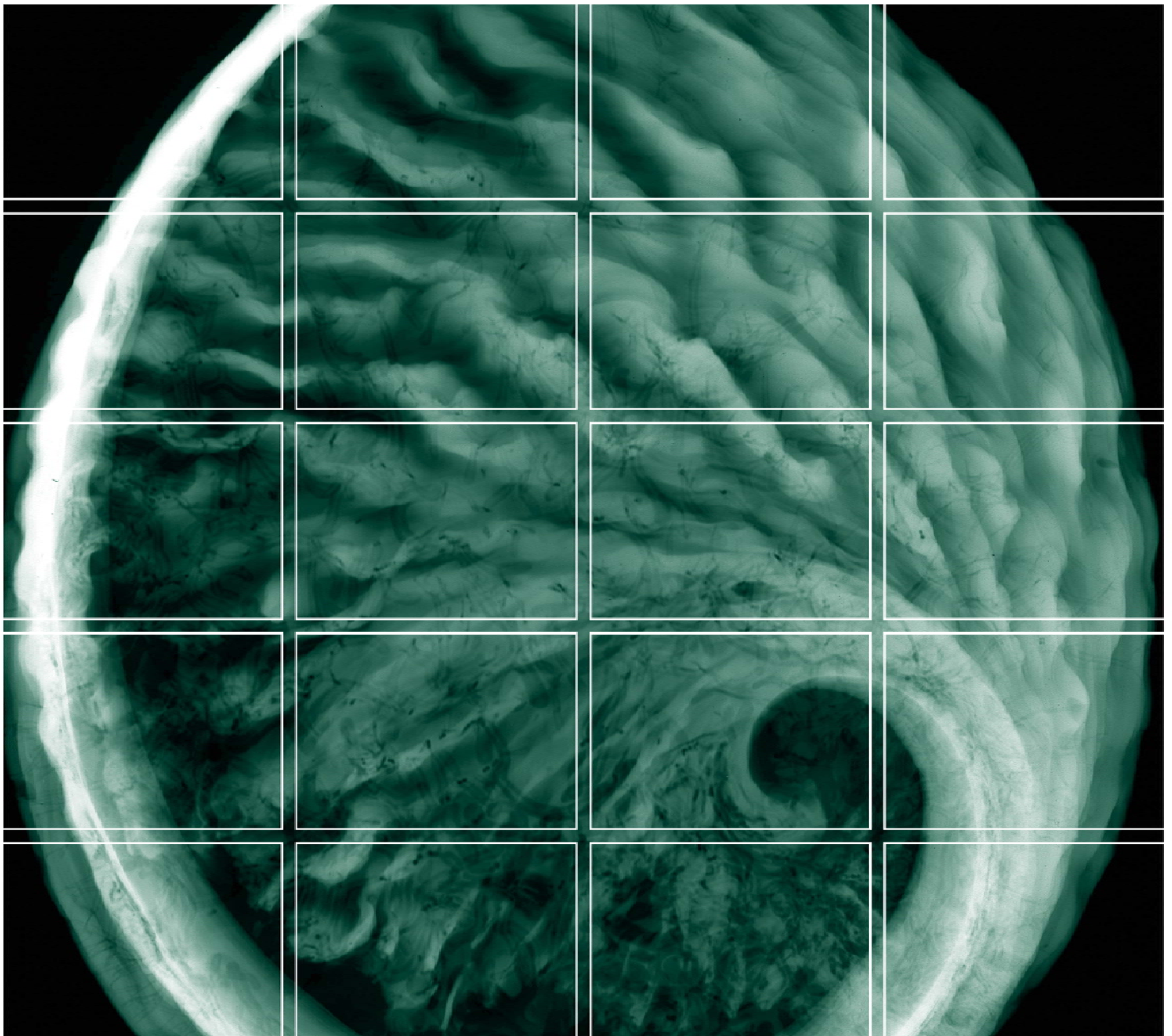




**Remedial Action Plan Addendum –
Off-site Tar Tank Structure (36
Hickson Road)**

*NSW EPA Declaration Area 21122 and
Block 4 (Stage 1b) Development Works,
Barangaroo, Millers Point*

Lend Lease Building Pty Ltd

September 2017

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Remedial Action Plan Addendum – Off-site Tar Tank Structure (36 Hickson Road)

NSW EPA Declaration Area 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point

Prepared by:	Jessica Lawrence
Position:	Project Manager
Signed:	
Date:	28 September 2017
Approved by:	Sophie Wood
Position:	Partner
Signed:	
Date:	28 September 2017

Lend Lease Building Pty Ltd

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Environmental Resources Management Australia Pty Ltd (ERM) has been appointed by Lend Lease Building Pty Ltd (LLB) to prepare an addendum to the *Remediation Action Plan (RAP) Validation of Declaration Area, Block 4 (Stage 1B) Development Works and Stage 1B Waterfront Public Domain* (AECOM, 2013b). The RAP sets out the planned remediation works (the “VMP Remediation Works”) associated with Remediation Site (No. 21122) declared by the New South Wales Environment Protection Authority (NSW EPA) (‘the Site’), as well as development remediation works at Block 4.

This RAP Addendum documents how the contamination within the former tar tank, that straddles the boundary between Hickson Rd and 36 Hickson Rd, will be addressed.

A location plan showing the area declared a Remediation Site (No. 21122) (referred to as the Declaration Area) is presented in *Figure 1 of Annex A*. The tar tank and other off-site structures are shown on *Figure 2, Annex A*.

1.1

BACKGROUND

The Declaration Area is approximately 2.1 hectares in area and includes land that has been contaminated primarily as a result of the former gasworks operations, and includes separate phase tars. The Declaration Area is located on parts of the Barangaroo development site, and on part of the existing Hickson Road.

Some of the former gasworks infrastructure extends off-site to the East of the Declaration Area at the Hickson Road reserve, into the adjacent commercial properties at 30 and 36 Hickson Road. This includes part of the annulus of the former main gasholder and part of a tar tank beneath 36 Hickson Road and possibly a portion of a smaller secondary gasholder beneath 30 Hickson Road (see *Figures 1 and 2, Annex A*).

Both the RAP (AECOM 2013b) and the Remediation Extent report (AECOM 2013a) acknowledge that Separate Phase Gas Works and Tar (SPGWT) associated with these structures is potentially present in the area directly east of the Declaration Area. Remediation of this off-site area was not recommended in the Remediation Extent report, and the RAP put forward the use of management measures (i.e. engineering controls) to mitigate the risk of the remediated Declaration Area being re-contaminated from potential off-site sources. The RAP stated (AECOM, 2013b, Section 8.5.5) that this may involve construction of localised cut off walls on the eastern Declaration Area boundary in the areas adjacent to the eastern portion of the main gasholder annulus and the tar tank (if required).

Following review of the anticipated off-site extent of the Tar Tank structure, the approach proposed in the RAP for addressing the adjacent off-site impacts associated with the tar tank was re-considered and an alternative approach is now planned for the portion of the tar tank that extends onto 36 Hickson Rd.

1.2

OBJECTIVES

The purpose of this RAP Addendum is to outline how contamination present within the tar tank off-site to the east of the Declaration Area will be addressed where this is different to the approach specified in the RAP (AECOM 2013b).

2.1 CONTEXT

2.1.1 Summary of Off-Site Structures

The remnant gas holder annuli and tar tank infrastructure are understood to comprise of excavations cut into the underlying bedrock. Specific details for each of the structures that extend off-site are as follows:

Tar Tank

The majority of the tar tank is located beneath Hickson Rd; however a small section extends (by an estimated 2 m) off-site beneath the 36 Hickson Rd property.

The tar tank is considered to be a main source of contamination, with environmental investigations and the in-situ remediation pilot trial confirming the tar tank comprises of mixed fill and tar waste, including DNAPL (dense non-aqueous phase liquids) and extends to approximately 5.5 m below the ground surface (EPS, 2016).

Small Gasholder

Any of the small gasholder related impacts that previously extended beyond the site boundary are expected to have been removed during the excavation prior to basement construction at 30 Hickson Rd. This is evident in the aerial photograph of the excavation presented within the *Stage 1B Geotechnical Investigation and Testing Revision 1* report (Coffey, 2014).

Main Gasholder Annulus

A large portion of the off-site portion of the main gasholder annulus was remediated in 2003 prior to the construction of 'The Bond' building, which occupies the 30 Hickson Rd property. The annulus is approximately 1.5 m wide and extends to approximately 9 metres below the ground surface. The material encountered in the annulus was described as mixed fill containing soil, sandstone cobbles and concrete fragments. Below approximately -3.4 m AHD (approximately 6 m below the ground surface), the material was saturated with tar impacted water and free tar. Below approximately -5.3 m AHD (approximately 8 m below the ground surface) the fill was observed to contain solid tar (Coffey, 2014).

While impacts from the portion of the main gasholder annulus beneath the 'Bond' building at 30 Hickson Road were removed in 2003 (Coffey, 2014), it is understood that impacts remain within the south eastern portion of the Main Gasholder annulus beneath the 36 Hickson Road property (AECOM, 2013b; URS, 2003).

The Remediation Extent report (AECOM, 2013a) notes that previous investigation, remediation and construction works have been undertaken at 30-34 and 36 Hickson Rd and Site Audit Statements were prepared confirming the sites are suitable for their current land use.

2.1.2 *The In-Situ Pilot Trial & the Revised Hickson Rd Remediation Approach*

The RAP put forward the following preferred remediation options for Block 5 VMP Remediation Works and Hickson Rd (within the Declaration Area) VMP Remediation Works:

Option 1 - completion of a Surfactant enhanced In Situ Chemical Oxidation (S-ISCO®) and Surfactant Enhanced Product Recovery (SEPR™) Pilot Trial and, if successful, full scale remediation using S-ISCO® and SEPR™; and

Option 2 - if the pilot trial is unsuccessful, excavation of required contaminated materials followed by on-site treatment (where required) and off-site landfill disposal.

The in-situ remediation pilot trial (which involved SEPR only) was completed between November 2015 and July 2016 and was conducted in an area of Hickson Road which was the former location of the gasworks tar tank. Following completion of the Pilot Trial, a Remedial Works Plan (RWP) (ERM, 2017) was prepared for the Hickson Road VMP Remediation Works. The RWP defined the revised remediation approach for Hickson Rd to be Option 2, supplemented where necessary by potential localised in-situ immobilisation via jet grouting techniques in selected areas.

2.1.3 *Implications of the Revised Hickson Rd Remediation Approach*

The revised Hickson Rd remediation approach includes excavations and/or jet grout immobilisation up to the eastern site boundary. This changes the feasibility for remediation works to extend off-site at the tar tank and remove some contaminant mass that is present to the east of the site, in lieu of engineering controls (per the RAP) at this location.

2.2 *REMEDIATION APPROACH FOR OFF-SITE STRUCTURES*

2.2.1 *Tar Tank*

Following review of the off-site extent of the Tar Tank structure, it is now considered feasible and practicable to excavate the material within the portion of the tar tank that extends off-site (on 36 Hickson Rd). The remediation of this limited off-site material is proposed to remove the need for engineering controls at this part of the boundary (as proposed in the RAP), to mitigate potential future impacts to the Hickson Rd Site if this part of the Tar Tank was to remain.

2.2.2 *Main Gasholder Annulus*

Given the depth of the remaining off-site impacts and that remediation of the off-site portion of the main gasholder annulus is not required, the placement of engineering controls (such as a cut-off wall) where the annulus intersects the site boundary is still the preferred approach. At the time this RAP Addendum was prepared, details relating to the proposed engineering control were not finalised, so will be included in a separate document.

2.2.3 *Small Gasholder*

The excavation at 30 Hickson Rd extended to the Site boundary, so no off-site remediation or management is required.

2.3 *OFF-SITE TAR TANK REMEDIATION CRITERIA AND STANDARD OF OFF-SITE REMEDIATION*

Where excavation is proposed to extend off-site (i.e. the eastern portion of the tar tank), similar criteria and factors determining the standard and extent of remediation for the Declaration Area are considered appropriate. These are provided in the Remediation Extent report (AECOM, 2013b) and the RAP (AECOM, 2013a) and are summarised below:

The standard of remediation should equal the higher of:

- Removal of SPGWT to the extent practicable; and
- Removal/remediation of soil and groundwater concentrations present within fill material in the tar tank exceeding the relevant SSTC^{VMP}, to the extent practicable.

SPGWT is defined in the RAP as:

- tar containing materials (TCM), defined for this work as:
 - greater than 10% visible coal tar (where coal tar is a phase separated hydrocarbon by-product from coal gasification); and/or
 - contaminant concentrations exceeding the following limits:
 - polycyclic aromatic hydrocarbons (PAHs) - 2 000 mg/kg; or
 - benzo(a)pyrene (B(a)P) - 150 mg/kg; and
- Dense Non Aqueous Phase Liquids (DNAPL).

The vertical extent of remediation is broadly defined as the depth of the underlying bedrock. The lateral extent of excavation will be limited to the extent of the former Tar Tank structure only.

Excavation within the off-site tar tank area is therefore proposed to be conducted to bedrock and the excavated material will be removed from site for treatment/disposal (subject to landowners consent and planning approval).

3.1***APPROVALS***

36 Hickson Rd is owned by a third party. The proposed remediation approach for the off-site portion of the tar tank (located on 36 Hickson Rd) is therefore subject to landowner consent as well as consent from the relevant planning authorities.

The Environmental Protection Licence (EPL) (13336) may require a variation to include the off-site tar tank remediation. The majority of other project approvals will be undertaken as part of the Hickson Rd remediation.

3.2***SITE FACILITIES AND PROCEDURES***

The same site facilities and procedures should be used during the off-site remediation at the tar tank as for the Hickson Rd remediation works. The required facilities and procedures for the Hickson Rd remediation are presented in the RAP (AECOM, 2013a) and are not repeated in this document.

3.3***GENERAL REMEDIATION EXCAVATION AND MATERIALS MANAGEMENT***

The same general remediation excavation and materials management should be used during the off-site remediation at the tar tank as for the Hickson Rd remediation works. The required facilities and procedures for the Hickson Rd remediation are presented in the RAP (AECOM, 2013a) and in the Hickson Rd Remedial Works Plan (ERM, 2016) and are not repeated in this document.

As stated in the Hickson Rd Remedial Works Plan (ERM, 2017), validation of off-site areas outside the Declaration Area Boundary is not required.

To provide a good record of the works undertaken, it is proposed that for the portion of the tar tank that extends into 36 Hickson Rd, validation should be conducted as per the requirements of the Hickson Rd Remedial Works Plan (ERM, 2017) and the VMP VSMP (ERM, 2016). This is summarised as follows:

Validation of excavation batter wall if in fill or natural marine sediments - Visual inspection of excavation batter wall for evidence of potential SPGWT. Where observations of potential SPGWT are made, collection of validation samples is required at a frequency of 1:20 m grid for assessment against SPGWT criteria (saturated) and soil SSTC^{VMP} (unsaturated soils).

Validation of excavation wall and base if in rock - Visual inspection for the presence of SPGWT.

If jet grout columns are required to be installed to support the excavation, validation will comprise of visual inspection after bulk excavation (to demonstrate that the jet grout wall reaches bedrock and no significant seepage is present).

The mass removed from the off-site portion of the tar tank should not be included in the Declaration Area Mass removal calculation.

The following potential issues have been identified to have the potential to arise during remediation of the off-site portion of the tar tank:

Excavation Access Issues (Presence of Services or Other Structures):

If the presence of services or other underground structures prevent part of the off-site tar tank area being excavated, then, similar to the approach taken for the Hickson Rd remediation, jet grout immobilisation should be considered. Jet grout immobilisation is outlined in further detail in the Hickson Rd Remedial Work Plan (ERM, 2017).

Failure of Validation Criteria:

As noted in *Section 4* above, validation of the off-site areas, outside the Declaration Area boundary, are not required and the validation criteria are therefore not applicable. The purpose of validation is primarily to provide a record of works undertaken.

In relation to the Declaration Area boundary, the excavation of the tar tank, off-site beneath 36 Hickson Rd, satisfies the requirements of Sections 19.5.1 and 19.5.2 of the RAP (AECOM, 2013b) to over-excavate SPGWT in fill, if encountered during validation of remedial excavations.

If there is visual evidence of SPGWT in rock, engineering mitigation measures to prevent ingress of SPGWT to the excavation and towards the Declaration Area boundary may include:

- local over excavation of bedrock to remove SPGWT;
- grouting of the rock defect to seal the SPGWT within the rock matrix; or
- shotcreting (200mm thick) of the rock surface to seal SPGWT within the rock matrix.

Many other potential unexpected issues are identified in *Section 23* of the RAP (AECOM, 2013a) and are not repeated herein.

Following review of the off-site extent of the Tar Tank structure, it is now considered feasible and practicable to excavate the material within the portion of the tar tank that extends off-site (on 36 Hickson Rd). The remediation of this limited off-site material is proposed to remove the need for engineering controls at the boundary (as proposed in the RAP), to mitigate potential future impacts to the Hickson Rd Site if this part of the Tar Tank was to remain, and mitigate potential future long-term management in this area.

The proposed off-site excavation at the tar tank will be subject to landowner consent as well as consent from the relevant planning authorities and if granted will proceed in accordance with the processes and procedures required for the rest of the Hickson Rd remediation as presented in the RAP (AECOM, 2013a).

Validation of off-site areas outside the Declaration Area Boundary is not required, however it is proposed that for the portion of the tar tank that extends into 36 Hickson Rd, validation should be conducted as per the requirements of the Hickson Rd Remedial Works Plan (ERM, 2017) and the VMP VSMP (ERM, 2016). The purpose of validation in this area will primarily be to provide a good record of the works undertaken, and addressing failure of validation criteria will be optional.

Placement of engineering controls at the site boundary (such as a cut-off wall) is still the preferred approach for the main gasholder annulus. Details are not yet available, and will be provided in a separate document.

AECOM (2013a) *VMP Remediation Extent, VMP Remediation Works Area, (Parts of Barangaroo and Hickson Road), Millers Point, NSW.*

AECOM (2013b) *Remedial Action Plan, NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW.*

AECOM (2015) *Addendum to the RAP, NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW – Offsite Treatment/Transport of Contaminated Material*

Barangaroo Delivery Authority (BDA) (2016) *Management Order 20151402 & the Hickson Road Pilot Trial.* Dated 15 September 2016.

Coffey (2014) *Barangaroo South Stage 1B Geological Investigation and Testing.* Rev 1. 2 June 2014

Coffey (2016b) *Localised Jet Grouting at the Western Boundary of Hickson Road (including within the Western Gasholder) as part of Ex-Situ Remediation.* Dated 7th November 2016.

Enviropacific Services (EPS) (2016) *Stage 2A Pilot Trial Completion Report, Former Millers Point Gasworks Site, Hickson Road Declaration Area, Barangaroo South Precinct*

ERM (2016a) *Validation and Sampling Management Plan, VMP Remediation Works and NSW EPA Declaration Area 21122.* Dated September 2016

ERM (2016b) *Barangaroo VMP Remediation Works and NSW EPA Declaration Area 21122 Groundwater Monitoring Requirements.*

ERM (2017) *Hickson Road VMP Remediation – Remedial Works Plan.* Dated March 2017

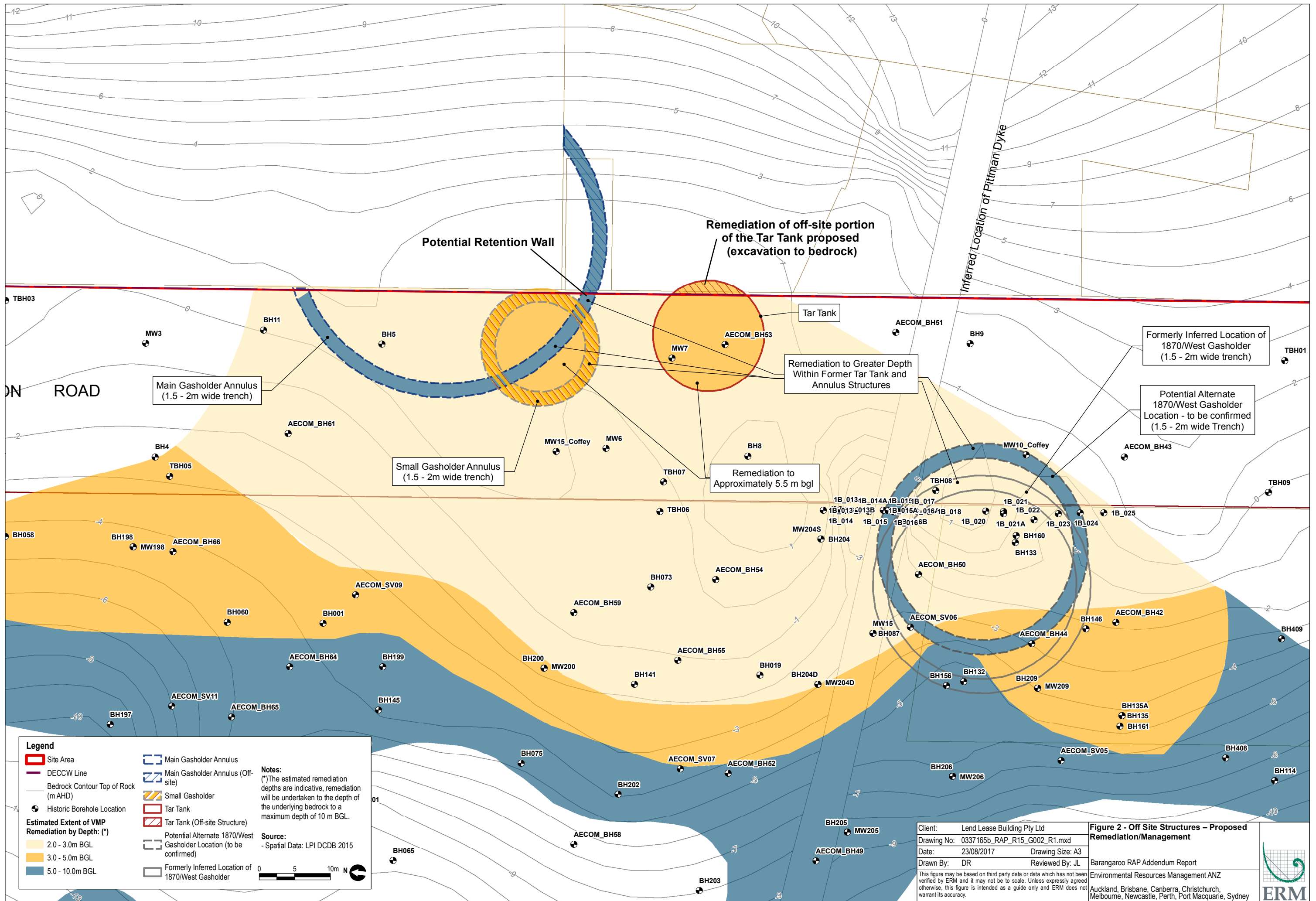
NSW Environmental Protection Authority (2015) *Management Order.* Order Number 20151402; Declaration Number 21122; Area Number 3221. Dated 16 December 2015 and amended 4 February 2016.

URS (2003) *Remediation Validation Report 36 Hickson Road, Millers Point, NSW.*

Annex A

Figures





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Environmental Resources Management

Level 15 309 Kent Street
Sydney NSW 2000
Locked Bag3012,
Australia Square NSW 1215

T: 61 2 8584 8888
F: 61 2 8584 8800
www.erm.com

