

# **Clyde Western Area Remediation Project (WARP) SSD-9302**

## Annual Report

Reporting Period: 01 October 2020 to 30 June 2021

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# 1 Introduction

Viva Energy Australia Pty Ltd (Viva Energy) owns the land associated with the former Clyde Refinery (the 'Site') located at Durham Street, Rosehill on the Camellia Peninsula. Viva Energy currently operates the Clyde Terminal on part of the Site; however, a large part of the former refinery land in the south-western part of the Site (the 'Western Area') is no longer required for operational purposes. As such, Viva Energy is undertaking the remediation of contaminated soils in the Western Area to a standard suitable for future commercial / industrial land uses.

The Western Area Remediation Project (WARP) was designated state significant development due to the scale of the proposed works and an Environmental Impact Statement (EIS) was prepared. On 7 May 2020, The Minister for Planning and Places approved the development application (SSD 9302) for the Clyde WARP.

The Clyde Terminal site and the Western Area are shown in Figure 1.

Viva Energy are proposing to stage the remediation of the Western Area as follows:

- Stage 1 – Former Process West
- Stage 2 – Former Utilities and Movements
- Stage 3 – Former Process East.

The Stage 1 to 3 areas are shown in Figure 2.

Remediation of the Stage 1 area was completed between October 2020 and February 2021. A Site Audit Statement (SAS) No.043/2127799 was issued in February 2021 confirming the successful completion of remediation works and the suitability of the Stage 1 area for future commercial/industrial land uses. Figure 3 illustrates the remediation areas for the Stage 1 works.

Remediation of the Stage 2 area is expected to commence in September 2021.

The content of this Annual Report provides relevant details of the Stage 1 remediation works and meets the requirements of SSD 9302 condition C12. Table 1 below lists the requirements and the corresponding sections where each specific requirement is addressed.

**Table 1: Annual review and reporting requirements**

Condition C12 requirement	Report section
Within 12 months of the commencement of the remediation works, and every year thereafter until the completion of demobilisation, or other timing as may be agreed by the Planning Secretary, the Applicant shall review and report on the environmental performance of the development. The report shall:	
(a) be submitted to the Planning Secretary and EPA;	
(b) describe the works that were carried out in the previous year and the works to be carried out in the coming year;	Section 2
(c) include a comprehensive review of the monitoring results and complaints records of the development over the previous year, to demonstrate the effectiveness of the remediation works, including a comparison of: <ul style="list-style-type: none"><li>i. air quality monitoring data with relevant limits or performance measures/criteria;</li><li>ii. water discharges with established discharge criteria for contaminants of concern;</li><li>iii. groundwater monitoring data with background data and trigger levels established in accordance with condition B22;</li><li>iv. detail community consultation activities during the year, including any alterations to works or mitigation measures implemented to address community concerns;</li></ul>	Section 3
(d) identify any non-compliances over the last year, and describe what actions were (or are being) taken to ensure compliance; and	Section 4
(e) describe what contingency measures would be implemented over the coming year to improve the environmental performance of the Development, should any issues be identified with the effectiveness of the remediation works.	Section 5





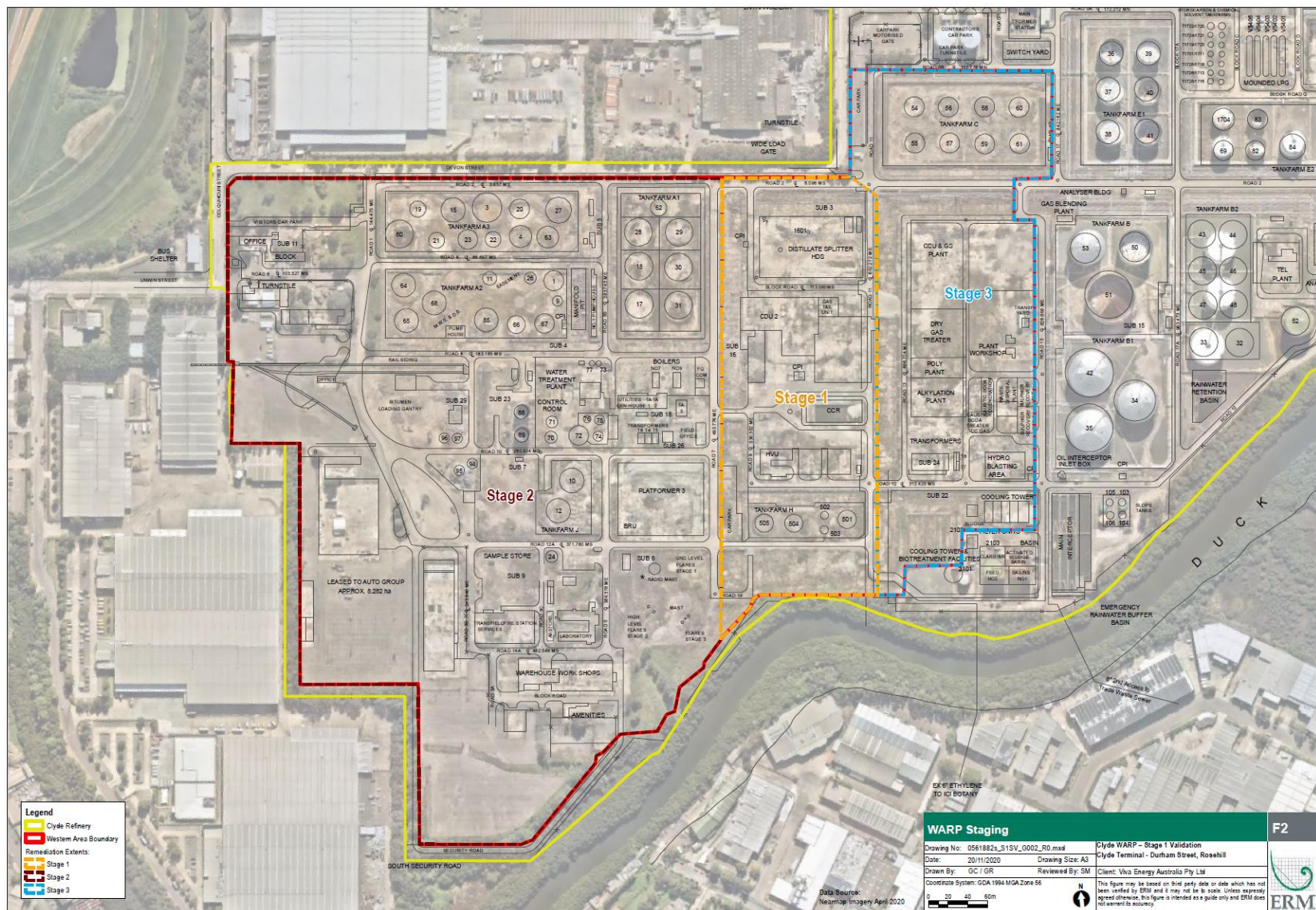
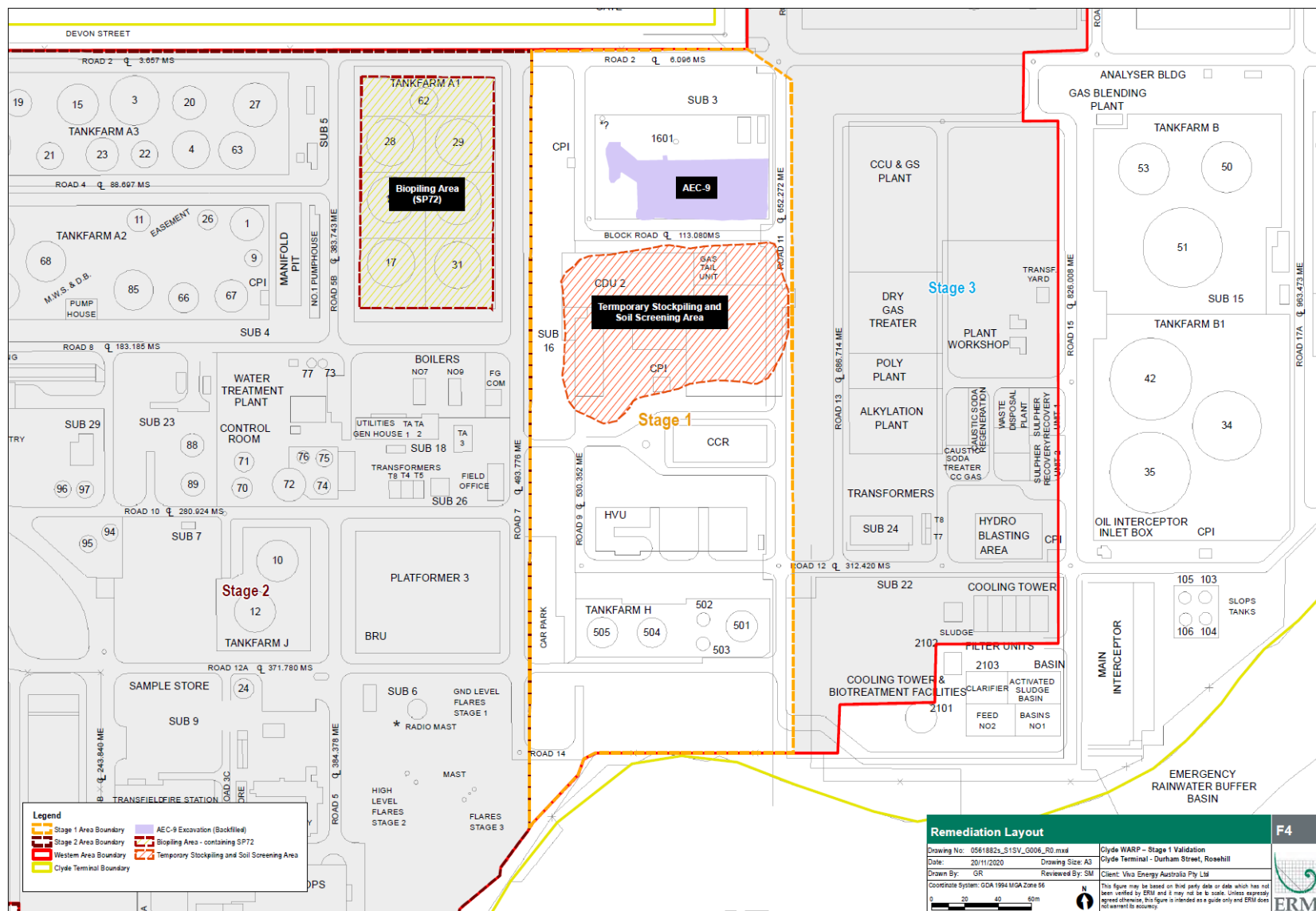


Figure 2 – Clyde WARP Stages 1, 2 and 3



## 2 Works undertaken

This Section describes the works undertaken in accordance with Development Consent SSD 9302 during the period 1 October 2020 to 30 June 2021.

### 2.1 Remediation works

Stage 1 remediation activities commenced on 6 October 2020. Excavation of an in-situ volume of 4,673m<sup>3</sup> from Area of Environmental Concern 9 (AEC-9) was undertaken in accordance with the Stage 1 Remediation Action Plan (RAP) to remove contaminated soil materials and Light Non-Aqueous Phase Liquids (LNAPL) in shallow soils. Validation of the walls and base of the excavation was undertaken prior to backfilling with imported Virgin Excavated Natural Material (VENM) in mid to late November 2020.

Of the excavated material, an estimated 2,418 m<sup>3</sup> was classified as requiring remediation and was moved to the biopiling area established within the Stage 2 area, where biopiles were constructed and covered. The active biopile remediation process commenced in early December 2020 and was successfully completed on 12 February 2021 with validation sample results demonstrating that remediation criteria had been met.

Full details of the Stage 1 remediation works are detailed in the Stage 1 Validation Report, prepared by ERM and dated 17 December 2020. All remediation works and results were also assessed by an EPA accredited auditor who prepared a Site Audit Statement (SAS No. 055-2127799A) and Site Audit Report (SAR) dated 18 February 2021. The Audit report and statement confirmed that the remediation works were completed in accordance with the Stage 1 RAP and determined the Stage 1 area to be suitable for future commercial / industrial land uses.

### 2.2 Erosion and sediment control works

As a result of the remediation and subsequent development of the Stage 1 area, and the decommissioning of the former refinery's subgrade drainage system, surface water runoff from the Stage 2 area no longer drains to the Clyde Terminal waste water treatment plant.

To ensure adequate surface water management across the Stage 2 area, an erosion and sediment control plan (ESCP) including the construction of a sediment basin, was submitted to DPIE as part of an update to the Stage 1 REMP and Soil and Water Management Plan. These plans were approved by the Planning Secretary on 9 April 2021.

Following approval of these plans, a sediment basin was constructed in the southern part of the Stage 2 area during May and June 2021. The sediment basin has been designed and constructed in general accordance with the requirements from 'Managing Urban Stormwater: Soils and Construction – Volume 1: Blue Book (Landcom 2004)'.

## 3 Environmental performance

### 3.1 Air

During the reporting period, air quality was monitored and managed in accordance with the Remediation Environmental Management Plan (REMP), the Air Quality Management Plan (AQMP) and the Air Emissions Verification Report (AEVR), in addition to EPL570.

A description of the monitoring undertaken and a summary of results is provided in **Appendix A.1**

### 3.2 Water

Minimal groundwater was encountered during excavation works or accumulated in excavations from rainfall. Consequently, no water was required to be discharged from the site.

### 3.3 Groundwater

During the reporting period, groundwater was monitored in accordance with the Remediation Environmental Management Plan (REMP), the Groundwater Monitoring and Management Plan (GMP) and EPL570.

A description of the monitoring undertaken and a summary of results is provided in **Appendix A.2**



### 3.4 Community consultation

Prior to the commencement of the Stage 1 remediation activities, a Community Update newsletter/flyer was prepared and physically distributed to approximately 2330 residents and businesses within a 2km (approx.) radius of the Site.

The Community Update (dated September 2020) was also loaded onto the Viva Energy website at the following location: <https://www.vivaenergy.com.au/operations/clyde>

No concerns in relation to the remediation works were raised by any members of the community. Accordingly, no alterations to works or implementation of mitigation measures were required as a result of any issue raised by the community.

## 4 Non-compliances

No reportable incidents or non-compliances occurred relating to consent conditions during this reporting period.

No non-compliances with the Clyde Terminal Environment Protection Licence (EPL570) conditions occurred during the reporting period.

## 5 Contingency measures

Environmental performance for Stage 1 of the Clyde WARP (this reporting period) has been compliant and consistent with the statutory requirements and limits.

There were no issues identified with the effectiveness of the remediation works that warranted the consideration or implementation of any contingency measures.

## Appendix A

- A.1 Summary of air quality monitoring results
- A.2 Summary of groundwater monitoring results



## A.1 Summary of air quality monitoring results

Environmental Resources Management Australia Pty Ltd (ERM) conducted air quality monitoring on behalf of Viva Energy throughout the execution of Stage 1 remediation works for the project.

This section provides an overview of air quality monitoring undertaken in accordance with the Stage 1 Air Emissions Verification Report (AEVR) during the remediation works and includes the following:

- **Photo-ionisation Detector (PID) Area monitoring:** which was used to provide real-time information on the intensity of VOC emissions during soil handling works, and implement response measures as required;
- **Boundary VOC monitoring:** which was undertaken during the Stage 1 remediation works in order to provide assurance of the efficacy of PID area monitoring in managing potential offsite VOC impacts; and
- **Biopile Soil Vapour Extraction (SVE) system monitoring:** which was undertaken in accordance with the AEVR and Environment Protection Licence (EPL) requirements, including daily monitoring of exhaust concentrations (Monday – Friday) and weekly reporting of monitoring and operational data.

Data related to the above has been reported in detail within Weekly Air Quality Performance Reports provided to the NSW EPA in accordance with the relevant conditions of EPL 570.

### 1.1 PID Area Monitoring

PID area monitoring was undertaken during soil handling operations in order to provide real-time assessment of total volatile organic compound (TVOC) concentrations and to inform Level 1 and Level 2 responses, as nominated within Section 5.5.2 of the Stage 1 AEVR.

All PID monitoring was documented within the weekly Air Quality Performance Reports that were submitted to the NSW EPA between 9 October 2020 and 12 February 2021. A total of 19 weekly reports were prepared. The results of this monitoring are summarised as follows:

- The Level 1 trigger (5ppm) was reached on Tuesday 20 October 2020 (peak value of 7.2ppm) and Wednesday 21 October 2020 (peak value of 6.7ppm). On both occasions the following actions were taken;
  - Operators notified that level 1 trigger level reached adjacent to contaminated odorous stockpile;
  - Progressive covering of stockpile;
  - Continuation of perimeter odour suppressant;
  - Additional area and boundary PID monitoring;
  - After implementation of actions, PID levels were not measured above 5 ppm;
- PID measurements were below 1 ppm for the majority of the works. PID levels were highest between 19 and 23 of October 2020, with maximum daily work area concentrations ranging between approximately 3 ppm and 7.2 ppm during this period.
- The Level 2 trigger (10ppm) was not reached at any time during the works.

### 1.2 Boundary VOC Monitoring

Ambient VOC monitoring was undertaken during the Stage 1 remediation works in order to provide assurance of the efficacy of PID area monitoring in managing potential offsite VOC impacts.

The sampling was conducted using evacuated canisters in accordance with the USEPA TO-15 methodology, as specified within Compendium Method TO-15 - Determination of volatile organic compounds in air collected in specially-prepared canisters and analysed by gas chromatography / mass spectrometry (US EPA, 1999).

#### 1.2.1 Monitoring Program

Monitoring was conducted near to the northern boundary (AS01), southern boundary (AS02) and western boundary (AS03) of the Western Area. In addition, an 'at-source' location (AS04) was included to allow assessment of the contribution of the remediation works relative to other local and regional VOC emission sources.

Three rounds of monitoring were included, targeted to the intensive phases of remediation works. These include:

- Round 1: Excavation and stockpiling (14/10/2020 – 15/10/2020);
- Round 2: Excavation and stockpiling (15/10/2020 – 16/10/2020); and

■ Round 3: Excavation, stockpiling and screening (22/10/2020 – 23/10/2020).

Figure A1-1 illustrates the monitoring locations relative to the Stage 1 remediation works. Figures A1-2 and A1-3 shows the physical placement of AS01, AS02, AS03 and AS04.



Figure A1-1: Aerial imagery showing monitoring locations relative to the excavation area



Figure A1-2: Air sampling locations AS01, AS02 and AS03 (left to right)





Figure A1-3: Excavation of AEC-9 showing AS04 on fencing between AEC-9 and adjacent stockpile

### 1.2.2 Results

Table A1-1 through Table A1-3 present a summary of the Stage 1 ambient VOC monitoring results for analytes presented within the Stage 1 AEVR. It is noted that of the 64 TO-15 analytes reported by the laboratory, results above the Limit of Reporting (LOR) were limited to toluene, xylenes, 1,2,4-trimethylbenzene and naphthalene, and are shown within the tables in bold font.

Table A1-1: Summary of Stage 1 ambient VOC monitoring results: Round 1 (14-15/10/20)

Substance	Measured Concentration ( $\mu\text{g}/\text{m}^3$ )			
	AS01	AS02	AS03	AS04
	~50m N	~500m SSW	~600m WSW	At Source
Benzene	< 3	< 3	< 3	< 3
Toluene	< 7.5	<b>13</b>	< 7.5	<b>7.5</b>
Ethylbenzene	< 4	< 4	< 4	< 4
Xylenes - Total	< 12	< 11	< 12	< 13
1.2.4-Trimethylbenzene	< 4	< 4	< 4	< 5
1.3.5-Trimethylbenzene	< 4	< 4	< 4	< 5
Hexane	< 3.5	< 3.5	< 3.5	< 3.5
Naphthalene	< 19	< 17	< 19	< 21

Notes: Detections above the LOR shown in bold font. "<" – Less than LOR.

**Table A1-2: Summary of Stage 1 ambient VOC monitoring results: Round 2 (15-16/10/20)**

Substance	Measured Concentration (µg/m³)			
	AS01	AS02	AS03	AS04
	~50m N	~500m SSW	~600m WSW	At works
Benzene	< 2	< 3	< 3	< 3
Toluene	<b>9.4</b>	<b>7.9</b>	< 7.5	<b>15</b>
Ethylbenzene	< 3	< 4	< 4	< 4
Xylenes - Total	< 10	< 12	< 12	<b>12</b>
1.2.4-Trimethylbenzene	<b>3.7</b>	< 4	< 5	<b>5.3</b>
1.3.5-Trimethylbenzene	< 4	< 4	< 5	< 4
Hexane	< 3.5	< 3.5	< 3.5	< 3.5
Naphthalene	< 16	< 19	< 20	< 18

Notes: Detections above the LOR shown in bold font. "<" – Less than LOR.

**Table A1-3: Summary of Stage 1 ambient VOC monitoring results: Round 3 (22-23/10/20)**

Substance	Measured Concentration (µg/m³)			
	AS01	AS02	AS03	AS04
	~50m N	~500m SSW	~600m WSW	At works
Benzene	< 3	< 3	< 3	< 1.6
Toluene	< 7.5	< 7.5	< 7.5	< 7.5
Ethylbenzene	< 4	< 4	< 4	< 2.2
Xylenes - Total	< 11	< 12	< 12	< 6.6
1.2.4-Trimethylbenzene	< 4	< 4	< 4	<b>5.2</b>
1.3.5-Trimethylbenzene	< 4	< 4	< 4	<b>2.9</b>
Hexane	< 3.5	< 3.5	< 3.5	< 3.5
Naphthalene	< 17	< 19	< 19	<b>15</b>

Notes: Detections above the LOR shown in bold font. "<" – Less than LOR.



### 1.2.3 Screening of Monitoring Results

Screening criteria were compiled to provide a means of assessing whether ambient air quality monitoring results are elevated so as to warrant additional investigation. 24 hour averages were collated for direct screening of maximum monitoring results, whilst annual average (chronic) criteria have also been presented for contextual purposes.

The following sources of screening criteria were adopted in order of priority:

- NEPM Air Toxics Monitoring Investigation Levels (MILs), (NEPC, 2011);
- US Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs), (ATSDR, 2021);
- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA, 2016); and
- Texas Commission of Environmental Quality (TCEQ) TAMIS Database (TCEQ, 2021).

MILs provided within NEPC (2011) have been adopted as a priority, given their endorsement in a local context as part of the NEPM Air Toxics program.

ATSDR MRLs have been adopted as screening criteria for VOC/averaging period combinations for which MILs are not available. This approach has been adopted given the compatibility in the intended application of the MRLs, which are also provided as a screening tool for assessing where potential health effects should be considered in more detail. It is also noted the ATSDR MRLs are considered extensively in the derivation of MILs, and are in some cases identical to the corresponding MILs (e.g. benzene annual average). It is also noted that exceedances of either MILs or MRLs do not mean that adverse health effects will occur, but indicate a situation in which further investigation should be undertaken.

In addition, for substances for which MILs or MRLs are not available, 1 hour criteria provided in NSW EPA (2016) and TCEQ (2021) have been adapted to 24 hour criteria simply by dividing by 24, thus representing the theoretical lower bound of concentrations against which compliance with the 1 hour criterion is demonstrated<sup>1</sup>. Annual average criteria for these substances have been sourced from TCEQ (2021). Table A1-4 presents the results of this screening process.

**Table A1-4: Screening of monitoring results**

Substance	Maximum 24 hour Concentration: Rounds 1 – 3 (µg/m <sup>3</sup> )			Screening Criteria	
	AS01	AS02	AS03	24 hour	Chronic / Annual
	~50m N	~500m SSW	~600m WSW		
Benzene	< 3	< 3	< 3	29 <sup>(a)</sup>	9 <sup>(b)</sup>
Toluene	9.4	13	< 7.5	3,770 <sup>(b)</sup>	377 <sup>(b)</sup>
Ethylbenzene	< 4	< 4	< 4	21,700 <sup>(a)</sup>	260 <sup>(a)</sup>
Xylenes - Total	< 11	< 12	< 12	1,085 <sup>(b)</sup>	868 <sup>(b)</sup>
1.2.4-Trimethylbenzene	3.7	< 4	< 5	92 <sup>(c*)</sup>	54 <sup>(d)</sup>
1.3.5-Trimethylbenzene	< 4	< 4	< 5	92 <sup>(c*)</sup>	54 <sup>(d)</sup>
Hexane	< 3.5	< 3.5	< 3.5	133 <sup>(c*)</sup>	200 <sup>(d)</sup>
Naphthalene	< 17	< 19	< 20	18 <sup>(d*)</sup>	50 <sup>(d)</sup>

Notes:

(a) ATSDR (2021)

(b) NEPC (2011)

(c) NSW EPA (2016)

(d) TCEQ (2021)

\* 1 hour average criterion divided by 24 to obtain the theoretical lower bound 24 hour average concentration indicative of compliance.

"<" Maximum result less than LOR.

As shown in these data, detections above the limit of reporting are limited to toluene and 1,2,4-trimethylbenzene, with maximum measured concentrations of these substances being less than an order of magnitude below respective screening criteria. In addition, the maximum toluene detection, was significantly higher than the corresponding at-source sample, accordingly, this measurement is indicative of an external toluene source not associated with the Stage 1 remediation works.

<sup>1</sup> Based on these assumptions, exceedances of the adapted 24 hour criteria do not necessarily indicate an exceedance of the 1 hour criteria, however compliance with the adapted 24 hour criteria do indicate compliance with the 1 hour criteria.

### 1.2.4 Comparison against Urban Background Datasets

Table A1-5 provides additional context on the scale of monitoring results, with comparison to average and maximum concentrations measured by the NSW Department of Environment and Conservation (DEC) in Sydney as part of the NSW Ambient Air Quality Research Project (1996 – 2001) (DEC, 2004) and the NSW NEPM air toxics monitoring campaign (NEPC, 2010). Comparison against the screening criteria is also provided.

**Table A1-5: Comparison of monitoring results with historical monitoring within Sydney**

Substance	WARP Stage 1	Urban Air				24 hour Screening Criteria
		(Sydney 1996 – 2001):		(Sydney 2009 – 2010):		
	Average (maximum)	Average (Maximum)		Average (Maximum)		
	AS01 - 03	Rozelle	Sydney CBD	Rozelle	Turrella	
Toluene	<7.5 (13)	8.3 (60.3)	15.8 (37.7)	3.4 (14.3)	6.8 (24.1)	3,770
1,2,4-Trimethylbenzene	<7.5 (3.7)	1.5 (9.3)	3.4 (16.7)	NM		92

Note: All values converted from volumetric to mass-based units at conditions of 25°C and 1 atmosphere.

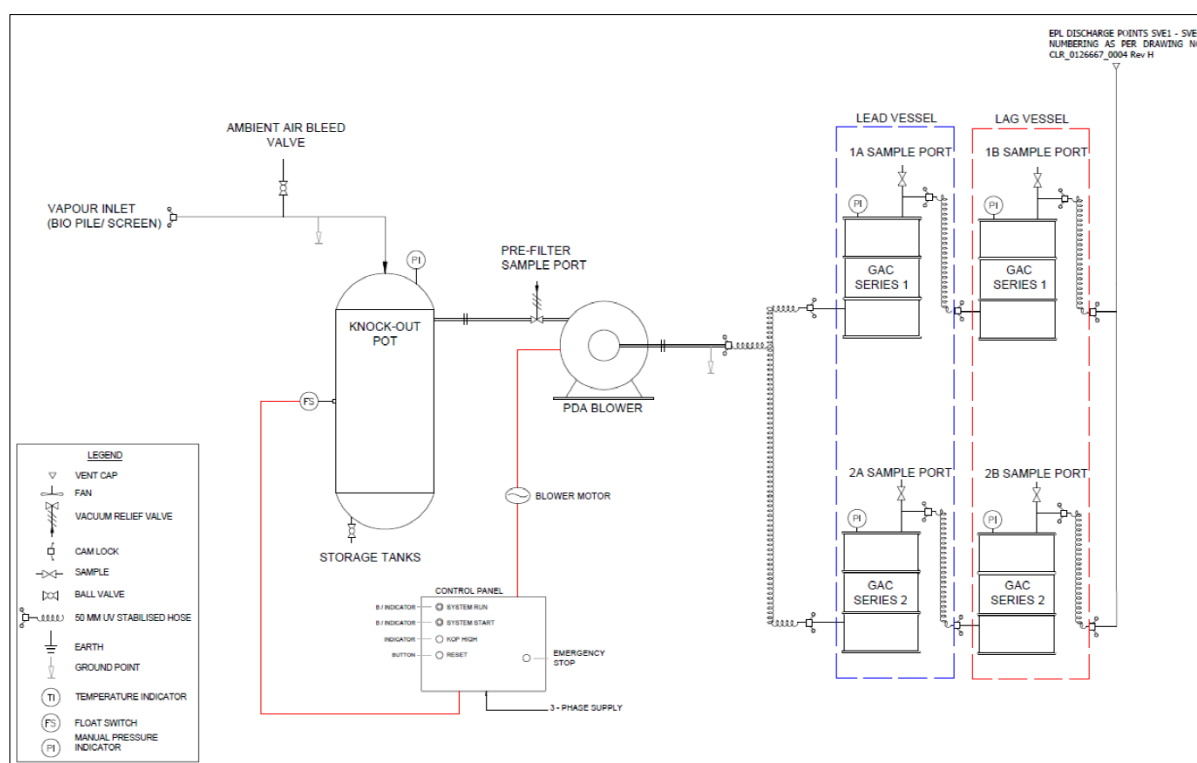
As shown in these data, concentrations of detected VOCs during Stage 1 are within the range of those observed in ambient air within Sydney as documented in DEC (2004) and NEPC (2010).

## 1.3 Biopile Area Monitoring and Soil Vapour Extraction (SVE) System

Biopile monitoring was undertaken in accordance with the AEVR and a number of supplementary Environment Protection Licence (EPL) requirements, including daily monitoring of exhaust concentrations (Monday – Friday) and weekly reporting of monitoring data and operational data.

### 1.3.1 Carbon Breakthrough Times

As per the carbon breakthrough management procedure (Enviropacific Services, 2020), the SVE system was arranged in a parallel configuration, consisting of a lead and lag drum in parallel for each of the four SVE systems, resulting in initial lead vessel adsorption capacity estimates ranging from 19 days (SVE-03) to 194 days (SVE-01), which progressively increased during the remediation, as inlet loadings decreased. The configuration of the parallel SVE system is shown below in Figure A1-4.



**Figure A1-4: Stage 1 SVE System Process Diagram (Enviropacific Services, 2020)**

In addition to process monitoring, detailed evaluations of remaining lead vessel adsorption capacity were made on a weekly basis and reported within weekly Air Quality Performance Reports provided to the EPA throughout the duration of soil treatment process. Table A1-6 summarises this data.

**Table A1-2 Summary of lead vessel remaining adsorption capacity during Stage 1 soil treatment**

Date	Lead Vessel Remaining Adsorption Capacity (weeks)			
	SVE-01	SVE-02	SVE-03	SVE-04
18/12/2020	28	23	6	4
23/12/2020	64	66	12	8
15/01/2021	106	94	42	27
22/01/2021	36	40	20	20
29/01/2021	36	27	18	18
5/02/2021	20	22	13	16
12/02/2021	25	23	17	15

Note: Detailed calculations were performed each Friday to provide assurance of system performance over the forthcoming weekend.

### 1.3.2 Monitoring of SVE Inlet, Lead-lag Interface and Discharge Points

During Stage 1, SVE system monitoring was undertaken on a daily basis during weekdays, in accordance with EPL requirements. During this time, the SVE treatment system operated in a consistent and predictable manner, with effective control of VOC for the duration of the biopiling operations. Table A1-7 presents this data.

The following is noted with regard the system operation:

- Inlet concentrations were observed to decrease rapidly throughout the first week of treatment, prior to a more gradual decrease across the duration of the biopile treatment;
- Treatment capacity was observed to be consistent with breakthrough estimates, and change out of carbon filter media in the lead vessels was not required;
- VOC concentrations at the outlet of lead vessel were less than or equal to 0.1 ppm for the duration of the biopile treatment, demonstrating no breakthrough of VOCs from the lead to the lag vessel;
- VOC concentrations at the EPL discharge points were less than or equal to 0.1 ppm for the duration of the biopile treatment; and
- Ambient VOC concentrations in close proximity to the biopile covers were indicative of negligible fugitive VOC emissions from the covered biopiles.

**Table A1-3: Summary of Stage 1 SVE System PID monitoring across the duration of soil treatment (ppm)**

Date	Inlet (pre-filter)				Inter-bed (Maximum of A/B trains)				Outlet			
	SVE-01	SVE-02	SVE-03	SVE-04	SVE-01	SVE-02	SVE-03	SVE-04	SVE-01	SVE-02	SVE-03	SVE-04
14/12/2020	32.7	32.6	109.5	112.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
15/12/2020	19.2	19.1	101.7	104.6	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
16/12/2020	14.0	14.0	78.6	79.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
17/12/2020	12.7	13.0	66.2	65.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
18/12/2020	9.4	9.7	50.2	55.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19/12/2020	-	-	-	-	-	-	-	-	-	-	-	-
20/12/2020	-	-	-	-	-	-	-	-	-	-	-	-
21/12/2020	11.7	8.5	24.8	34.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
22/12/2020	6.5	7.1	28.1	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23/12/2020	3.6	3.3	20.4	25.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Christmas Shutdown												
11/01/2021	15.5	15.1	31.6	36.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/01/2021	5.8	5.5	21.5	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13/01/2021	13.4	14.1	26.4	29.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14/01/2021	5.0	4.7	14.4	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15/01/2021	2.6	2.8	6.2	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16/01/2021	-	-	-	-	-	-	-	-	-	-	-	-
17/01/2021	-	-	-	-	-	-	-	-	-	-	-	-
18/01/2021	6.8	6.5	6.7	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19/01/2021	6.2	7.5	8.5	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20/01/2021	5.1	6.3	10.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21/01/2021	14.0	12.6	14.5	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22/01/2021	6.5	6.2	12.6	12.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23/01/2021	-	-	-	-	-	-	-	-	-	-	-	-
24/01/2021	-	-	-	-	-	-	-	-	-	-	-	-
25/01/2021	6.6	8.6	12.8	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26/01/2021	-	-	-	-	-	-	-	-	-	-	-	-
27/01/2021	4.6	6.5	15.1	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28/01/2021	13.5	14.6	19.0	19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29/01/2021	12.8	12.9	15.5	17.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30/01/2021	-	-	-	-	-	-	-	-	-	-	-	-
31/01/2021	-	-	-	-	-	-	-	-	-	-	-	-
1/02/2021	10.8	11.2	13.2	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2/02/2021	15.5	14.9	16.3	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3/02/2021	12.6	14.3	16.2	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4/02/2021	13.2	12.6	14.8	16.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/02/2021	10.3	9.7	13.7	12.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6/02/2021	-	-	-	-	-	-	-	-	-	-	-	-
7/02/2021	-	-	-	-	-	-	-	-	-	-	-	-
8/02/2021	9.8	9.0	11.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9/02/2021	9.5	8.0	10.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10/02/2021	12.5	12.0	14.0	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11/02/2021	13.0	13.5	14.8	14.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/02/2021	8.4	9.0	11.4	12.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



## A.2 Summary of groundwater monitoring results

ERM was engaged by Viva Energy to complete groundwater monitoring requirements in accordance with the approved Groundwater Monitoring and Management Plan (GMP) and the associated Groundwater Monitoring Program (GWMP) for the WARP (ERM, 2021a<sup>2</sup>). The groundwater monitoring program included the following:

Existing groundwater monitoring wells were selected for gauging and sampling based on the following objectives:

- **Monitoring during remediation** – to demonstrate remediation works do not have short-term adverse effects on localised groundwater quality or the Duck River and implement contingency actions (if required); and
- **Monitoring post-remediation** – to demonstrate that stable to decreasing groundwater concentrations continue to be observed as a result of natural attenuation processes and removal of key source areas.

### Stage 1 – Monitoring During Remediation

During the active remediation period from October – November 2020, ERM conducted the following compliance monitoring activities related to groundwater management during the Stage 1 remediation works in accordance with the Groundwater Monitoring Program (GWMP) (ERM, 2021a<sup>3</sup>):

- weekly groundwater gauging of the near-excavation monitoring wells to the Stage 1 Excavation Area (MW11/24, MW12/17 and MW18/06). The downgradient monitoring well MW11/27 was identified as destroyed and MW18/06 was substituted to obtain monitoring data downgradient of the excavation; and
- Pre and post works sampling event of these wells to assess potential for adverse changes to groundwater conditions from excavation works.

Based on groundwater monitoring undertaken throughout the execution of remedial works in the Stage 1 Area, the following was noted:

- Groundwater levels of near-excavation monitoring wells around the AEC-9 excavation were not significantly altered throughout the course of works and are consistent with no dewatering being undertaken and relatively shallow excavation depths (average depth of 1.5 m). Minor observed changes in groundwater elevation in the near-excavation monitoring wells fall within the normal range of groundwater elevation at these locations and are consistent with historical gauging data from the site.
- No evidence of contaminant mobilisation or migration of Light Non-Aqueous Phase Liquids (LNAPL) into key indicator wells were noted during gauging or sampling events conducted pre, during or post remediation works.
- No significant changes were observed in groundwater pH measurements taken pre- and post remediation. As such, no acidification of groundwater conditions is considered to have occurred and is consistent with the low risk of acid sulfate soils and the fact that no dewatering was undertaken.
- Contaminant concentrations of TRH/BTEXN reported by the laboratory were comparable pre- and post remediation works and consistent with historical data from the site.
- Concentrations of contaminants of concern were reported below the laboratory limit of reporting at down-gradient boundary wells when silica gel-cleanup was undertaken on TRH C10-C40 fractions. As such, no evidence of contaminant migration or impacts to the Duck River are considered to have occurred as a result of the Stage 1 remediation works.

On the basis of the above assessment, the implementation of contingency measures for groundwater (as per the GWMP) were not required to be implemented during remediation works.

All groundwater data obtained during the remediation works is detailed within the “Quarter 4 (2020) Groundwater Monitoring Report”, prepared by ERM and dated 24 March 2021.

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<sup>2</sup> ERM (2021a) Clyde Western Area Remediation Project – Groundwater Monitoring Program. Final Revision 4, January 2021.

### Stage 1 – Monitoring Post Remediation

Two post remediation Groundwater Monitoring Events (GME) have been completed within the Stage 1 Area during the reporting period to satisfy Condition B22 of the conditions of Consent for the Project:

- GME 1 (December 2020); and
- GME 2 (March 2021).

Monitoring of groundwater conditions for concentrations of petroleum hydrocarbon based contaminants of concern has identified the following conclusions in relation to the Stage 1 Area:

- Ongoing monitoring was undertaken in general accordance with the Site Auditor Approved GWMP and met the requirements of B22 of the Conditions of Consent for the Project.
- No exceedances of Site Specific Target Levels (SSTLs) were reported for on-site receptors in any groundwater monitoring wells sampled.
- Evidence of stable groundwater conditions and natural attenuation processes continue to be identified as per previous monitoring, including:
  - No evidence of mobilisation or migration of LNAPL in key indicator wells was noted during gauging or sampling events conducted.
  - No statistically significant increasing trends of key contaminants of concern (Benzene, TRH C<sub>6</sub>-C<sub>9</sub> fractions, TRH C<sub>10</sub>-C<sub>36</sub> fractions following silica gel clean-up) identified during GMEs 1 and 2; and
  - The presence of a high proportion of polar compounds in groundwater samples, as indicated by widespread detections of TRH C<sub>10</sub>-C<sub>40</sub> fractions versus non-detect following silica gel clean-up analysis. Polar metabolites are formed via microbial degradation of petroleum hydrocarbon source areas.

The above findings are consistent with groundwater monitoring events undertaken in the subject wells in recent years.

Detailed interpretation and presentation of groundwater data obtained post the Stage 1 remediation works is detailed within the following reports:

- “Quarter 4 (2020) Groundwater Monitoring Report”, prepared by ERM and dated 24 March 2021.
- “Stage 1 – Ongoing Groundwater Monitoring Event 2 and Annual Summary Report (2021)”, prepared by ERM and dated 30 September 2021.

### Contingency Actions

The implementation of contingency items (as per Section 3.7 of the GWMP) were not warranted as no adverse changes to environmental conditions or risk to offsite receptors were identified.