Division	Fuels and Infrastructure
Type	Plan
Title	Asbestos Contaminated Soil (ACS) Containment Cell Long Term Environment Management Plan

Division: : Fuels & Infrastructure

Asbestos Contaminated Soil (ACS) Containment Cell Long Term Environmental Management Plan (LTEMP)

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Reporting Information

Document: Asbestos Contaminated Soil (ACS) Containment Cell Long Term Environmental Management Plan

Date: 22 February 2021

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Revision History

Revision No.	Date of Revision	Description of Revision	PM Signature
A	29th November 2019	Draft	
B	30 July 2020	Draft	
C	27 November 2020	Draft	
D	22 February 2021	Final	

1. Introduction

Ampol Australia Pty Ltd ABN 46 004 610 459 (Ampol) has prepared this containment cell long term environmental management plan (CCLTEMP) for management of asbestos contaminated soils (ACS) sourced from all areas identified as the 'pipeways' and placed into a purpose built containment cell. All works were located within the Ampol Kurnell Terminal, located at Solander Street Kurnell, NSW (the 'Site'). The location of the containment cell is provided in Appendix A1. The source areas from where the ACS was excavated in the pipeways are provided in Appendix A2.

1.1 Background

Ampol has converted the former petroleum refinery in Kurnell (the Site) to a finished fuel terminal facility (the Project). The objective of the Project was to ensure that Ampol's operations within Australia remain viable and can provide a safe, reliable and sustainable supply of petroleum fuels to NSW and the ACT. As such the Project allowed the Site to continue to be utilised as a terminal where finished products are received by ship and stored in tanks before leaving the Site by pipeline to other terminals.

ACS contained within the pipeways section of the property was previously managed in situ under an exemption from Safe Work NSW. Although remediation has been conducted within the pipeways potential residual ACS may remain which will be managed by the Operational Environmental Management Plan (OEMP). In order to mitigate the ongoing health and safety risks for those working in the impacted areas, reduce related operational constraints, and remove the Exemption from the pipeways, Ampol sought a Modification to its Development Consent SSD 5544 (MOD 2) for the construction of an on-site containment cell for ACS. The subsequent Conditions of Consent included a requirement for the preparation of a Containment Cell Long Term Environmental Management Plan (CCLTEMP) to be implemented following closure of the containment cell. Consent Condition C53 requires that the CCLTEMP is to be endorsed by the appointed NSW EPA accredited Site Auditor. Details of the consent for the containment cell are included within the Development Consent SSD 5544 (MOD 2).

1.2 Objectives and Overview

The objectives of this CCLTEMP are to:

- Identify potential environmental impacts associated with the ongoing management of the closed containment cell, and
- detail the procedures in place to ensure the waste within the containment cell remains contained and does not present a risk to human health and the environment following closure.

This CCLTEMP details the ongoing environmental management of the containment cell, including:

- Maintenance of the capping and drainage.
- Groundwater monitoring (including groundwater quality and levels).

The CCLTEMP also includes physical details of the pipeways source area including:

- Location of the marker layer across the entire pipeways area.
- Depth of excavations and the marker layer.

A requirement of this CCLTEMP is to conduct and document six monthly inspections of the containment cell to ensure that the integrity of the capping layer is maintained, and infrastructure associated with leachate from the containment cell is monitored. (refer Appendix I for the Checklist).

If disturbance of the surface capping layer is observed or contaminated groundwater associated the leachate system is identified during 6 monthly inspections, then action is to be taken in accordance with the corrective action outlined in Section 5.7 below

The CCLTEMP objectives will be achieved through the management commitment, strategies, and monitoring programs outlined in this CCLTEMP. In accordance with Consent Condition C53 under SSD 5544 and Section 10.6 of the Remediation Action Plan (AECOM 2018), this CCLTEMP has been prepared in consultation with the NSW Environment Protection Authority (EPA) prior to the closure of the containment cell and to the satisfaction of the Site Auditor. The CCLTEMP will be attached to the Section 10.7 Planning Certificate for the land as it will be an annex of the Site Audit Statement.

1.3 CCLTEMP Duration

This CCLTEMP has been developed for implementation over the entire existence of the cell. To ensure an instrument is in place for ongoing implementation of the CCLTEMP it will be attached to the Section 10.7 certificate for the site.

1.4 Scope

This CCLTEMP has been prepared in consultation with the NSW EPA in the form of review of the document, prior to the closure of the containment cell. This is in accordance with Conditions C53 and C54 of Schedule 2 of the Conditions of Consent for SSD 5544 which are outlined in Table 1 -

Table 1 - SSD 5544 Conditions of Consent addressed in this Management Plan

Condition	Requirement	Reference Section
Sch. 2 C53	Prior to the completion of the construction aspects associated with the ACS management works, the Applicant in consultation with the EPA, shall prepare a LTEMP for the containment cell, to the satisfaction of the Site Auditor. A copy of the Site Audit Report and Site Audit Statement shall be provided to the EPA and Secretary, which demonstrates the appropriateness of the LTEMP.	Appendix D Regulatory Consultation
C54	Upon completion of the construction aspects associated with the ACS management works (which includes closure of the containment cell), the Applicant shall:	-
a)	implement the approved LTEMP and manage the containment cell in accordance with the approved LTEMP	This LTEMP
b)	ensure the containment cell is listed on the relevant planning certificate for the land, issued under Section 10.7 certificate of the EP&A Act, for the site.	

This CCLTEMP is a sub-plan to the Site's Operational Environmental Management Plan (OEMP). The Site's OEMP will be updated to include on-going management and monitoring of the closed containment cell. This CCLTEMP may also be read in conjunction with the Containment Cell Detailed Design Report (AECOM, 2017) for an in-depth discussion on the design of the containment cell and the Containment Cell Closure Report (AECOM 2020). The ACS was constructed in accordance with the Containment Cell Detailed Design Report (AECOM, 2017) with no material changes made during construction of the cell.

1.5 Consultation

The CCLTEMP addresses the requirements outlined by the DPE in the Post Approval Lodgement Checklist. The CCLTEMP will be attached to the Section 10.7 for the land. No other consultation with external agencies has been required for this CCLTEMP.

As required under the SSD 5544, the CCLTEMP was prepared in consultation with the NSW EPA. A record of consultation has been provided in Appendix D. In addition, the CCLTEMP was reviewed by an EPA approved Site Auditor. A copy of which is also provided in Appendix D.

1.6 Legislation and Guidance

1.6.1 Environment Protection Licence

The terminal currently operates in accordance with an Environment Protection Licence (EPL 837) issued by the EPA. EPL 837 contains numerous operational conditions and Pollution Reduction Programs (PRPs). All work undertaken as part of the ACS Management Works will comply with the conditions within EPL 837.

1.6.2 Development Consent

As previously stated, Development Consent was initially received for the Project on the 7 January 2014. Approval for the ACS Management Works (MOD 2) was received on the 27 October 2017. All work undertaken as part of the ACS Management Works will comply with the relevant conditions of Development Consent SSD 5544 as modified.

1.6.3 Guidance Documents

The following documents have been used to develop the CCLTEMP:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guideline (ANZG 2018). Australian and New Zealand Environment Conservation Council and Agriculture Resource Management Council of Australia and New Zealand.
- Department of the Environment, 2014, Environmental Management Plan Guidelines, Australian Government.
- DIPNR, 2004, Guideline for the Preparation of Environmental Management Plans, Department of Infrastructure, Planning, and Natural Resources.
- NSW EPA, 2019, Draft for consultation, Contaminated land guidelines, Consultants reporting on contaminated land, New South Wales Environment Protection Agency.
- NSW EPA, October 2017, Management of Contaminated Sites, Guidelines for the NSW Site Auditor Scheme (3rd edition).
- National Environment Protection Council (NEPC) 2013, National Environment Protection (Assessment of Contaminated Land) Measure (NEPM) 1999, as amended 2013, Schedule B1, Guideline on Investigation Levels for Soil and Groundwater.
- National Environment Protection Council (NEPC) 2013, National Environment Protection (Assessment of Contaminated Land) Measure (NEPM) 1999, as amended 2013, Schedule B2, Guideline on Site Investigation.
- Safe Work Australia, 2016, Code of Practice, How to Manage Asbestos in the Workplace
- WA DOH, 2019, Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Site in Western Australia, Western Australia Department of Health (WA DOH).
- Where guidelines listed above are revised, superceded, or retired, the LTEMP will be updated to reflect these changes.

2. Implementation

2.1 Induction

Ampol has a Site induction program that all contractors and employees are required to complete prior to undertaking any work.

2.2 Roles and Responsibilities

Table 2 provides a summary of the responsibilities for the implementation and management of the CCLTEMP. These responsibilities do not replace any other regulatory responsibilities of the parties in relation to works at the site:

Table 2 Roles and Responsibilities

Responsible Entity	Obligations
Owner/Ampol Australia	- Ensure all parties clearly understand the CCLTEMP requirements and ensure that compliance with the CCLTEMP is a condition of any works undertaken by any contractor/site worker. - Ensure that all licences, clearances, permits and approvals are in place in the appropriate manner. - Management of the works in accordance with all statutory requirements, best practice guidelines and the requirements of the CCLTEMP. - Suspension of site work in a specific area or areas should the environment or health and safety of personnel or the community potentially be at risk. - Update the CCLTEMP if they become aware that the site conditions have changed and inform any other parties of the changes. - Update the CCLTEMP if there is a change in land use and/or environmental management requirements. - Temporary suspension of site work if the environment or health and safety of personnel or the community is at risk; and - Suspension of individuals from the Site where disregard for the CCLTEMP has been identified.
Appointed Sub contractor/site workers/	- Comply with the CCLTEMP for site works including relevant legislation and guidance (Work Health and Safety Act 2011 or relevant legislation current at the time of the works). - Inform Ampol if conditions change or observed significantly from those documented in the CCLTEMP. - Temporary suspension of site work if the environment or health and safety of personnel or the community is at risk; and - Suspension of individuals from the Site where disregard for the CCLTEMP has been identified.

2.3 Training

All personnel will have the experience and necessary training to carry out their required tasks, including in the use of equipment and the implementation of this CCLTEMP. Staff required to work with hazardous/flammable/contaminated materials would be trained in safe use and handling and would be provided with all relevant safety equipment. Ampol or its representative and the Contractor will each maintain a Training Register that records all environmental training completed by its personnel, including records of attendance at awareness training and toolbox talks, as well as competency assessments.

Ampol will include an update on the management of the ACS containment cell in the DPE Annual Review required under SSD 5544 Condition D4.

2.4 Corrective Action

Corrective actions will be implemented in the event that monitoring is undertaken in accordance with this plan and identifies that the ACS has potentially caused environmental impacts. Dependent on the cause of the impact corrective actions will be implemented to mitigate and remove the impact. Table 8 includes a summary of potential corrective actions which may be implemented for the capping layer of the containment cell and groundwater.

2.5 Review of the CCLTEMP

This EMP may require revision to reflect relevant changes in the condition or use of the Site and/or changes in environmental management requirements. Any changes to the LTEMP should be made by a certified contaminated land consultant (as accredited by a certification scheme recognised by the NSW EPA). The CCLTEMP may also require revision on the basis of:

- Any changes in Council policies relating to the management of contaminated land;
- Any changes in regulatory requirements and guideline documents listed in this EMP; and
- Any change to a more sensitive land use.

It is noted that any changes made to this LTEMP must not result in any increase in the potential for unacceptable risks from the ACS soil to human health or the environment.

3. Overview of the Containment Cell

3.1 Containment Cell Location

The ACS containment cell is an above ground containment cell located in the south eastern part of the Site close to the other waste management activities. The extent of the containment cell is 80 metres in the east-west direction and 114 metres north-south, with an airspace volume design capacity of 22,000 m^3. Underlying the ACS is a base layer comprising 7000 m^3 of sand. The cells has been capped with VENM, gravel and topsoil. The containment cell is located within the area which previously contained tanks 224 and 225, and the majority of the bunded area for tanks 333, 334 and 335, refer to Figure A1, Appendix A.

Approximately 17,282 m^3 ACS was used to fill the containment cell with the highest classification of waste to be contained within the containment cell being Special Hazardous Waste. The NSW EPA in their letter dated 16 May 2017 recommended the placement of ACS classified as hazardous waste in the on-site containment cell without pre-treatment, subject to appropriate conditions. The containment cell has been designed in general accordance with the requirements for a restricted landfill cell as per the Guidelines for Solid Waste Landfills (EPA, 2016). Refer to the Containment Cell Final Report (AECOM, 2020) (required under SSD 5544, Condition C52) for additional information on the final design and construction of the containment cell.

Table 3 Results Summary of the Maximum Concentrations reported in the Cell.

Analyte	Highest Concentration (mg/kg)	Sample ID	Sample Date
TPH C6-C9	4,320	B014_0.4-0.5	24 Oct 2013
TPH C10-C36	148,450	A013.5_0.0-0.2	16 Mar 2016
TRH F1 (mg/kg)	19	A007.5_0.0-0.2	16 Mar 2016
TRH F2	18,100	A007.5_0.0-0.2	16 Mar 2016
Benzene	0.6	B014_0.4-0.5	24 Oct 2013
Toluene	7.2	B001_0.0-0.2	21 Oct 2013
Ethylbenzene	3.8	B001_0.0-0.2	21 Oct 2013
Total Xylene	66.1	B001_0.0-0.2	21 Oct 2013
PAHs	3000.5	A011_0.0-0.	19 Oct 2013
B(a)p	51.2	A010_0.0-0.2	19 Oct 2013
Arsenic	22	B015_0.0-0.2	18 Oct 2013
Lead	393	B009.5_0.0-0.2	14 Mar 2016
Mercury	61.7	B009.5_0.0-0.2	14 Mar 2016

3.2 Containment Cell Design

3.2.1 Leachate Barrier System

A composite liner system was installed at the base of the containment cell. The leachate barrier system from top to bottom consists of:

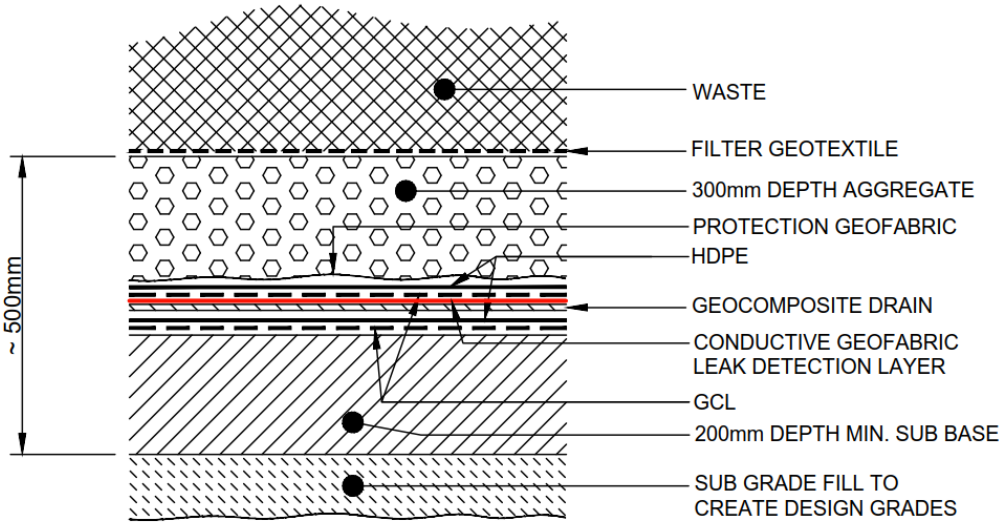
1. Filter geotextile placed above the drainage layer to reduce the ingress of fines from the overlying waste.
2. 300 mm thick gravel primary leachate collection layer containing collection pipework.
3. Protection geotextile to protect the flexible membrane liner from damage by construction equipment and overlying materials.
4. Composite primary barrier liner comprising an upper geomembrane liner and lower geosynthetic clay liner.
5. A conductive geofabric has been placed under the primary geosynthetic clay liner to facilitate leak detection testing of the primary geomembrane liner during construction.
6. Secondary leachate collection layer comprising a geonet drainage/leak detection layer.
7. Secondary composite barrier comprising an upper geomembrane liner and lower geosynthetic clay liner.
8. Compacted sub-base 200 mm thick to provide a firm, stable, smooth surface of high strength on which to install the liner.

These components provide the following functions and reference the item numbers above:

- Primary base liner – items 3, 4 & 5
- Secondary base liner – items 7 & 8
- Leak detection system – item 6
- Leachate collection system – items 1 & 2

A Technical Specification was prepared for the purposes of obtaining Auditor and Regulator approvals and as a reference for the construction to ensure the liners are installed in accordance with the approved design. The leachate barrier system is illustrated in Figure 1 below.

Figure 1 Leachate Barrier System

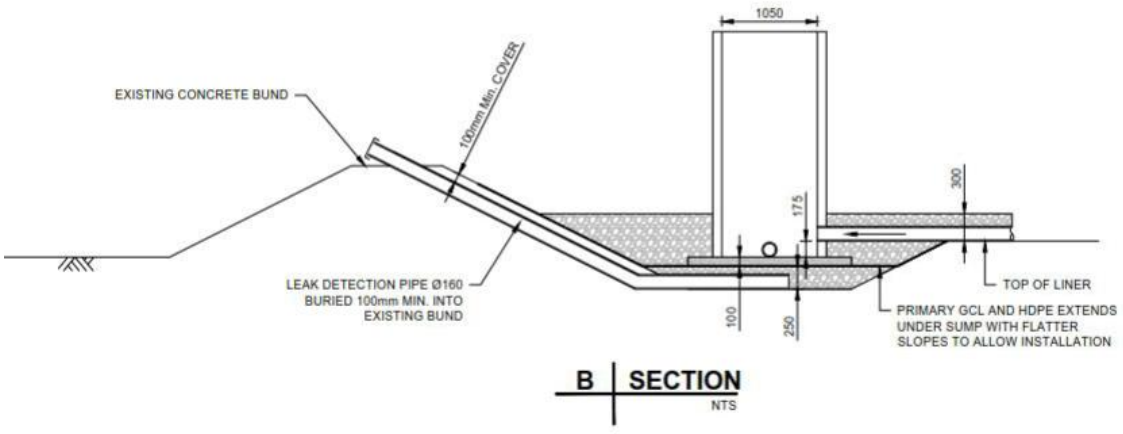


Leachate is stored in a leachate storage tank. The leachate storage tank is connected to the Site's Oily Water Sewer System (OWSS) and is treated at the Site's Wastewater Treatment Plant (WWTP) prior to discharge off site in accordance with EPL 837.

3.2.2 Leak Detection

The purpose of the leak detection layer sampling is to detect the presence of liquid in the leak detection layer and to determine if this liquid is leachate, potentially caused by a malfunction of the upper primary liner, as seen below in Figure 2.

Figure 2 Sectional view of the Leak Detection System

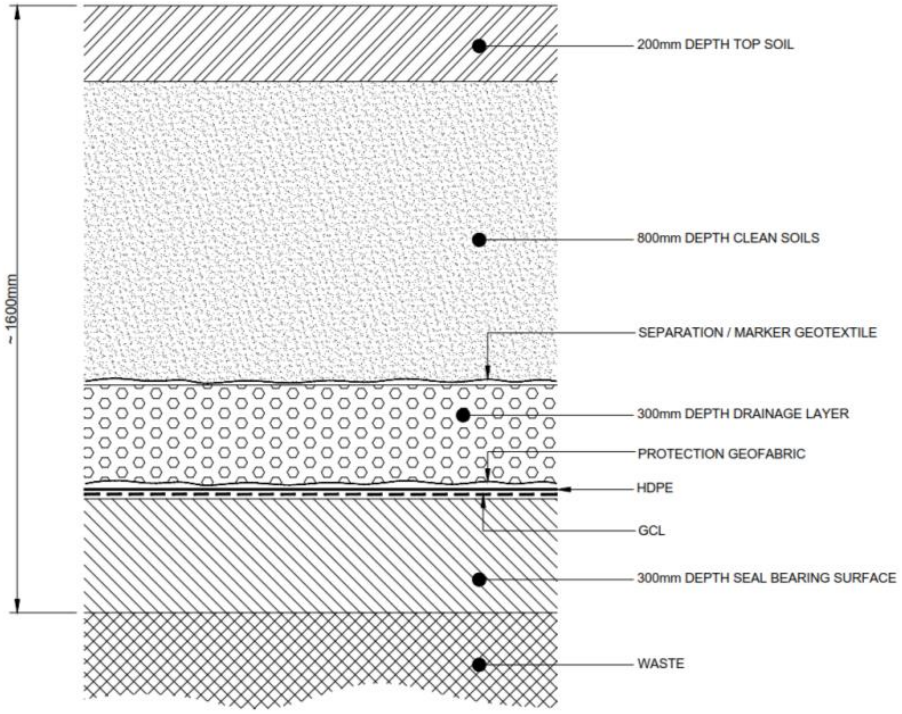


3.2.3 Capping Layer

The containment cell capping layer was designed in general accordance with the requirements of a restricted landfill cell as per the Solid Waste Landfill Guidelines (EPA, 2016). The cap design includes layers which were characterised as VENM, by multiple consultants and sourced from multiple sites across the Sydney metropolitan area. The material used was generally described as clay, silty clay and sandstone. The VENM documents are provided in the Containment Cell Final Report (AECOM, 2020) prepared for the cell. Above the VENM lies two geosynthetic layers including a geosynthetic clay liner, a HDPE, and a separation geotextile, which have been used as a marker layer to signify the presence of asbestos below (as illustrated in Figure 3).

A Technical Specification was prepared for the purposes of obtaining Auditor and Regulator approvals and as a reference for the construction to ensure the capping is installed in accordance with the approved design. The final as built drawing is provided in **Appendix B**.

Figure 3 Containment Cell Capping Layer



3.3 Containment Cell Land-use Restrictions

It is envisaged that whilst Ampol occupies the land no construction or alternate use of the cell will be undertaken. In the event that the site does change ownership the following restrictions will continue to apply whilst the cell is in place.

- No construction works are to be undertaken on the cell.
- No construction works are to be undertaken within 5 m from the boundary of the cell.
- No excavation on or within 5 m from the cell, except where these are for required maintenance works and are completed in accordance with the requirements of this CCLTEMP.
- Only approved vegetation is to be maintained on the top of the cell.

4. Management and Mitigation Measures for Environmental Contamination

This section outlines the measures that will be implemented to manage and mitigate the potential environmental impacts of the closed containment cell.

4.1 Potential Environmental Impacts

Potential impacts to the environment from the closed containment cell have been identified and summarised in Table 4.

Table 4 Summary of potential environmental impacts from the ongoing management of the containment cell

Environmental Aspect	Potential Environmental Impacts
Groundwater contamination	• Failure of the leachate barrier system and potential contamination of groundwater.
Sediment and Erosion Control	• Erosion of the capping layer resulting in sediment laden runoff into stormwater runoff. • Dust, and • human health exposure to contaminated ACS soils in the event of a breach of the capping layer
Cell Breach	• potential environmental impacts beyond the cell from migration of contaminated soil/leachate from the breach area.
Vegetation and weeds	• Spread of existing noxious weed infestations • Discharge of stormwater run-off, sediment laden water.

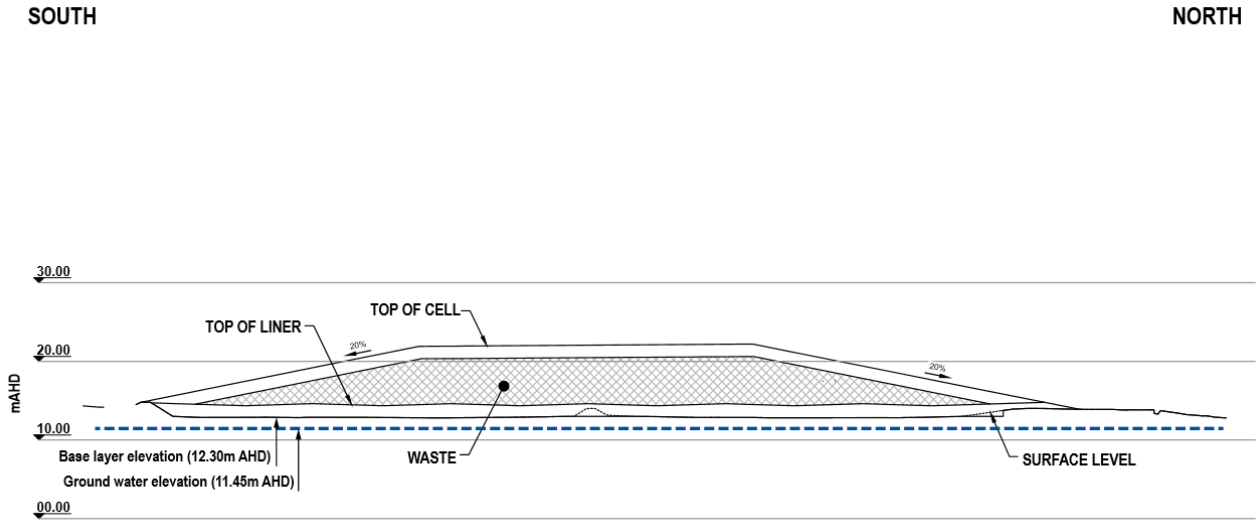
4.2 Groundwater

Groundwater under the containment cell is inferred to flow in a north-westerly direction. To minimise the potential impacts to groundwater from the containment cell the following management and mitigation measures have been implemented:

- The containment cell was designed and constructed as an aboveground containment cell to limit interaction with groundwater. The average groundwater elevation within the nearest groundwater monitoring wells on the eastern side of the cell is 11.45 m AHD (PMW60 and PMW61). The elevation of the base of the containment cell at the lowest point on the eastern end is 12.30 m AHD presenting a height difference of 0.85 m between the cell base layer and groundwater.
- The containment cell has been constructed in general accordance with the requirements of the NSW Solid Waste Landfill Guidelines, which includes the design of a leak detection liner which in the event that the primary liner fails the secondary liner will act as a secondary control measure.
- Two sentinel groundwater monitoring bores (PMW60 and PMW61) (refer to Figure 5 in Section 5.1) were installed to the west and north of the containment cell to intercept any potential contamination potentially sourced from the contents of the containment cell.

Figure 4 below presents a schematic cross section of the cell with the relative level of groundwater on the site relative to the elevation of the base of the containment cell.

Figure 4 Groundwater Elevation Schematic



4.3 Leachate

Leachate from the closed containment cell is directed to the leachate collection tank (refer to Appendix C). The following management and mitigation measures will be implemented to minimise the potential impacts from leachate:

- The leachate tank is located within a bund.
- The leachate tank is connected to the Site's OWSS and is treated at the WWTP prior to discharge off-site.
- The leachate tank has a manual isolation value.
- The leak detection sumps outlet to the leachate storage tank.

4.4 Erosion and Sediment Control

Stormwater runoff from the containment cell cap will be managed as clean stormwater runoff and directed off-site, as shown in Appendix C. The following management and mitigation measures will be implemented to reduce the potential for erosion and sediment impacts:

- The containment cell has been constructed at a maximum gradient of 20% in accordance with the NSW Landfill Guidelines.
- The containment cell cap profile has been designed and built with drainage lines that direct to the east side of the containment cell into a swale. The swale drains into a rock groin to slow water flow prior to discharge off-site.
- Vegetation cover will be maintained to reduce erosion impacts including dust.

4.5 Vegetation and Weeds

The containment cell cap will be vegetated with grass species that will provide rapid and sustainable establishment, stabilise the surface, protect the cap from erosion, sustain high evapotranspiration rates, extend roots into all areas of the cap for moisture removal, ensure growth and coverage through all seasons, survive sub-optimal seasons (such as droughts), and be resilient. The vegetation of the containment cell will be maintained to reduce the potential impacts from dust and erosion.

The list of vegetation were selected based on their tolerance to pH and salinity and comprised of Dicanthium sericeum, Chloris truncata, Bothriochloa macra, Digitaria brownie, Austrostipa scabra, Cymbopogon refractus, Aristida ramosa, Sporobolus creba, Themeda australis and Panicum decompositum. These species were identified as the most appropriate for the area and its environment.

5. Monitoring Requirements

5.1 Containment Cell Monitoring Records.

All monitoring is to be recorded electronically by the Kurnell maintenance team. The maintenance team will conduct the inspections and record the comments on the Ampol Kurnell SAP maintenance system. The minimum monitoring requirements will adhere to the example checklist provided in Appendix I and be kept for the duration of the existence of the cell.

5.2 Groundwater

Prior to filling the containment cell with ACS, a Baseline Groundwater Monitoring Event (GME) (AECOM, 2019) was undertaken in January 2018. The Baseline GME comprised installation of four groundwater monitoring wells, (AECOMM1 to AECOMM4). Monitoring wells AECOMM1 and AECOMM 2 were installed within the cell and AECOMM 3 and AECOMM4 were installed down hydraulic gradient from the cell. Monitoring wells AECOMM3 and AECOMM4 were subsequently renamed PMW60 and PMW61 respectively and form part of the Quarterly monitoring conducted under the EPL licence as EPL28 (PMW60) and EPL29 (PMW61).

Following the Baseline GME, quarterly monitoring for the two sentinel monitoring wells (PMW60 and PMW61, **Figure 5** below) was undertaken during construction, filling, and closure of the containment cell from January 2018 to January 2020. Note that monitoring wells AECOMMW1 was decommissioned in accordance with the Minimum Construction Requirements for Water Bores in Australia, 3rd edition, 2012. AECOMMW2 was also proposed to be decommissioned but was not located and assumed to be destroyed. The location of monitoring wells sampled is provided in **Figure 5** below.

Ongoing quarterly groundwater monitoring will be undertaken of the two sentinel monitoring wells (EPL 28 and EPL29) as part of the Ampol Environmental Protection Licence (EPL), Licence 837 to provide ongoing demonstration that the containment cell liner is operating effectively.

5.3 Baseline GME

The Baseline GME objective was to establish a baseline for groundwater conditions in the proposed area for the cell. The results of the Baseline GME identified existing contamination at PM61 (northern sentinel well), as shown in Table 5 below. All results from monitoring well PM60 reported concentrations below the laboratory LORs. These results were compared to the existing groundwater criteria for the site (ASC NEPM 2013, Schedule B1, Guideline on Investigation Levels for Soil and Groundwater) as part of the quarterly monitoring program and are based on the sites historical use as a petrochemical refinery.

Table 5 Results Summary for Baseline GME for Sentinel Wells

Well ID	TRH F1 (µg/L)	TRH F2 (µg/L)	Benzene (µg/L)	Naphthalene (µg/L)	Lead (mg/L)	Mercury (mg/L)
EPL28	<20	<100	<1	<1	<0.001	<0.0001
EPL29	33,600	5,060	582	430	<0.001	<0.0001

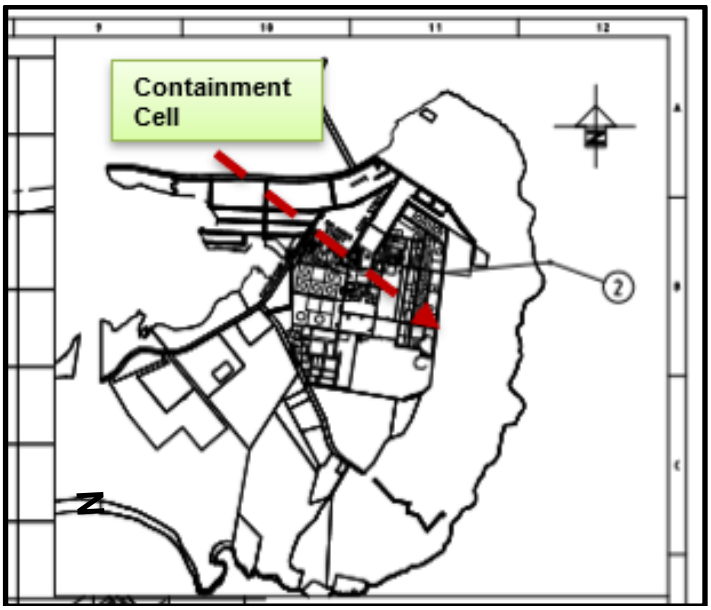
Note: The well IDs have changed overtime as follows

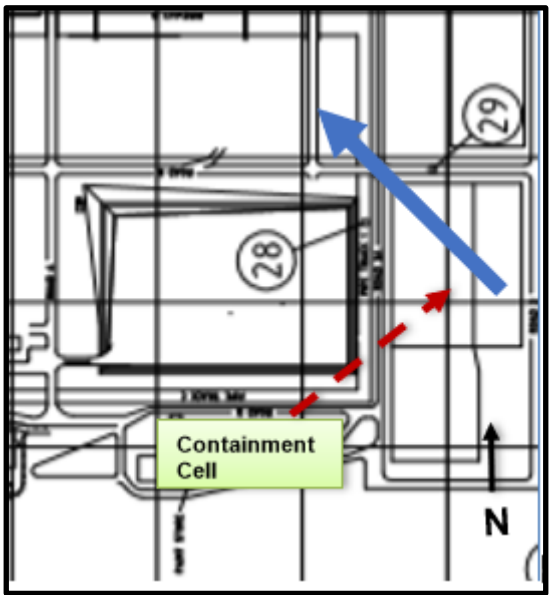
- AECOMM3 → PMW60 → EPL28
- AECOMM4 → PMW61 → EPL29

As the objective of the Baseline GME was to establish a baseline for groundwater in the area prior to operation of the containment cell, it is noted that this location already had impacts prior to containment cell construction and operation from upgradient ASTs. The impacts identified in groundwater at AECOMMW4 are likely related to the identified soil impacts sourced from historical upgradient sources and potentially in the future from contaminants contained within the cell, and originating from the pipelines.

The results of the baseline groundwater monitoring event are provided in Appendix G. Figure 5 below provides a schematic plan of monitoring well locations plan in relation to the cell. The full Site figure is provided in Appendix A as Figure A3.

Figure 5 Schematic Location Plans for Monitoring Wells EPL28 (28) and EPL29 (29). The left side shows the whole Kurnell site and the right side is zoomed in to the Containment Cell with the two monitoring wells on the north-west (28) and north (29). The blue arrow is the general direction of groundwater flow at the Containment Cell.





5.3.1 Groundwater Monitoring Plan

As noted in Section 5.1 above, groundwater monitoring will be conducted from EPL numbers (EPL28 and EPL 29) quarterly to provide ongoing demonstration that the containment cell liner is operating effectively. The methodology for monitoring of these bores will occur in accordance with the existing groundwater monitoring programs for the Site which is summarised as follows:

- The wells are to be sampled using hydrosleeve, thereby minimising the potential for cross contamination.
- Collection of the following groundwater geochemical parameters during sampling: water quality: temperature, electrical conductivity, redox potential, dissolved oxygen and pH.
- Collection of QAQC samples Field intra-laboratory samples at a rate of 1 in every 10 primary samples, field inter-laboratory samples at a rate of 1 in 20 primary samples.[1]
- Collection for blank samples including a trip blank and a rinsate blank every day.

The two sentinel monitoring wells will be monitored for the COPC referenced in the Ampol Environmental Protection Licence (EPL), Licence 837 for the asbestos cell and include:

- Benzene
- Ethylbenzene
- Lead (Pb)
- Mercury (Hg)
- Naphthalene
- Per- and polyfluoroalkyl substances (PFAS)
- pH
- Polycyclic aromatic hydrocarbons (PAHs)
- Standing Water Levels (SWL)
- Toluene
- Total recoverable hydrocarbons (TRH)
- Total Phenolics. And
- Xylene.

Any change in dissolved phase concentrations at the sentinel wells does not necessarily mean there is a leak or compromise in the containment cell as seasonal variation and site activities may influence the condition of the groundwater at these locations. Rather, notable changes in concentrations at these sentinel wells will trigger a requirement to assess the containment cell to for evidence of a leak in the leachate collection system, along with an assessment of other activities may be occurring in the area and areas up-gradient of the well locations. Historical monitoring data from the Baseline GME and subsequent quarterly GMEs will be used to assess potential contamination that may be an indicator of leaks in the containment cell liners.

5.3.1 Groundwater Triggers

Any change in dissolved phase concentrations at the sentinel wells does not necessarily mean there is a leak or compromise in the containment cell as seasonal variation and site activities may influence the condition of the groundwater at these locations. Rather, notable changes in concentrations at these sentinel wells will trigger a requirement to assess the containment cell to for evidence of a leak in the leachate collection system, along with an assessment of other activities may be occurring in the area and areas up-gradient of the well locations. Historical monitoring data from the Baseline GME and subsequent quarterly GMEs will be used to assess potential contamination that may be an indicator of leaks in the containment cell liners.

[1] QA samples, dups, blanks etc may be part of a larger sample batch inclusive of other wells at the site

Table 6 Trigger Values Sentinel Wells EPL28 and EPL29

Analyte	Mean of Results 2018 – 2020 EPL 29	One Standard Deviation from the mean Results 2018 - 2020	Trigger Value EPL 29 – Mean + 2 standard deviations from the mean	Trigger Value EPL 28 ANZG, 2018. Australian and New Zealand Governments. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. August 2018
TRH F1 (µg/L)	44,550	12,828	72,206	*3,700
TRH F2 (µg/L)	1,201	1019	3,239	*640
Benzene (µg/L)	2111	1,002	4,115	950
Toluene (µg/L)	14,000	3,930	21,860	180
Ethylbenzene (µg/L)	6,700	2,195	11,090	80
Total Xylene (µg/L)	33,687	10,357	54,401	75
Naphthalene (µg/L)	496	639	1,774	16
Lead (µg/L)	2.0	0.44	2.1	2.1
Mercury (µg/L)	0.4	<0.1	>0.1	>0.1
*PFOS (µg/L)	0.14	*NA	NA	NA
*PFOA (µg/L)	0.88	N/A	*10	**10
*Sum of PFOS and PFHxS (µg/L)	0.145	N/A	*2.0	**2.0

"-" = Neither well exceeds guideline or LOR.
NA = Not Applicable.
*= Californian Water Boards: Update to Environmental Screening Levels (ESLs), January 24 2019 - Aquatic Habitat Goal Levels, Salt Water Ecotox.
**= *PFAS National Environmental Management Plan Version 2.0* Human health guideline values developed by health regulators,– Recreational water quality guideline value, January 2020 (sourced from the PFAS National Environmental Management Plan Version 2.0 – January 2020).
ANZG, 2018. Australian and New Zealand Governments. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. August 2018.
m-xylene trigger value - used as the conservative indicator for total xylenes.

Baseline trigger levels from sampling in September 2020 for PFAS recorded concentrations exceeding the NEMP 2020 guidelines as follows:

- Monitoring wells EPL28 and EPL29 exceeded the Marine 95 and/or 99% trigger levels for PFOS, and
- Monitoring well EPL29 exceeded the Health drinking levels for PFAS, PFOA, sum of PFAS and Sum of PFHxS and PFOS.

Based on the site's ongoing use as a terminal, and potential risk to surrounding receptors, including Botany Bay, the NEMP 2020 Health Recreational Waters criteria has been selected as the most appropriate and conservative regulatory guideline for PFAS at the site.

If the adopted trigger level values are exceeded* then the following will be undertaken:

- A visual inspection of the containment cell will be undertaken to assess its integrity, including inspection of the leachate collection tank and pumps.
- Rainfall data will be reviewed to assess potential climatic effects on the monitoring data.
- The sentinel wells may be re-sampled.
- Identification of other potential sources of the impact will be investigated, noting the historical contaminant concentrations in AECOMMW4 and that the sentinel wells may be influenced by other activities other than the containment cell.
- Assessment of changes in groundwater levels and changes in groundwater flow direction, and
- If required additional sentinel groundwater wells may be installed.

*If leachate/leachate detection monitoring results indicate that leachate quality is less impacted than groundwater from sentinel wells EPL28 and EPL29, action items relating to the containment cell would not be relevant

Table 7 below presents the highest concentrations recorded historically for all analytes tested including PFAS. Table 1 Appendix G presents the historical groundwater monitoring results for sentinel wells EPL28 and EPL29 with the exception of PFAS results. Table 2, Appendix G presents the results of baseline results for PFAS during monitoring conducted in September 2020.

Table 7 Trigger Values Sentinel Wells EPL28 and EPL29

Analyte	Highest Concentration	ANZG (2018) Marine water 95% toxicant DGVs Waters/*NEMP 2020 (PFAS)	Well Exceeding Guideline Value	Sample Date
TRH F1 (µg/L)	59,000	NG	EPL29	Jan 2018- Aug 2020
TRH F2 (µg/L)	2,500	NG	EPL29	Jan 2018- Aug 2020
Benzene (µg/L)	3,700	700	EPL29	Jan 2018- Aug 2020
Toluene (µg/L)	18,100	NG	EPL29	Jan 2018- Aug 2020
Ethylbenzene (µg/L)	9,200	NG	EPL29	Jan 2018- Aug 2020
Total Xylene (µg/L)	43,000	NG	EPL29	Jan 2018- Aug 2020
Naphthalene (µg/L)	2,000	NG	EPL29	Jan 2018- Aug 2020
Lead (µg/L)	9.0	4.4	EPL29	Jan 2018- Aug 2020
Mercury (µg/L)	0.4	0.4	No wells exceeded	Jan 2018- Aug 2020
*PFOS (µg/L)	0.14	*NA	EPL29	Sept 2020
*PFOA (µg/L)	0.88	*10	EPL29	Sept 2020-
*Sum of PFOS and PFHxS (µg/L)	0.145	*2.0	EPL29	Sept 2020

Notes:
"-" = Neither well exceeds guideline or LOR.
NG = No Guideline.
*= *PFAS National Environmental Management Plan Version 2.0* Human health guideline values developed by health regulators,– Recreational water quality guideline value, January 2020 (sourced from the PFAS National Environmental Management Plan Version 2.0 – January 2020).

5.4 Leachate Monitoring

The leachate tank and associated collection pumps will be inspected six monthly to check the system is operating effectively and maintained appropriately. Where liquid is present in the leachate collection tank, a sample will be collected and analysed for COPCs. Additional sampling of the leachate collection tank should be undertaken:

- After periods of heavy rain or if any identified malfunction of the system.
- If there is a notable increase in concentrations of COPCs, when compared with recent and or historical concentrations sourced from the cell, in the two sentinel groundwater monitoring wells.
- If petroleum hydrocarbon sheen and/or odours appears in the sentinel wells and/or
- If liquid is observed in the leak detection system.

Ampol will undertake monitoring of the leachate via sampling at the leachate collection tank during quarterly groundwater monitoring if the leachate is observed to contain noticeable petroleum hydrocarbon sheen and odours, or if required as part of Ampol internal processes.

5.5 Leak Detection Monitoring

Leak detection monitoring should be undertaken of the leak detection pipe by an appropriately experienced person to determine if liquid is present in the leak detection sump. If liquid is present within the sump, the level of liquid should be noted. A sample of the liquid should be collected using a water sampling device, for example a peristaltic pump. The samples should be collected by an appropriately experienced person in accordance with standard industry practice, and submitted for laboratory analysis to a National Association of Testing Authorities (NATA) accredited laboratory.

Through comparison of the liquid sample from the leak detection sump and the monitoring results for the leachate within the leachate collection tank it can be determined if the liquid within the leachate detection sump is leachate or water (for example condensation or rain water). The actions for the detection of water are:

- If the liquid is water, it may be pumped out and 6 monthly monitoring of the pipe/sump continues as normal.
- If the liquid is not water, ie sediment, it will need to be tested and appropriately disposed either to a NSW EPA liquid waste facility, or treated to a standard that would enable it to be pumped or removed out as above.
- If liquid is present within the leachate detection sump, monitoring of the levels should continue to determine if the quantity of liquid within the sump is increasing (and the rate of increase) or remaining steady.
- If the liquid level is not changing, then monitoring frequency can be reduced to 6 monthly.
- If the liquid level is increasing, then further investigations will need to be undertaken to determine the reason for the rate of increase.

5.6 Erosion and Sediment Monitoring

To assess the continued integrity and performance of the final cap, post-closure monitoring will include the following components:

- A minimum of 6 monthly visual inspections for deterioration of the cap's condition including erosion, cracking, dead or stressed vegetation, ponding, differential settlement, slope instability, damage to any pipes or drains and other works installed on the final capping.
- Repair and/or replacement of portions of the final capping if found to be damaged.
- The stormwater controls (swale and rock groin) will be inspected monthly and cleaned as required.

5.7 Vegetation and Weed Monitoring

The vegetation cover density has been planted on a 15 cm grid. The containment cell will be inspected 6 monthly to ensure this density is maintained, and for weeds and other vegetation which could potentially damage the capping layer of the containment cell. If weeds are identified they will be managed in accordance with the OEMP.

5.8 Summary of Monitoring Requirements

Table 8 below presents the frequency of monitoring and inspections of items associated with the cell as well as reporting timeframes. Reporting is to be completed in accordance with the

Consultants reporting on contaminated land, Contaminated Land Guidelines (NSW EPA, April 2020).

Table 8 Monitoring Program Schedule

Monitoring	Frequency	Reporting	Report Timing
Groundwater	3 Monthly	Groundwater monitoring report	To be submitted 6 weeks after final analytical results are received.
Leachate	6 monthly	Leachate Monitoring Summary Letter	To be submitted 3 weeks after final analytical results are received
Erosion and Sediment	6 monthly	6 monthly digitised checklist	To be inserted into the Ampol digitised checklist 1 week after the inspection has taken place.
Vegetation and Weed	6 monthly	6 monthly digitised checklist	To be inserted into the Ampol digitised checklist 1 week after the inspection has taken place.

5.9 Contingency Measures

Unexpected conditions on the Site may be observed or reported during routine maintenance works or during six monthly inspections. In response to these unexpected conditions, the conditions should be reported to Ampol and the following proposed action is to be taken. The contingency measures listed in Table 9 below should be initially considered.

Table 9 Contingency Measures

Anticipated Problem	Corrective Action	Action Timeframe
Excessive dust on or surrounding the containment cell during routine or required works (vegetation maintenance/mowing).	Use water sprays or cease dust-generating activities until better dust control can be achieved.	Immediately on observation or notification.
Suspected ACM: *Note that this can only occur if the capping is disturbed/damaged and the lining broken*	Stop works and assess. Controlled wetting and/or covering may be employed to reduce asbestos dust emission by suitably trained personnel. Consult with geotechnical consultant to undertake remediation of any damage to the capping layer by wind and rain (i.e. scouring by wind and rain into the capping layer or damage to vegetation on the cap).	Implement any required OHS controls as soon as possible. Commence assessment and rectification works within 2 weeks (i.e. signage and/or covers).

Anticipated Problem	Corrective Action	Action Timeframe
Potentially impacted soil/ groundwater encountered (not previously identified), Eg. chemicals that have not previously been assessed such as PFAS.	Report the incident to Ampol to discuss best course of action including engagement of a suitably qualified environmental and/or geotechnical consultant to oversee the works. Indications of impact may be visual (e.g. staining), olfactory (i.e. odorous), or the presence of fibro sheet fragments. Undertake works in accordance with the required site-specific health, safety, and environment plan, incorporating Safe Work Method Statements for each activity proposed. Replace capping materials following completion of works and dispose of waste off-site to an appropriately licensed facility in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).	Implement any required OHS controls as soon as possible. Commence assessment and rectification works within 2 weeks (i.e. signage and/or covers).
Weather Event: Heavy storm/tornado (1:100 flood, wind greater than 100 km per hour).	Anticipate potential impact of weather on containment cell, leachate system and stormwater system. Apply measures to protect equipment (leachate) extra bunding surrounding stormwater system. Consult with geotechnical consultant to undertake remediation of any damage to the capping layer by wind and rain (i.e. scouring by wind and rain into the capping layer or damage to vegetation on the cap). Excessive water in stormwater system, with potential contamination in stormwater – Consult with environmental consultant on remedial options. Replace all materials removed during the above weather events with the following for each specific capping layer	Implement any required OHS controls as soon as possible. Commence assessment and rectification works within 2 weeks (i.e. signage and/or covers).

Anticipated Problem	Corrective Action	Action Timeframe
	1. Seal bearing layer – clean clay 2. Aggregate: blue metal. 3. Clean soil: VENM 4. Topsoil: organic soil. Following completion of works and dispose of waste off-site to an appropriately licensed facility in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).	

All activities/tasks that require the engagement of contractors should be undertaken in accordance with current regulatory requirements, Work Health and Safety Act 2011 (or relevant legislation current at the time of the proposed works). The LTEMP will refer to revisions of those guidelines and or regulations whenever applicable.

If conditions encountered differ from those anticipated, Ampol should be notified. Occurrence of worker discomfort should be immediately reported, works discontinued and the Site conditions assessed by a suitably qualified contractor/consultant which may include an occupational hygienist.

6. References

- AECOM (2016) ACS Management Project Containment Cell Concept Design
- AECOM (2017) Kurnell Asbestos Contaminated Soil Management Project, Containment Cell Detail Design
- AECOM (2018) Kurnell ASC Containment Cell Construction Quality Assurance Report.
- AECOM (2018) Construction Quality Assurance Plan Kurnell Asbestos Contaminated Soil Management Project
- AECOM (2018) ACS Modification works - Remedial Action Plan Ampol Kurnell Terminal
- NSW EPA (2016) Solid Waste Landfill Guidelines.

Appendix A Site Plans

A1 Containment Cell Location Plan

A2 Pipeways Source Area Location Plan

KURNELL ACS PROJECT - OVERVIEW

AECOM

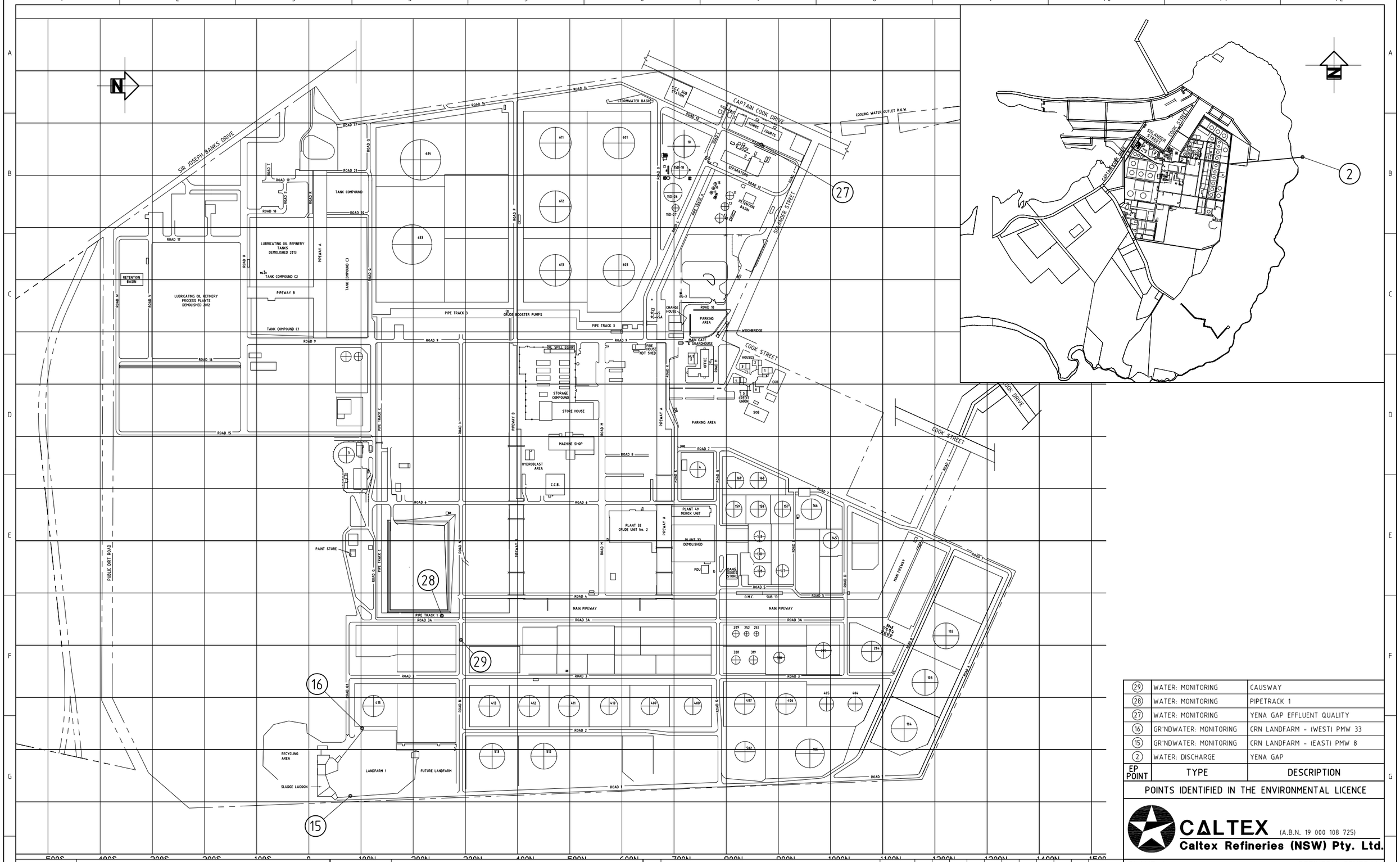
N

0 100 200 m

Legend

- Pipeway extent
- Tiltex
- Geofabric
- Road
- Excavated to 0.15m
- Excavated to 0.2m
- Excavated to 0.25m
- Excavated to 0.3m
- Excavated to 0.4m
- Excavated to 0.5m
- Left in-situ
- Left in-situ and covered with geofabric and backfill
- Asbestos patch
- Concrete pad

A3 Baseline Groundwater Monitoring Well Location Plan



(29)	WATER: MONITORING	CAUSWAY
(28)	WATER: MONITORING	PIPETRACK 1
(27)	WATER: MONITORING	YENA GAP EFFLUENT QUALITY
(16)	GR'NDWATER: MONITORING	CRN LANDFARM - (WEST) PMW 33
(15)	GR'NDWATER: MONITORING	CRN LANDFARM - (EAST) PMW 8
(2)	WATER: DISCHARGE	YENA GAP
EP POINT	TYPE	DESCRIPTION

POINTS IDENTIFIED IN THE ENVIRONMENTAL LICENCE

CALTEX (A.B.N. 19 000 108 725)
Caltex Refineries (NSW) Pty. Ltd.

PLANT 1 — REFINERY GENERAL

ENVIRONMENT PROTECTION LICENCE
EP IDENTIFICATION POINTS

No.	DESCRIPTION	DATE	DRN	CHK	APPROVALS
6	POINTS 40 & 41 RENUMBERED TO EPA NUMBER S 28 & 29	21.06.18	MJP	J.K.	
5	POINT 1 REMOVED POINTS 40 & 41 LOCATION IDENTIFIED	4.05.18	MJP	D.D.	JK
4	POINTS AT OLD REFINING AREA DELETED DUE TO SITE CONVERED TO TERMINAL	21.07.15	BJ	RPP	JK
3	POINTS 3, 6 & 28 DELETED DUE TO PLANT DECOMMISSIONING	21.03.14	RPP	N/A	RD

REFERENCE DRAWINGS: A4-18588 sht 2 — EP LICENCE EMISSION POINTS LOCATION LIST

SPECIFICATIONS

REVISIONS

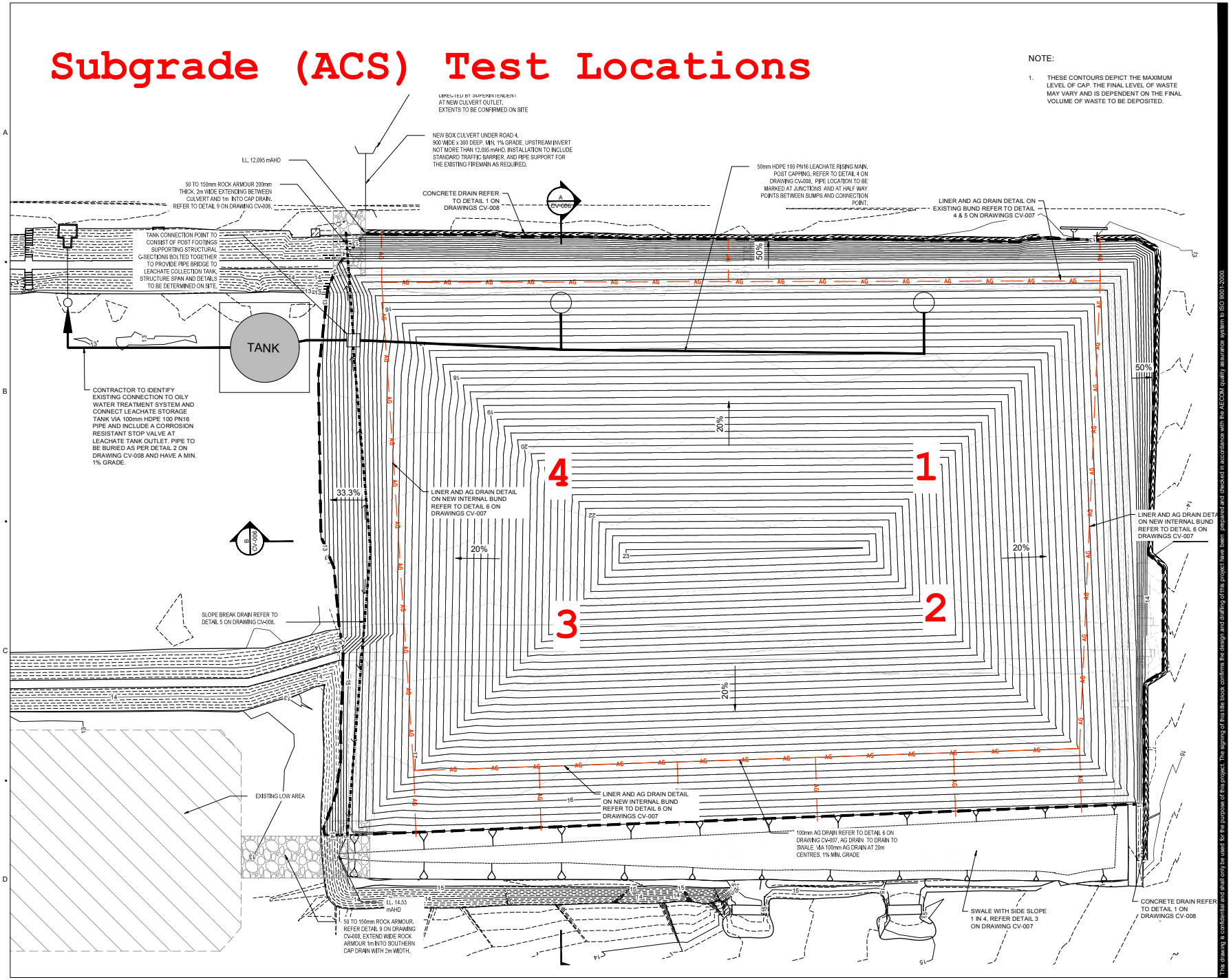
PROJECT

PMR. No.	INDEX	SHT SIZE.	DRAWING No.	SHT No.	REV.
	A	A1	18588	1	6

Appendix B Containment Cell "As built" Plan

ISO A1 594mm x 841mm

Subgrade (ACS) Test Locations



AECOM

PROJECT

KURNELL ASBESTOS CONTAMINATED SOIL MANAGEMENT PROJECT DETAIL DESIGN

KURNELL, NSW 2231

CLIENT

CALTEX AUSTRALIA PTY LTD

ENGINEERING

AECOM Services Pty. Ltd.
A.B.N. 20 093 846 925
www.aecom.com

LEGEND:

- 0.2m EXISTING CONTOURS
- 1.0m EXISTING CONTOURS
- 0.2m DESIGN CONTOURS
- 1.0m DESIGN CONTOURS
- AG DRAIN
- CONCRETE DRAIN
- RISING MAIN
- SLOPE BREAK DRAIN
- EXTENT TOP OF WASTE

PROJECT MANAGEMENT INITIALS

QL	AP	LR
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	11/1/2018	LINER SURFACE LOWERED
A	9/1/2018	ISSUED FOR REVIEW

SCALE

0 6.25 12.5 m

PROJECT NUMBER

60488804

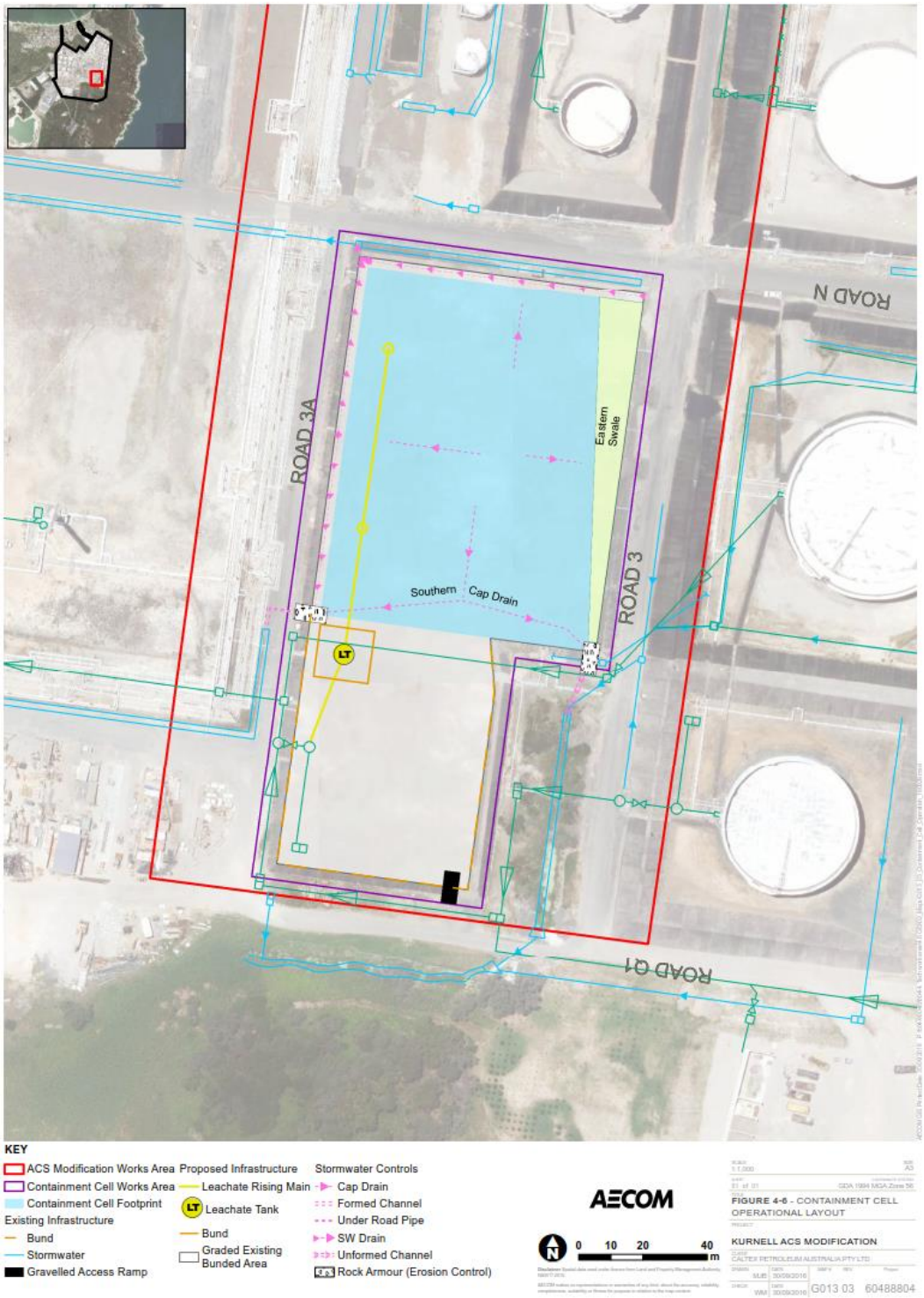
SHEET TITLE

KURNELL
TOP OF CAPPING LAYOUT

SHEET NUMBER

60488804-DRG-CV-005

Appendix C Containment Cell Drainage Plan



Appendix D Records of NSW EPA Consultation

Comment #	NSW EPA Comment	AECOM Response
1	1. Section 1.2 of the LTEMP identifies the objectives and ongoing environmental management of the cell. Item A12 in Section 11.3 of Attachment B (Management and Mitigation Measures) of the Project Approval (SSD 5544 MOD 2) states "A Containment Cell Long Term Environmental Management Plan (CCL TEMP) would be prepared in consultation with the EPA prior to the closure of the containment cell. The CCLTEMP would detail the ongoing environmental management of containment cell, including maintenance of the capping and drainage, groundwater monitoring (including groundwater quality and levels), and land use restrictions that will apply to the containment cell". The plan does not appear to address any land use restrictions that may apply to the containment cell area. The plan should ensure that all relevant management measures and conditions of the Project Approval are addressed.	Refer to Section 3.5 for Containment Cell Land Use Restrictions
2	Section 4.2 provides information on the height difference between the lowest point of the cell base layer and the average groundwater elevation. Figure 3 in the LTEMP provides a schematic cross section of the containment cell. The plan should show the ground surface level and average groundwater level in relation to the contained materials so that the containment cell design, risks associated with contained materials can be fully understood and to help facilitate any future repairs if required.	Refer to Figure 4 which presents a cross section of the cell with groundwater elevation compared with the base of the cell.
3	Section 5.4 identifies when leachate sampling should occur at the leachate collection tank. The plan may also need to consider undertaking leachate sampling during the following scenarios a) if there is a notable increase in concentrations at the two sentinel groundwater monitoring: wells; b) if the sentinel well samples are observed to contain petroleum hydrocarbon sheen and/or odours; c) if a liquid sample is collected from the leak detection sump and submitted for analysis.	Refer to Section 5.4 where these additional checks have been included
4	Table 7 (Monitoring program schedule) does not include the proposed six monthly leak detection monitoring as identified in Section 5.5. It also reports a frequency for leachate monitoring as six monthly while Section 5.4 indicates inspections and sampling of the leachate collection system will be undertaken quarterly. The monitoring program schedule should be consistent and should include all required monitoring (including monitoring frequencies) to minimise/prevent any potential environmental impact associated with the ongoing management of the closed containment cell.	All monitoring has been converted to 6 monthly monitoring throughout the document with the exception of gr.oundwater montioring which is required to be conducted quarterly.
5	Table 8 (Contingency measures) does not include an action timeframe for the anticipated problem of "Weather Event: Heavy storm/tornado". All appropriate timeframes should be clearly identified in the plan.	Included 2 weeks within the Weather Event Response time.

Appendix E Equipment Installed and Maintenance Requirements

Equipment Register

- Two of – 25mm air driven diaphragm pumps (Blagdon type 1A-AA-BB-BBS)
- Two of – compressed air regulator/oiler/filter set
- Two of – Air switch 3/2 Norgren V62c4d7A-XA090
- Two of – air activated level switch float type vertical mounted FPV 01 146.
- Two of - Foot valves are a standard brass foot valve series 1510
- One of – 20kL poly tank
- One of – 100mm ball valve
- One of – 50mm gate valve
- One of - Level indicator is from Control Components

Maintenance Requirements

General inspection of the cell looking for weeds and incorrect vegetation, eg. trees, weeds.

Frequency – 6 monthly or after an extreme weather event.

Actions:

- Gardener to inspect and action weed or tree removal activities.
- Gardener to check for any subsidence, or drainage issues with the external layer.

Responsibility – Terminal Maintenance, Gardening contract.

General operation of the cell pump,

Frequency - 6 monthly

Actions:

- Open hatch on pump wells, and lift the level switch and define operation of the pump, and release
- Check tank level, must between one third to half full,
- Check well lids for structural integrity, rust.
- Check lubrication, filter is operational on compressed air supply, repair/replenish if required.
- If pump operation fails replace with spare pump and repair pump.

Responsibility – Terminal Maintenance

Water sampling, (to be added to ground water testing contractor),

Frequency - 3 monthly.

Actions:

- Water sample from the two ground water wells as per testing requirements
- Water sampling from the leachate tank
- Water sampling for the two well detection points.
- Send results to Ampol Environmental department for analysis.

Responsibility - Ampol Environmental department.

Expected life for the equipment is 20 years from 2017. Replacement or repair of items may be required.

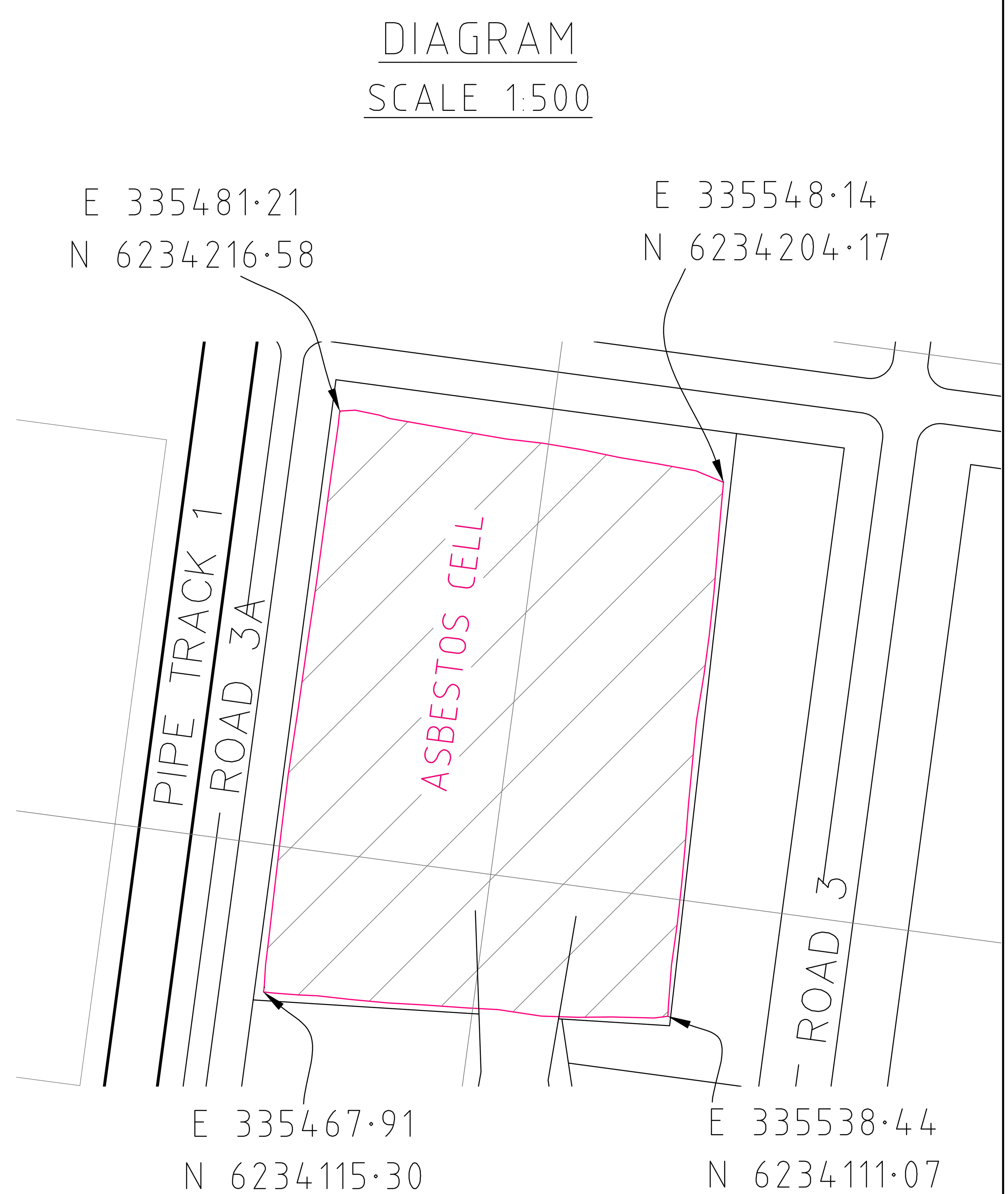
Limitations.

- No excavation works allowed
- No vehicles with more than two axles or above 5T allowed on the cell area.

Appendix F Containment Cell Survey Drawing

PLAN SHOWING LOCATION OF ASBESTOS CELL AND PROPERTY BOUNDARIES

CALTEX KURNELL TERMINAL



REVISION TABLE:

VER	BY	AMENDMENTS	DATE

NOTATIONS:
THE BOUNDARIES ON THIS PLAN HAVE NOT BEEN SURVEYED. THE BOUNDARIES HAVE BEEN COMPILED FROM PLANS ON PUBLIC RECORD.

DATUM INFORMATION:
HORIZONTAL: MGA
H. SOURCE: PM 112 E 335224.50 N 6234087.26
PM 113 E 335476.55 N 6234232.13
COORDINATES OBTAINED DIRECTLY FROM CORSnet ON 5/9/2019

ORIGINAL SURVEY DETAILS:
SURVEY DATE: 1/11/2019
SURVEYOR: D.MAHER
DRAFTING: D.MAHER
CHECKED BY: P.BENTLEY
CAD REFERENCE: 1801014-MGA-191101-V1.dwg

SCALE 1:2500 | SHEET SIZE A0
0 25 50 75 100
LENGTHS ARE IN METRES

Beveridge Williams
development & environment consultants
Miranda ph : 02 9524 4073
www.beveridgewilliams.com.au

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CLIENT:
CALTEX AUSTRALIA

TITLE DETAILS:
LOT 25 IN D.P. 776328

SURVEYORS REFERENCE: 1801014 — SHEET 1 OF 1

Appendix G Historical Groundwater Results – Sentinel Wells

Groundwater Analytical Results

				TRH							BTEXN							PAH												Metals							
				C6 - C10 Fraction	C6-C10 Fraction minus BTEX (F1)	>C10-C16 Fraction	>C10-C16 Fraction minus Naphthalene (F2)	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (sum)	Benzene	Toluene	Ethylbenzene	m & p-Xylene	o-Xylene	Total Xylene	Naphthalene	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Anthracene	Phenanthrene	Pyrene	Fluoranthene	Benz(a)anthracene	Chrysene	Benzo(a)pyrene	Benzo(e)pyrene	Benzo(k)fluoranthene	Indeno(1,2,3-cd)pyrene	Benzo(g,h,i)perylene	Dibenzo(a,h)anthracene	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury
		LOR		20	20	100	100	100	100	100	1	2	2	2	2	2	1.0	5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	1.0	1.0	1.0	1.0	0.001	0.0001	0.001	0.001	0.001	0.001	0.005	0.0001
		Units		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Sample Location	**Date Sampled**	**Sample ID**	**Sample Type**																																			
AECOMMW3	11/01/2018	AECOMMW3_180111	N	< 20	< 20	< 100	< 100	< 100	< 100	< 100	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.002**	< 0.0001	< 0.001	**0.003**	< 0.001	**0.038**	**0.066**	< 0.0001
AECOMMW4	11/01/2018	AECOMMW4_180111	N	**70500**	**33600**	**5610**	**5060**	**250**	< 100	**5860**	**582**	**6890**	**5080**	**19500**	**4850**	**24400**	**430**	**550**	< 4.7	< 4.7	< 4.7	**< 4.7**	**< 4.7**	**< 4.7**	< 4.7	< 4.7	< 4.7	**< 4.7**	< 4.7	< 4.7	< 4.7	< 4.7	**0.004**	< 0.0001	< 0.001	**0.001**	< 0.001	**0.007**	**0.022**	< 0.0001
SPAMW10R	11/01/2018	SPAMW10R_180111	N	**1060**	**1060**	**370**	**330**	**390**	< 100	**760**	< 1	< 2	< 2	< 2	< 2	< 2	**23.1**	**44**	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.006**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.0001
SPAMW3R	11/01/2018	SPAMW3R_180111	N	< 20	< 20	< 100	< 100	< 100	< 100	< 100	< 1	< 2	< 2	**3**	< 2	**3**	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.006**	< 0.0001	< 0.001	**0.002**	< 0.001	**0.300**	**0.041**	< 0.0001
SPAMW9R	11/01/2018	SPAMW9R_180111	N	< 20	< 20	< 100	< 100	< 100	< 100	< 100	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.012**	< 0.0001	< 0.001	< 0.001	< 0.001	**0.004**	**0.022**	< 0.0001
PMW16	11/01/2018	PMW16_180111	N	< 20	< 20	**230**	**230**	**150**	< 100	**380**	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	< 0.001	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.0001
PMW20	11/01/2018	PMW20_180111	N	**1050**	**890**	**2670**	**2180**	**290**	< 100	**2960**	< 5	< 5	< 5	**158**	< 5	**158**	**246**	**492**	< 4.8	< 4.8	< 4.8	**< 4.8**	**< 4.8**	< 4.8	**< 4.8**	< 4.8	< 4.8	**< 4.8**	< 4.8	< 4.8	< 4.8	< 4.8	**0.007**	< 0.0001	**0.001**	< 0.001	< 0.001	< 0.001	< 0.005	< 0.0001
PMW20	11/01/2018	QC200_180111	FT	**2500**	**2300**	**3100**	**2700**	**200**	<100	**3300**	<1	<1	6	**210**	<1	**210**	**350**	**420**	<1	<1	<1	<1	<1	<1	**<1**	<1	<1	**<1**	<2	<1	<1	<1	**0.006**	<0.0001	<0.001	<0.001	<0.001	<0.001	**0.001**	<0.00005
RPD: PMW20/QC200				*82*	*88*	*15*	*21*	*37*	*nc*	*11*	*nc*	*nc*	*nc*	*28*	*nc*	*28*	*36*	*16*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*15*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*
PMW26	11/01/2018	PMW26_180111	N	< 20	< 20	< 100	< 100	< 100	< 100	< 100	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.009**	< 0.0001	< 0.001	**0.002**	< 0.001	< 0.001	< 0.005	< 0.0001
PMW26	11/01/2018	QC100_180111	FD	< 20	< 20	< 100	< 100	< 100	< 100	< 100	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.009**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.0001
RPD: PMW26/QC100				*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*0*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*
PMW27	11/01/2018	PMW27_180111	N	< 20	< 20	< 100	< 100	< 100	< 100	< 100	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.002**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	**0.006**	< 0.0001
PMW37	11/01/2018	PMW37_180111	N	< 20	< 20	**150**	**150**	**280**	< 100	**430**	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.008**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	**0.006**	< 0.0001
PP01	16/01/2018	PP01_160118	N	**700**	**700**	**1980**	**1450**	**110**	< 100	**2090**	< 1	< 2	< 2	< 2	< 2	< 2	**319**	**526**	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.001**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.0001
PP02	16/01/2018	PP02_160118	N	**30700**	**9720**	**870**	**660**	< 100	< 100	**870**	**10000**	**3000**	**927**	**6430**	**620**	**7050**	**85.8**	**213**	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.040**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	**0.008**	**0.0002**
PP02	16/01/2018	QC101_160118	FD	**29300**	**6400**	**540**	**300**	< 100	< 100	**540**	**12400**	**2590**	**926**	**6380**	**601**	**6980**	**79.2**	**238**	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.039**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	**0.0002**
RPD: PP02/QC101				*5*	*41*	*47*	*75*	*nc*	*nc*	*47*	*21*	*15*	*0*	*1*	*3*	*1*	*8*	*11*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*3*	*nc*	*nc*	*nc*	*nc*	*nc*	*nc*	*0*
PP03	16/01/2018	PP03_160118	N	< 20	< 20	< 100	< 100	< 100	< 100	< 100	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.002**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	**0.005**	< 0.0001
PP09	16/01/2018	PP09_160118	N	**40**	**40**	**160**	**160**	< 100	< 100	**160**	< 1	< 2	**3**	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	< 0.001	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.0001
PP10	16/01/2018	PP10_160118	N	< 20	< 20	< 100	< 100	< 100	< 100	< 100	< 1	< 2	< 2	< 2	< 2	< 2	< 1.0	< 5	< 1.0	< 1.0	< 1.0	**< 1.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**< 0.5**	< 1.0	< 1.0	< 1.0	< 1.0	**0.002**	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.0001

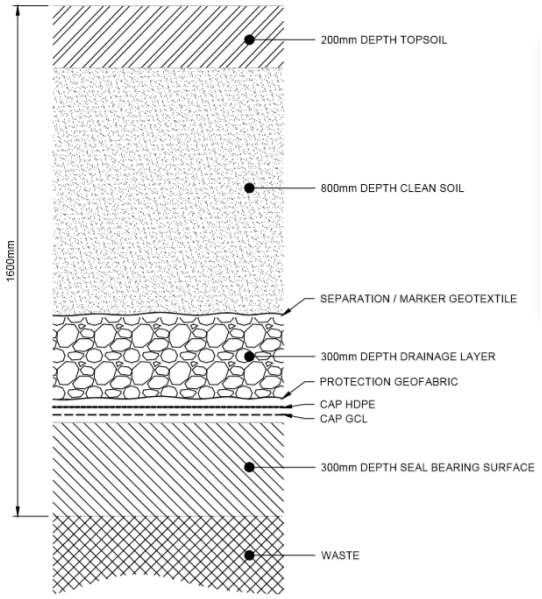
Notes
LOR: Limit of Reporting
Sample Type: N - Primary, FD - Duplicate, FT - Triplicate
mg/l: milligrams per litre
ug/l: micrograms per litre
RPD: relative percent difference
nc: not calculated, result(s) < LOR

Appendix H Cell Maintenance and Repair Requirements

The following description provides an outline of the repair works required where the capping layers are disturbed. The repair works for each layer has been described and each section should be applied as required depending on the depth and extent of the disturbance on the various layers.

Irrespective of the extent of disturbance the damage to all layers should be photographed, the extent and depths measured and/or surveyed as required for future reference and to inform the repair works.

The cap profile has been copied below for reference from the construction drawings.



Vegetation

Where the vegetated surface has been damaged or where the grass has died back, the vegetation should be re-established using the same grass species as was established at construction. Grasses can be hand seeded where small areas of disturbance has occurred or if the area is large it can by hydroseeded.

Following seeding it should be watered bi-weekly for a period of 3 to 4 weeks or until the grass has been established.

Soil Layers

Where mixing of soil types has occurred, the disturbed soils shall be discarded and not used for repair works. Further soils should be sourced and replaced in accordance with the material specification and placement methods described in the construction Technical Specification. Where the disturbed soils can be separated, for instance where only the uppermost topsoil layer has been disturbed, the soils can be replaced in accordance with the construction Technical Specification.

Aggregate Drainage Layer

Where the aggregate drainage layer has been disturbed the presence of soil in the remaining aggregate shall be determined by visual inspection including removal of the upper layers of remaining aggregate if required. Soil in the aggregate layer may create blockage to water flow and outlets and should be removed if at all practicable without creating further damage.

If the disturbed aggregate has been mixed with soils it should be discarded and not used for repair works. Where required further aggregate should be sourced and replaced in accordance with the material specification and placement methods described in the construction Technical Specification.

Geosynthetics

The extent and type of damage to the disturbed geosynthetic layers should be carefully inspected by a suitably qualified CQA Officer with specific knowledge of geosynthetics installation and repair to determine which materials require repair and/or replacement. The disturbance should be measured and recorded in detail for future reference and to guide the repair work. A work methodology should be prepared for the repairs and materials testing and approved by Ampol, the Auditor and/or relevant authority as required.

Geosynthetic materials to repair the damage should be sourced to the same specification as described in the construction Technical Specification. The full extent of any damaged material shall be removed and replaced and no damaged material shall remain in place unless approved by the CQA Officer. All replacement shall be welded, overlapped and reinstated in accordance with the construction Technical Specification.

The repair works shall be overseen by a suitably qualified CQA Officer as described in the Technical Specification. A detailed repair log and works description shall be maintained during the repairs and an as built report prepared.

Appendix I Example Survey Checklist

Containment Cell Survey Example Checklist –Use Digitised Version under Kurnell SAP.

Date Completed: _____

Person Completing the Survey: _____

Site Manager Signature: _____

Area of Potential Concern	Issues Observed (attached picture if possible)	Action Required	Action Closure DateAct
Erosion, Sediment, and Vegetation			
Is there any erosion of the vegetation cover designed to maintain and reduce erosion impacts including dust and run-off scouring?			
Is there evidence of sediment leaving site? Refer to Section 4.4 above.			
Is there visual change or damage to any areas or layers of the capping on the Containment Cell.			
Are there any other identified changes to the containment cell that may create a risk to onsite workers from the cell?			
Leachate System Checklist			

The Containment Cell capping profile has been designed and built with drainage lines directed to the east side of the containment cell into a swale. Are there integrity issues with the rock groin and/or swale that may affect the safe discharge of surface run-off water?			
Are there any elevated readings (>25 ppm) of volatile organic compounds (VOCs) using a photoionization detector (PID) and lower explosive limit (LEL) from the leachate?			
Is the Leachate System equipment maintained in accordance with the Equipment Maintenance register (Appendix I)			
Is sampling of the leachate required based on visual observations of impacts or the results of the annual groundwater monitoring ot the sentinel wells?			
Leak Detection			
Undertake monitoring of the leak detection pipe as described in section 5 to determine if liquid is present in the leak detection sump. If liquid is present within the sump, the level of liquid should be noted and sampling undertaken			

Ground Disturbance Works on or Around the Containment Cell			
All persons entering and/or undertaking works that involve the disturbance of petroleum hydrocarbon and asbestos impacted soils must always wear PPE (e.g., coveralls, gloves, safety footwear, and respiratory protective equipment). PPE must be determined by the risk assessment.			
All works that involve the disturbance of petroleum hydrocarbon and potentially asbestos impacted soils must be undertaken by contractors who hold the appropriate licenses. If works associated with the removal of asbestos or asbestos containing material (ACM) are required, works should be undertaken and/or supervised by a Class B licensed asbestos removalist if more than 10 m^2 of non-friable asbestos is involved or a Class A licensed asbestos removalist for any friable asbestos contaminated soil.			