NT]	[NT]	LCS-W2	83%
Sodium - Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W2	89%

QUALITY CONTROL All metals in water - total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			05/11/2012	81075-1	05/11/2012 || 05/11/2012	LCS-W2	05/11/2012
Date analysed	-			06/11/2012	81075-1	06/11/2012 || 06/11/2012	LCS-W2	06/11/2012
Aluminium-Total	µg/L	10	Metals-022 ICP-MS	<10	81075-1	1100 || 1000 || RPD: 10	LCS-W2	93%
Arsenic-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	21 || 23 || RPD: 9	LCS-W2	88%
Barium-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	50 || 55 || RPD: 10	LCS-W2	91%
Cadmium-Total	µg/L	0.1	Metals-022 ICP-MS	<0.1	81075-1	<0.1 || <0.1	LCS-W2	93%
Chromium-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	5 || 5 || RPD: 0	LCS-W2	91%
Copper-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	19 || 20 || RPD: 5	LCS-W2	83%
Iron-Total	µg/L	10	Metals-022 ICP-MS	<10	81075-1	46000 || 47000 || RPD: 2	LCS-W2	91%
Lead-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	6 || 6 || RPD: 0	LCS-W2	89%
Manganese-Total	µg/L	5	Metals-022 ICP-MS	<5	81075-1	4500 || 4800 || RPD: 6	LCS-W2	88%
Mercury-Total	µg/L	0.05	Metals-021 CV-AAS	<0.05	81075-1	<0.05 || <0.05	LCS-W2	96%
Nickel-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	94 || 100 || RPD: 6	LCS-W2	87%
Selenium-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	1 || 1 || RPD: 0	LCS-W2	88%
Silver-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	<1 || <1	LCS-W2	106%
Zinc-Total	µg/L	1	Metals-022 ICP-MS	<1	81075-1	93 || 98 || RPD: 5	LCS-W2	90%
Boron-Total	µg/L	5	Metals-022 ICP-MS	<5	81075-1	1000 || 1000 || RPD: 0	LCS-W2	91%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			05/11/2012	81075-1	05/11/2012 || 05/11/2012	LCS-W1	05/11/2012
Date analysed	-			05/11/2012	81075-1	05/11/2012 || 05/11/2012	LCS-W1	05/11/2012
pH	pH Units		Inorg-001	[NT]	81075-1	7.1 || [N/T]	LCS-W1	102%
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	81075-1	2700 || [N/T]	LCS-W1	95%
Electrical Conductivity	µS/cm	1	Inorg-002	<1	81075-1	4700 || [N/T]	LCS-W1	106%
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	81075-1	540 || [N/T]	LCS-W1	109%
Turbidity	NTU	0.1	Inorg-022	<0.1	81075-1	790 || 790 || RPD: 0	LCS-W1	99%
Chloride, Cl	mg/L	1	Inorg-081	<1	81075-1	20 || [N/T]	LCS-W1	106%
Hexavalent Chromium, Cr^{6+}	mg/L	0.005	Inorg-024	<0.005	81075-1	<0.1 || [N/T]	LCS-W1	94%
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	81075-1	0.98 || [N/T]	LCS-W1	103%
Free Cyanide in Water	mg/L	0.001	Inorg-013	<0.001	81075-1	<0.001 || <0.001	LCS-W1	98%
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	81075-1	0.24 || [N/T]	LCS-W1	103%
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	81075-1	0.031 || [N/T]	LCS-W1	97%
Sulphate, SO4	mg/L	1	Inorg-081	<1	81075-1	1600 || [N/T]	LCS-W1	116%
Total Organic Carbon	mg/L	1	Inorg-079	<1	81075-1	820 || 810 || RPD: 1	LCS-W1	101%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	81075-2	05/11/2012
Date analysed	-	[NT]	[NT]	81075-2	05/11/2012
pH	pH Units	[NT]	[NT]	[NR]	[NR]
Total Dissolved Solids (grav)	mg/L	[NT]	[NT]	[NR]	[NR]
Electrical Conductivity	µS/cm	[NT]	[NT]	[NR]	[NR]
Ammonia as N in water	mg/L	[NT]	[NT]	[NR]	[NR]
Turbidity	NTU	[NT]	[NT]	[NR]	[NR]
Chloride, Cl	mg/L	[NT]	[NT]	[NR]	[NR]
Hexavalent Chromium, Cr^{6+}	mg/L	[NT]	[NT]	[NR]	[NR]
Fluoride, F	mg/L	[NT]	[NT]	[NR]	[NR]
Free Cyanide in Water	mg/L	[NT]	[NT]	81075-2	103%
Nitrate as N in water	mg/L	[NT]	[NT]	[NR]	[NR]
Nitrite as N in water	mg/L	[NT]	[NT]	[NR]	[NR]
Sulphate, SO4	mg/L	[NT]	[NT]	[NR]	[NR]
Total Organic Carbon	mg/L	[NT]	[NT]	[NR]	[NR]

Report Comments:

Total Recoverable Hydrocarbons/BTEX in water:PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.

Total Recoverable Hydrocarbons in water:(semivolatile)# Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference. PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.

Phenols in water:PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.

PAH's in water:PQL has been raised due to the high concentration of analytes in the sample/s, resulting in the sample/s requiring dilution.# Percent recovery is not possible to report due to interference from analytes (other than those being tested) in the sample/s.

Hexavalent chromium's in water: PQL raised dut to sample matrix interference.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 81853

Client:
Enviropacific Services (Chatswood) Pty Ltd
1/28 Barcoo St
Chatswood
NSW 2067

Attention: Pearce Anderson

Sample log in details:

Your Reference:	**Wagga Gas Works-Bench Trail**
No. of samples:	4 Waters
Date samples received / completed instructions received	19/11/2012 / 19/11/2012

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	22/11/12 / 22/11/12
Date of Preliminary Report:	Not issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Rhian Morgan
Reporting Supervisor

Nick Sarlamis
Inorganics Supervisor

HM in water - total Our Reference: Your Reference Type of sample	UNITS ---------- ----------	81853-1 Raw Water Water	81853-2 1st Pass Zeolite Water	81853-3 Post GAC Water	81853-4 2nd Pass Zeolite Water
Date prepared	-	20/11/2012	20/11/2012	20/11/2012	20/11/2012
Date analysed	-	20/11/2012	20/11/2012	20/11/2012	20/11/2012
Arsenic-Total	µg/L	78	10	83	79
Cadmium-Total	µg/L	0.9	0.2	<0.1	<0.1
Chromium-Total	µg/L	76	2	4	4
Copper-Total	µg/L	95	120	1	25
Lead-Total	µg/L	150	<1	<1	<1
Mercury-Total	µg/L	0.10	<0.05	<0.05	<0.05
Nickel-Total	µg/L	240	21	8	5
Zinc-Total	µg/L	1,100	24	1	2

Miscellaneous Inorganics Our Reference: Your Reference Type of sample	UNITS ---------- ----------	81853-1 Raw Water Water	81853-2 1st Pass Zeolite Water	81853-3 Post GAC Water	81853-4 2nd Pass Zeolite Water
Date prepared	-	21/11/2012	21/11/2012	21/11/2012	21/11/2012
Date analysed	-	22/11/2012	22/11/2012	22/11/2012	22/11/2012
Ammonia as N in water	mg/L	360	94	88	28
TKN in water	mg/L	560	160	220	79

Method ID	Methodology Summary
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-057	Ammonia - determined colourimetrically based on EPA350.1 and APHA 22nd ED 4500-NH3 F, Soils are analysed following a KCl extraction.
Inorg-062	TKN - determined colourimetrically based on APHA 22nd ED 4500 Norg.

QUALITY CONTROL HM in water - total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			20/11/2012	81853-1	20/11/2012 || 20/11/2012	LCS-W1	20/11/2012
Date analysed	-			20/11/2012	81853-1	20/11/2012 || 20/11/2012	LCS-W1	20/11/2012
Arsenic-Total	µg/L	1	Metals-022 ICP-MS	<1	81853-1	78 || 78 || RPD: 0	LCS-W1	103%
Cadmium-Total	µg/L	0.1	Metals-022 ICP-MS	<0.1	81853-1	0.9 || 0.9 || RPD: 0	LCS-W1	106%
Chromium-Total	µg/L	1	Metals-022 ICP-MS	<1	81853-1	76 || 75 || RPD: 1	LCS-W1	103%
Copper-Total	µg/L	1	Metals-022 ICP-MS	<1	81853-1	95 || 95 || RPD: 0	LCS-W1	100%
Lead-Total	µg/L	1	Metals-022 ICP-MS	<1	81853-1	150 || 150 || RPD: 0	LCS-W1	112%
Mercury-Total	µg/L	0.05	Metals-021 CV-AAS	<0.05	81853-1	0.10 || [N/T]	LCS-W1	84%
Nickel-Total	µg/L	1	Metals-022 ICP-MS	<1	81853-1	240 || 240 || RPD: 0	LCS-W1	103%
Zinc-Total	µg/L	1	Metals-022 ICP-MS	<1	81853-1	1100 || 1100 || RPD: 0	LCS-W1	105%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			21/11/2012	81853-1	21/11/2012 || 21/11/2012	LCS-W1	21/11/2012
Date analysed	-			21/11/2012	81853-1	22/11/2012 || 22/11/2012	LCS-W1	21/11/2012
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	81853-1	360 || [N/T]	LCS-W1	95%
TKN in water	mg/L	0.1	Inorg-062	<0.1	81853-1	560 || 560 || RPD: 0	LCS-W1	90%

QUALITY CONTROL HM in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	81853-2	20/11/2012
Date analysed	-	[NT]	[NT]	81853-2	20/11/2012
Arsenic-Total	µg/L	[NT]	[NT]	81853-2	104%
Cadmium-Total	µg/L	[NT]	[NT]	81853-2	94%
Chromium-Total	µg/L	[NT]	[NT]	81853-2	102%
Copper-Total	µg/L	[NT]	[NT]	81853-2	80%
Lead-Total	µg/L	[NT]	[NT]	81853-2	100%
Mercury-Total	µg/L	[NT]	[NT]	[NR]	[NR]
Nickel-Total	µg/L	[NT]	[NT]	81853-2	86%
Zinc-Total	µg/L	[NT]	[NT]	81853-2	92%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	81853-2	21/11/2012
Date analysed	-	[NT]	[NT]	81853-2	21/11/2012
Ammonia as N in water	mg/L	[NT]	[NT]	81853-2	#
TKN in water	mg/L	[NT]	[NT]	[NR]	[NR]

Report Comments:

Ammonia:# Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

APPENDIX D – STORMWATER DISCHARGE PIPE DESIGN

534000 534050 534100 534150

6114900

CROSS STREET

CATTLE GRID

THEATRE

EARTHEN BUND

CELL 2

STOCKPILE 1

6114850

CELL 3

CELL 4

DECON UNIT

STOCKPILE 2

TARCUTTA STREET

Murrumbidgee River

EARTHEN BUND

6114800

SITE AMENITIES

Point 1:
Flowmeter
Sampling

WATER TREATMENT PLANT
(refer to Drg: N0520.dwg)

Point 3:
Direct River
Discharge

CATTLE GRID

Point 2 [200m south]
Storm water outlet to
Murrumbidge

534000 534100 534150

N

0 10 20m
METRES

LEGEND

REMEDIATION AREA

SURFACE FLOW DIRECTION

SEDIMENT FENCING

EARTHERN DIVERSION BUND

STORMWATER MAINS

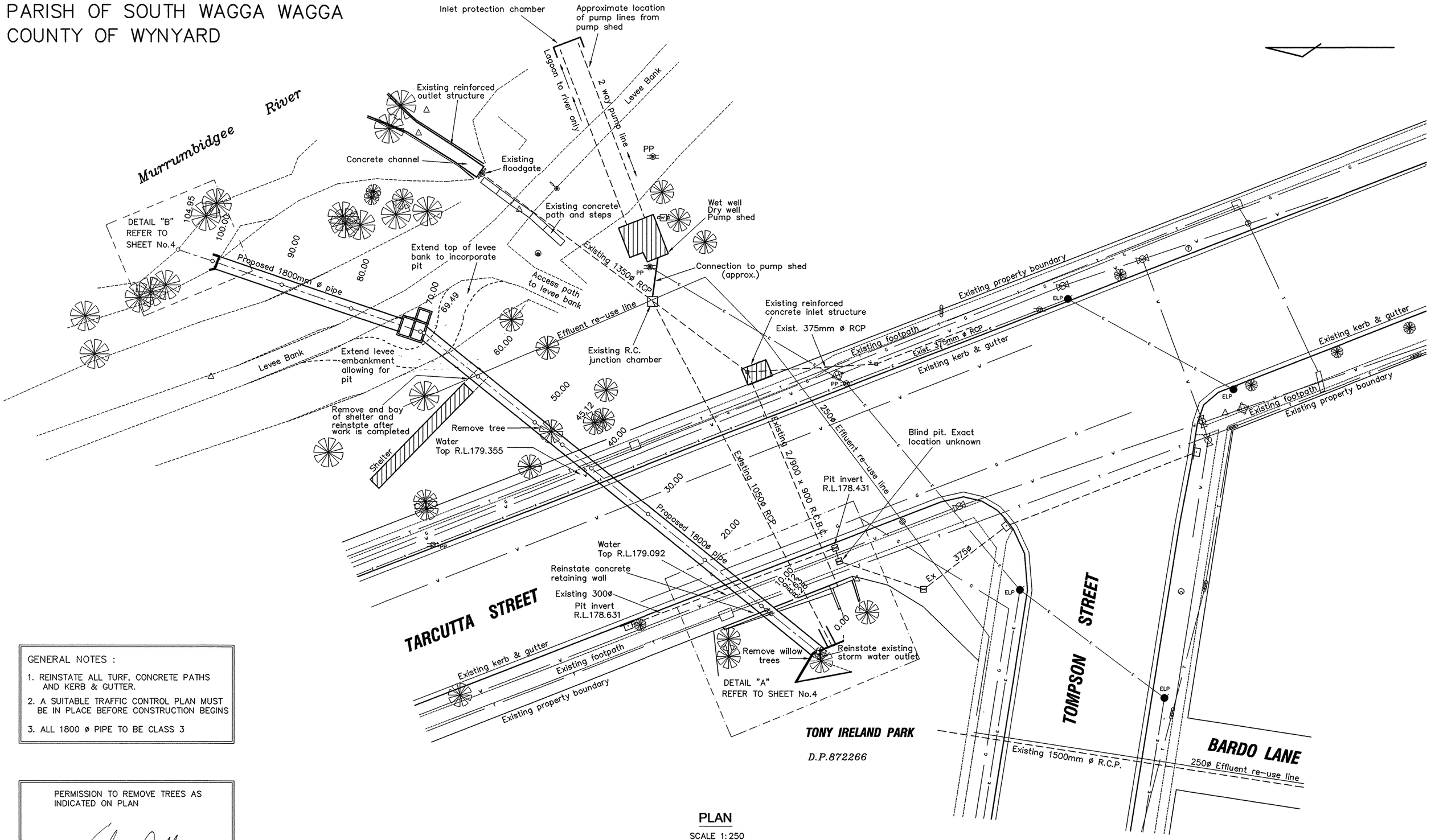
ENVIROPACIFIC SERVICES

SITE WATER MANAGEMENT CONTROLS

TARCUTTA STREET
WAGGA WAGGA
NEW SOUTH WALES

Author: N.R.	Layer: 3–General		
Checked: P.P.	Revison: 15 November 2012	Ref:	
Approved:	DRG No: N0527.dwg	Job No.: EYR3008	FIG. 4

PARISH OF SOUTH WAGGA WAGGA
COUNTY OF WYNYARD



PLAN
SCALE 1:250

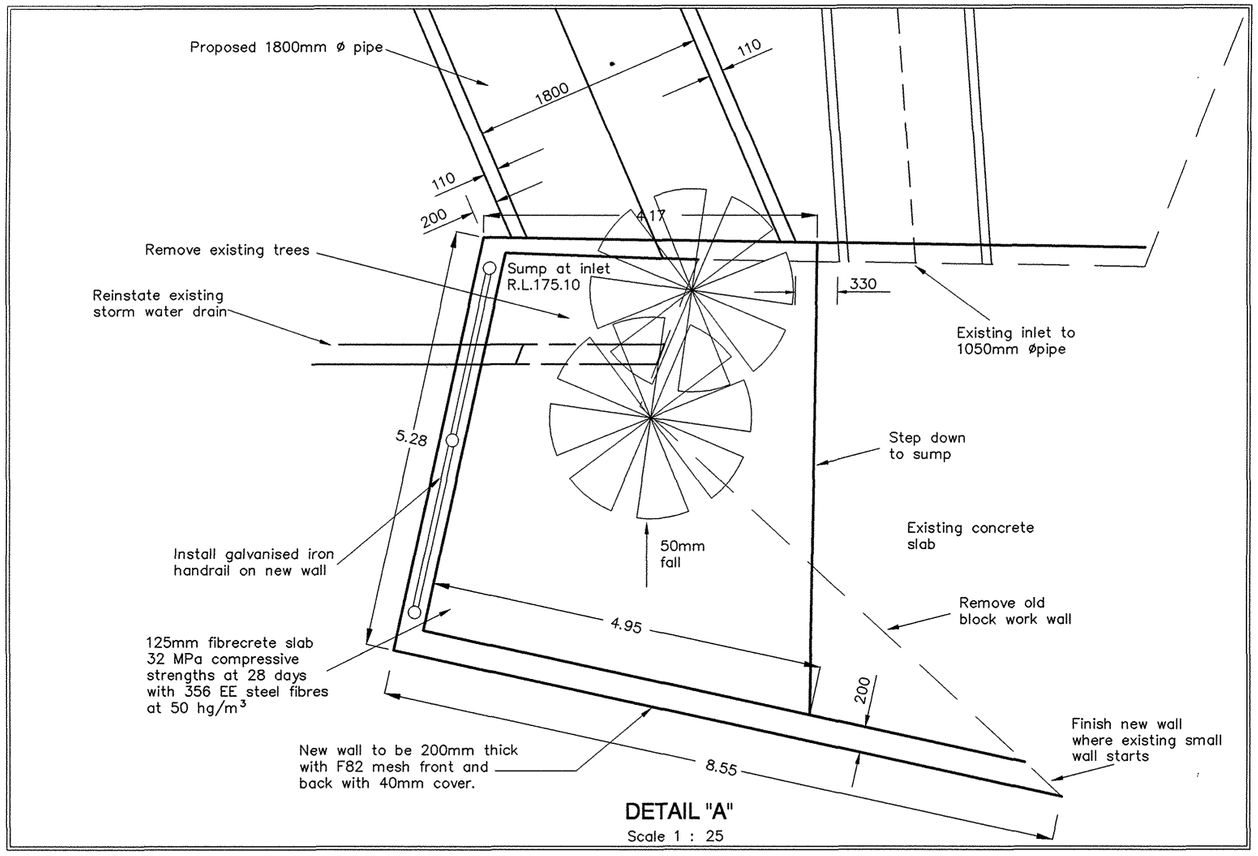
GENERAL NOTES :

1. REINSTATE ALL TURF, CONCRETE PATHS AND KERB & GUTTER.
2. A SUITABLE TRAFFIC CONTROL PLAN MUST BE IN PLACE BEFORE CONSTRUCTION BEGINS
3. ALL 1800 ø PIPE TO BE CLASS 3

PERMISSION TO REMOVE TREES AS INDICATED ON PLAN

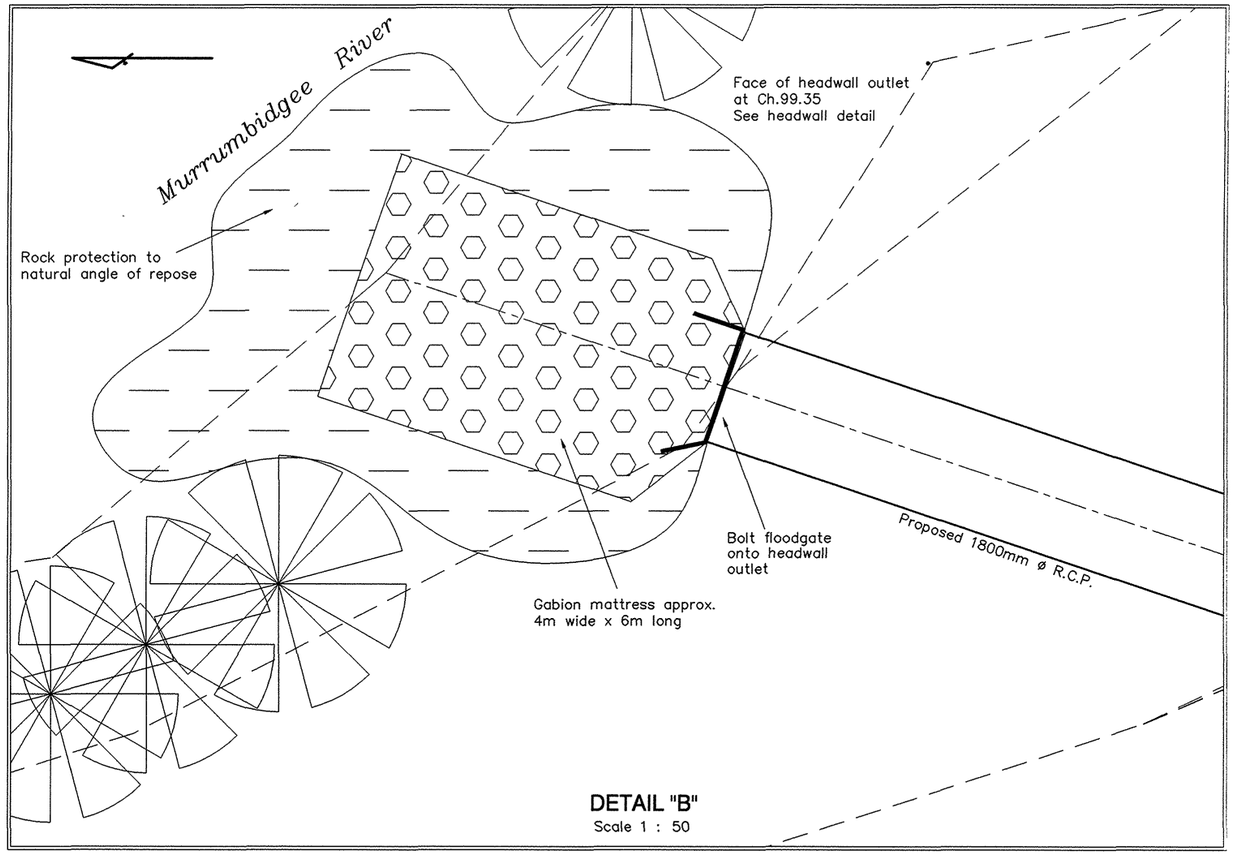
DIRECTOR OF RECREATIONAL & CULTURAL SERVICES
ACTING

			APPROVED BY MANAGER, DESIGN SERVICES	CLIENT APPROVED	THE COUNCIL OF THE CITY OF WAGGA WAGGA	PROJECT: TOMPSON STREET & TARCUTTA STREET WOLLUNDRY LAGOON OUTLET AUGMENTATION WITHIN TONY IRELAND PARK DRAINAGE
1.	Proposed Levee Bank Amendment	5/3/01	26/2/01	24/4/01	DEPARTMENT OF ENGINEERING AND TECHNICAL SERVICES	PLAN No. D 477
REVISION	AMENDMENT :	ISSUED	DESIGNED : S.C. FARRELL	DRAWN : K. COGGAN		FILENAME TIRELANDR
SCALE	A1 PLAN 1:250 / A3 PLAN 1:500 (0 5 10 15 20 25)		DATE : 4.9.2000	DATE : 4.9.2000		SHEET 3 of 9 SHEETS



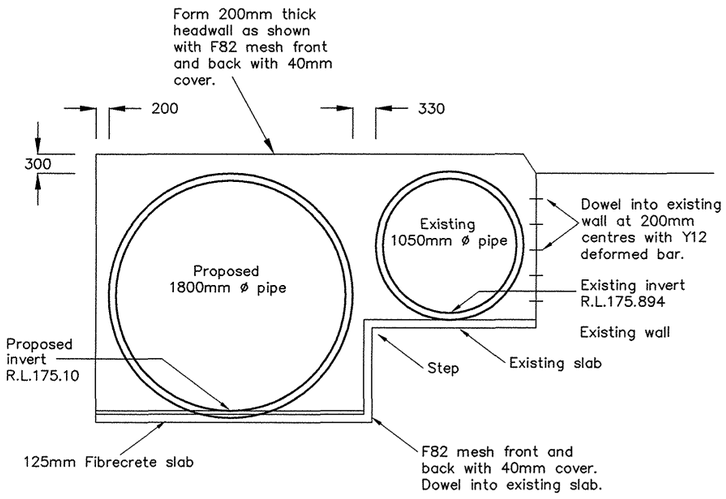
DETAIL "A"

Scale 1 : 25



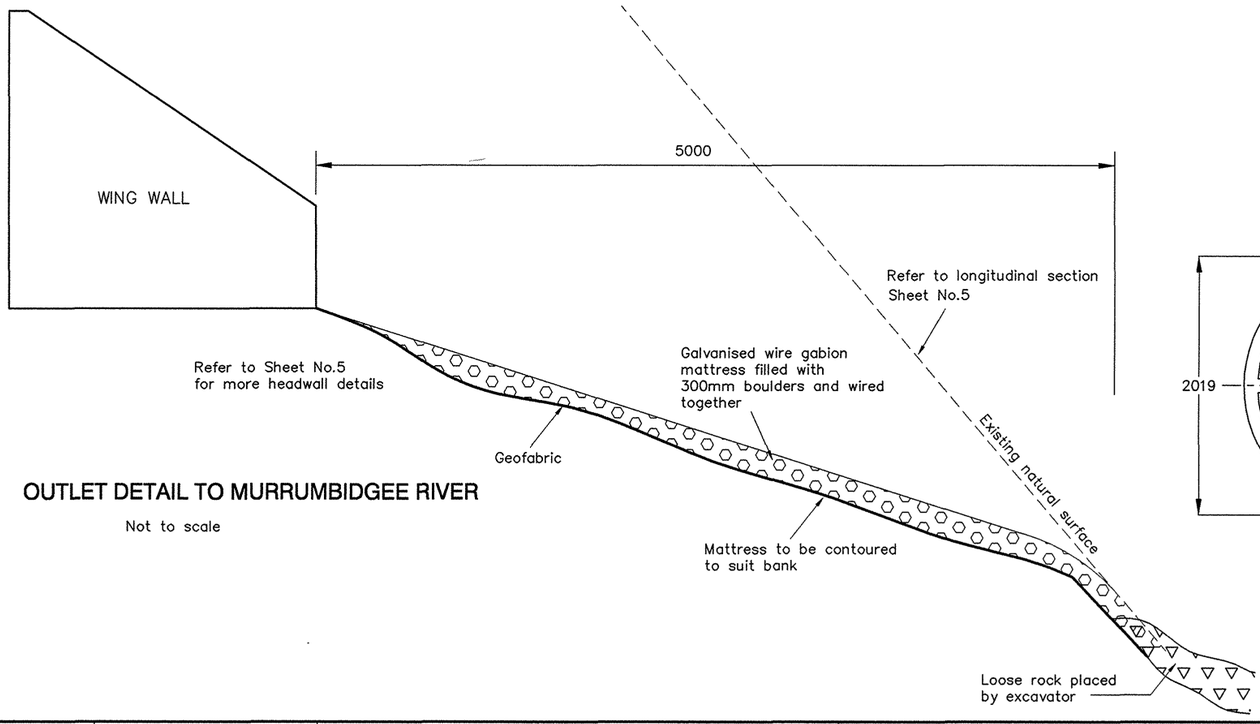
DETAIL "B"

Scale 1 : 50



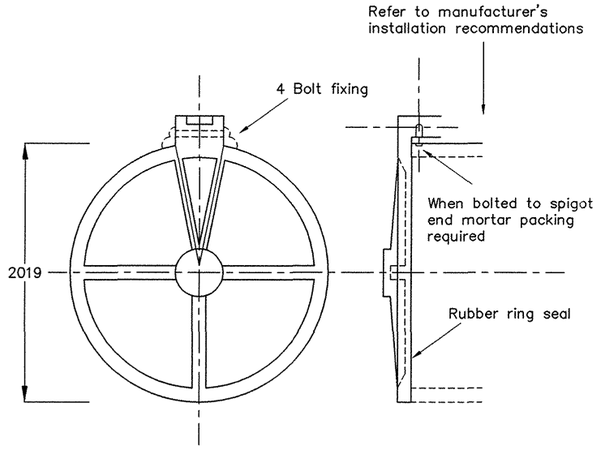
WOLLUNDRY LAGOON INLET DETAIL

Scale 1 : 50



OUTLET DETAIL TO MURRUMBIDGEE RIVER

Not to scale



1800mm BOLT ON TYPE FLOODGATE FROM ROCLA

Scale 1 : 25

REVISION	AMENDMENT :	ISSUED
3	HEADWALL DETAILS AMENDED	9-4-01
2	LOOSE ROCK NOTE ADDED	19-2-01
1	DIMENSIONS ADDED TO DETAIL "A"	19-2-01

SCALE AS SHOWN

APPROVED BY MANAGER, DESIGN SERVICES
26/2/01

CLIENT APPROVED
24/4/01

DESIGNED : S.C. FARRELL
DATE : 6.9.2000

DRAWN : K. COGGAN
DATE : 6.9.2000

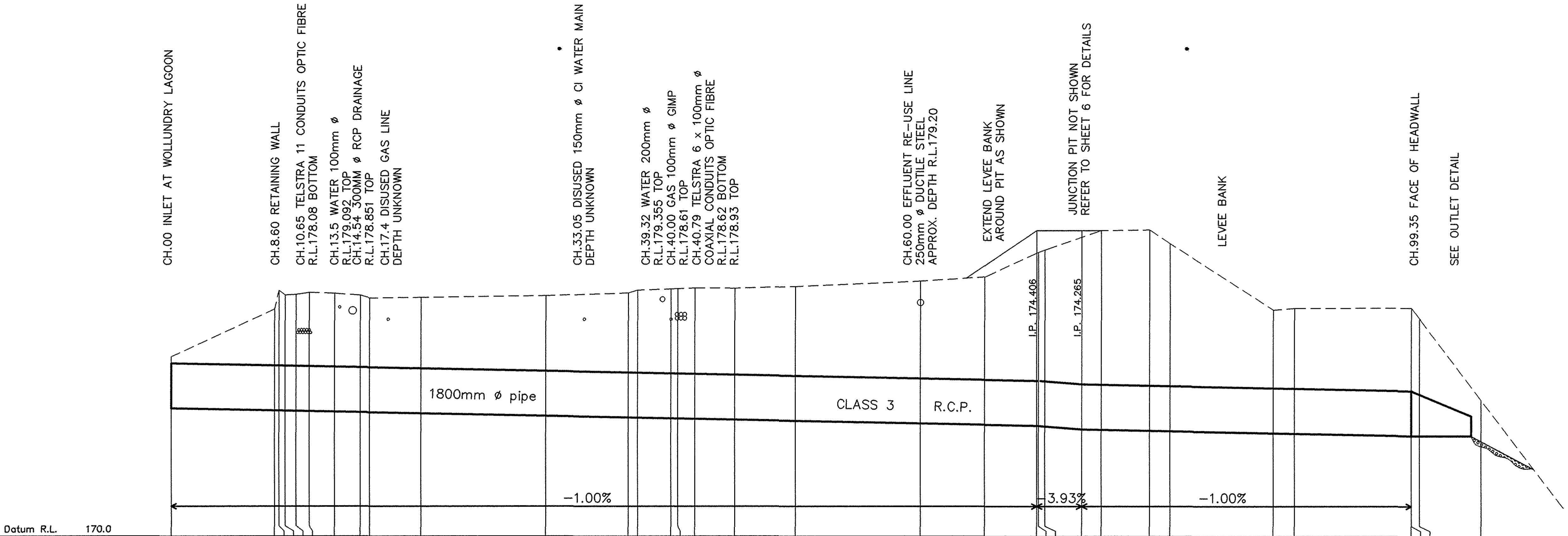
THE COUNCIL OF THE
CITY OF WAGGA WAGGA
DEPARTMENT OF ENGINEERING AND TECHNICAL SERVICES

PROJECT
TOMPSON STREET & TARCUTTA STREET
WOLLUNDRY LAGOON OUTLET AUGMENTATION
TONY IRELAND PARK
DRAINAGE STRUCTURE DETAILS

PLAN No.
D 477

FILENAME
PARK

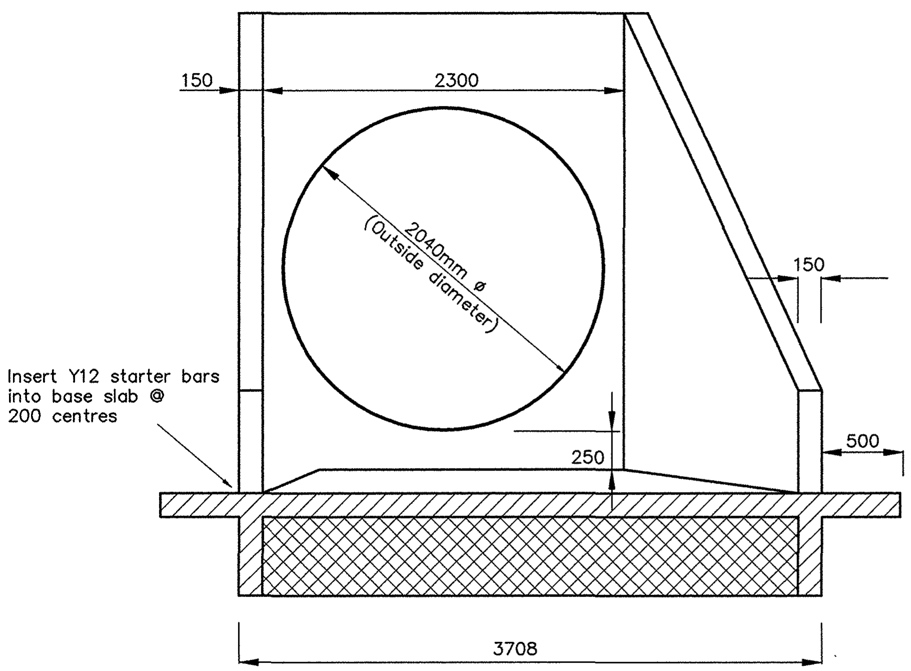
SHEET 4 of 9 SHEETS



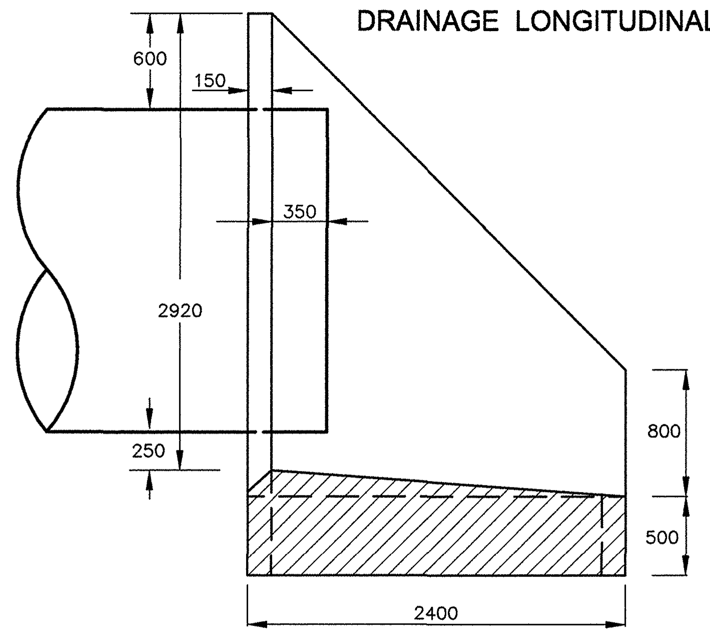
CHAINAGE	NATURAL SURFACE LEVELS	DESIGN INVERT LEVELS	CUT/FILL
0.000	177.166	175.100	-2.066
8.280	179.064	175.017	-4.047
8.627	179.815	175.014	-4.801
9.117	179.622	175.009	-4.613
10.000	179.649	175.000	-4.649
11.062	179.731	174.989	-4.741
13.097	179.695	174.969	-4.726
15.163	179.615	174.948	-4.667
15.911	179.505	174.941	-4.564
20.000	179.531	174.900	-4.631
30.000	179.599	174.800	-4.799
36.604	179.706	174.734	-4.972
37.351	179.818	174.726	-5.092
40.000	179.867	174.700	-5.167
40.552	179.880	174.694	-5.185
41.913	179.902	174.681	-5.221
45.124	179.899	174.649	-5.251
50.000	179.967	174.600	-5.367
60.000	180.184	174.500	-5.684
65.147	180.346	174.449	-5.898
69.360		174.406	
69.489	181.336	174.401	-6.935
70.000	181.427	174.381	-7.046
72.960		174.265	
74.520	182.204	174.249	-7.954
78.377	182.229	174.211	-8.018
80.000	181.686	174.194	-7.491
88.302	179.036	174.111	-4.925
90.000	179.098	174.094	-5.004
99.347	179.110	174.000	-5.110
99.350			
100.000	178.681		
104.953	175.435		

Scale Horizontal 1:200 Vertical 1:100

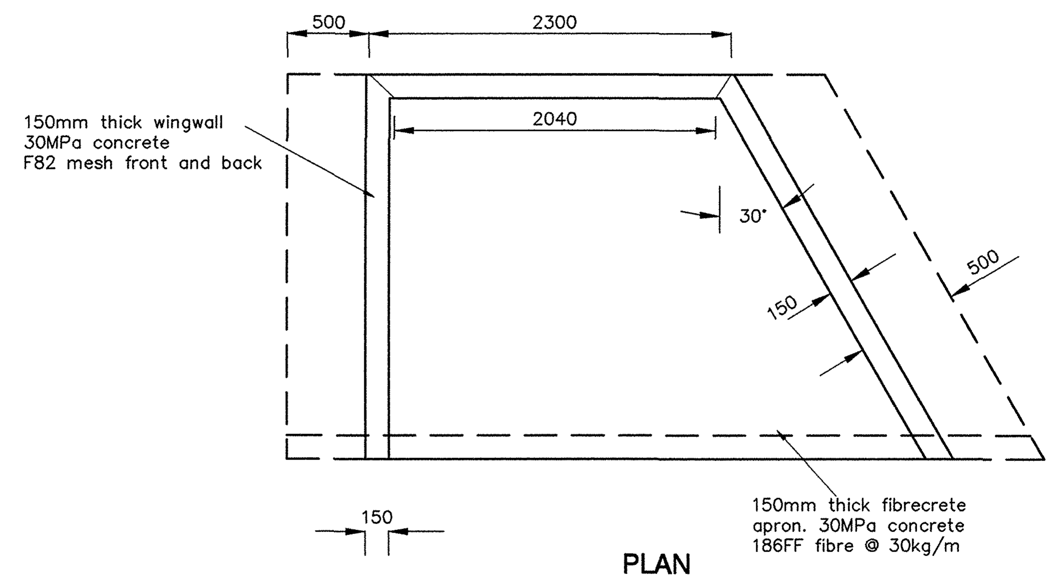
DRAINAGE LONGITUDINAL SECTION



ELEVATION
Scale 1 : 25



SIDE ELEVATION
Scale 1 : 25



PLAN
Scale 1 : 25

HEADWALL AT OUTLET

REVISION	AMENDMENT :	ISSUED
2	ELEVATION AMENDMENTS	9.4.01
1	HEADWALL AMENDMENTS	6.4.01

SCALE AS SHOWN

APPROVED BY MANAGER, DESIGN SERVICES — Bryan Grant 26/4/01

CLIENT APPROVED — A. Potter 24/4/01

DESIGNED : S.C. FARRELL DATE : 18.8.2000

DRAWN : K. COGGAN DATE : 18.8.2000

THE COUNCIL OF THE CITY OF WAGGA WAGGA
DEPARTMENT OF ENGINEERING AND TECHNICAL SERVICES

PROJECT
TOMPSON STREET & TARCUTTA STREET
WOLLUNDRY LAGOON OUTLET AUGMENTATION
TONY IRELAND PARK
DRAINAGE LONGITUDINAL SECTION & HEADWALL DETAILS

PLAN No. D 477

FILENAME TIRELAND2

SHEET 5 of 9 SHEETS