



## ENVIRONMENTAL ASSESSMENT

Remediation of Macdonaldtown Gasworks Site

**MP 09-0145**

Prepared for  
**Savills Project Management Pty Ltd c/o RailCorp**

March 2012



**CERTIFICATION**

I hereby certify that the information contained in this Environmental Assessment is neither false nor misleading.



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# Abbreviations

ABBREVIATION	DESCRIPTION
AQMP	Air Quality Management Plan
B(a)P	Benzo (a) pyrene
BTEX	Benzene, Toluene, Ethyl Benzene and Xylene
CEMP	Construction Environmental Management Plan
CLM Act	<i>Contaminated Land Management Act 1997</i>
DECCW	Department of Environment, Climate Change and Water (now OEH)
DGRs	Director-General's Requirements
DNAPL	Dense-nonaqueous-phase-liquid
DPI	Department of Planning and Infrastructure (formerly DoP)
DoP	Department of Planning (now DPI)
EA	Environmental Assessment
EMP	Environmental Management Plan
EP&A	<i>Environmental Planning and Assessment Act 1979</i>
GAC	Granular activated carbon
LNAPL	Light-nonaqueous-phase-liquids
LPG	Liquid Petroleum Gas
MNA	Monitored Natural Attenuation
MPa	Megapascal
OEH	Office of Environment and Heritage (formerly DECCW)
OHS Act	<i>Occupational Health and Safety Act 2000</i>
OU	Odour Unit
PAH	Polycyclic Aromatic Hydrocarbons
PHA	Preliminary Hazard Analysis
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
PSNL	Project Specific Noise Levels
RailCorp	Rail Corporation New South Wales
RAP	Remedial Action Plan (Appendix A - CH2M Hill 2007b)
RTA	Roads and Traffic Authority
RWVP	Remediation Works and Validation Plan
SAS	Site Audit Statement

SEPP 33	<i>State Environmental Planning Policy No 33 – Hazardous and Offensive Development</i>
SEPP 55	<i>State Environmental Planning Policy No 55 – Remediation of Land</i>
SRoH	Significant risk of harm
TPH	Total Petroleum Hydrocarbon
TSC Act	<i>Threatened Species Conservation Act 1995</i>
UCS	Unconfined Compressive Strength measured by NSW RTA Test Method T131
VMP	Voluntary Management Proposal (under <i>Contaminated Land Management Act 1997</i> )
WTS	Water Treatment System

# Executive Summary

This Environmental Assessment (EA) provides details of proposed works for the remediation of the former Macdonaldtown Gasworks site, located within RailCorp lands at Macdonaldtown, and for the option of transporting contaminated material for treatment to RailCorp land within the Chullora Railway Workshops and Yards.

This remediation project is being assessed against the Director General Environmental Assessment Requirements by the NSW Department of Planning as a major project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The proposal involves the excavation, treatment, reuse and/or disposal of approximately 23,000 m<sup>3</sup> of various materials, including soil, fill, clay, gravel sand, tar sludge and demolition wastes that will be remediated. Also included in the remediation process is impacted water, tar and scrap metal within pipework beneath the ground surface (JBS 2011e).

A Remedial Action Plan (RAP) is provided as part of the assessment, as well as a Remedial Strategy (JBS 2011e) which further refines the treatment options and works proposed. Both documents have been reviewed and endorsed by accredited Site Auditors in line with the requirements of the *Contaminated Land Management Act 1997*.

Remediation treatment options which are identified and assessed in this EA are:

- Off-site disposal
- Stabilisation / Immobilisation
- Bioremediation
- Containment and capping

Residential dwellings are in close proximity to the Macdonaldtown site, and space is limited. Consequently, this proposal also assesses a proposed alternative (optional) site for treatment of contaminated materials, namely the Chullora Railway Workshops and Yards. The Chullora site allows for more flexibility in the remediation treatment process.

This EA addresses key environmental issues associated with the remediation works. These include transport and traffic flow, managing surface water, archival recording and heritage interpretation, ensuring stability of structures, consideration of visual amenity and environmental emissions including managing air, noise and vibration. These key risks will be controlled in accordance with the commitments in this environmental assessment, and managed through an Environmental Management Plan (EMP, JBS 2011f).

The proposed control measures in the EMP facilitate compliance with relevant legislation as well as detail practical measures to eliminate or minimise the likelihood of identified impacts to the environment and community. These controls are based on the technical studies that have been prepared for this EA. Once appointed by RailCorp, a remediation contractor will be required to implement the documented EMP controls into a detailed Construction Environmental Management Plan (CEMP).

The assessment of the overall impacts of the proposed remediation contained in this report concludes that those impacts are acceptable and reasonable, subject to the measures outlined in the Statement of Commitments section of this EA.

The Project Application would result in remediation of the site so that it is no longer considered to pose a significant risk of harm to human health and the environment. No change to site usage or zoning is proposed, and it is anticipated that the site will continue to be used for rail infrastructure storage purposes. The project is justified on economic, social and environmental grounds, and consistent with the objects of the EP&A Act, and therefore the granting of project approval under Section 75E of the EP&A Act is recommended.

# 1 Introduction

This Environmental Assessment (EA) is for remediation of the former Macdonaldtown Gasworks site. To allow flexibility in the remediation process, the option of transporting contaminated material to RailCorp land within the Chullora Railway Workshops and Yards for temporary treatment, may be utilised. This EA identifies the range of remediation options being considered, and their relationship to both the Macdonaldtown and Chullora sites.

Advice has been received from the Director General of the NSW Department of Planning that the proposal is development of a kind described in Schedule 3, Part 5, Clause 5 of the *State Environmental Planning Policy (Major Projects) 2005* and is a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) applies. In accordance with this advice, this report contains the EA addressing the Director General's Environmental Assessment Requirements (see Section 4). This project application is made under the provisions of Section 75E of the EP&A Act.

The project application under the EP&A Act relates to part Lot 50 in Deposited Plan (DP) 1001 467 in Burren Street, Erskineville (hereafter referred to as the Macdonaldtown site) and part Lot 1 in DP 883 526 in Worth Street, Chullora (hereafter referred to as the Chullora site). The project application reference number is: 09\_0145.

## 1.1 BRIEF SITE HISTORY

The Macdonaldtown site operated as a gasworks plant between 1892 and 1958. During this time, gas was produced from coal and shale. The gasworks ceased production in the 1950s, and in 1958 the majority of the aboveground infrastructure was demolished. Storage of gas piped from the railway gasworks at the Mortlake Central Distribution Plant continued until the 1970s. Remnants of the southernmost gas holder are still extant today and are listed on the State Heritage Register.

## 1.2 CURRENT SITE STATUS

The operation of the gasworks has generated contamination, in particular coal tars from the production of coal gas, which have impacted the soils and groundwater of the site. The contaminants present in varying degrees are:

- monocyclic aromatic hydrocarbons (MAH), which include benzene, toluene, ethylbenzene & xylenes (BTEX);
- polycyclic aromatic hydrocarbons (PAH);
- nonhalogenated phenolic compounds;
- heavy metals (in localised fill materials); and
- asbestos (in localised fill materials).



The site also contains fill materials including bricks, metal pipes, tiles, and fibro-cement sheeting. Asbestos impacted demolition wastes are also present in some areas.

Contamination sources, particularly coal tars, have significantly impacted the soils and groundwater to a degree that they are considered by the NSW OEH to pose a significant risk of harm to human health and the environment (EPA letter, 14<sup>th</sup> August 2000, Appendix A). Contaminated areas include the Tar Wells, underground pipework, and the below ground remnants of the Northern Gasholder. The contaminants that were considered to drive the health risks were benzene and Benzo (a) pyrene, and these were considered to have a direct relationship to the tar source material and the ash/coke surface fill.

### 1.3 PROPOSED WORKS

The proposal involves the excavation, treatment and disposal of contaminated soils located at the Macdonaldtown site, to an extent that the site is no longer considered to pose a significant risk of harm to human health and the environment.

The proposed works will involve remediation of approximately 23,000 m<sup>3</sup> of various materials, including soil, fill, clay, gravel sand, tar sludge and demolition wastes (JBS 2011e). An unknown quantity of impacted water, scrap metal, and tar within pipework beneath the ground surface is also proposed to be remediated (JBS 2011e).

### 1.4 EA STRUCTURE

This report is divided into nine (9) sections, namely:

**Section 2** describing the site characteristics;

**Section 3** providing a detailed description of the remediation works and options;

**Section 4** detailing the Director General's Environmental Assessment Requirements;

**Section 5** outlining the statutory planning considerations for the remediation project;

**Section 6** considering the results of numerous technical studies (contained in the Appendices) for the predicted environmental impacts associated with the proposed remediation works and how these will be managed;

**Section 7** summarising the consultation that has occurred with the local community and liaison with state agencies in preparing this project application;

**Section 8** detailing the RailCorp commitments in undertaking the proposed remedial actions; and

**Section 9** providing a conclusion to this EA.

A stylised diagram representing the role of reports referenced in the document is outlined in Figure 1.

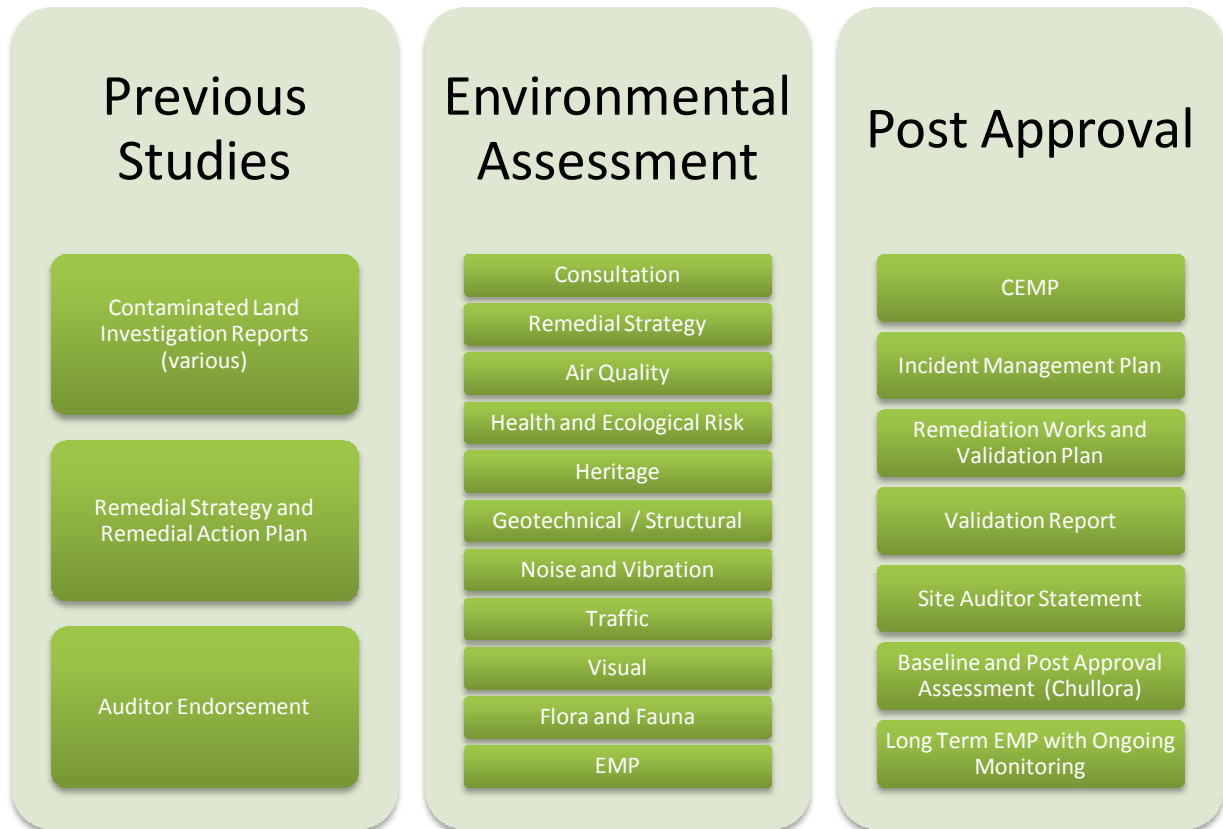


Figure 1: Reports related to the Project

## 2 Site Description

### 2.1 MACDONALDTOWN SITE

#### 2.1.1 The Macdonaldtown Locality

The Macdonaldtown site is a small triangular shaped land parcel covering 7,732 m<sup>2</sup>, bounded to the southeast by the Illawarra Rail Corridor, to the west by residential properties fronting Burren Street, Erskineville, and to the north by RailCorp land, which is used for train stabling. Macdonaldtown railway station is situated to the north of the site beyond the stabling yard (Figure 2). Details of the site are summarised in Table 1 below.



Figure 2: Macdonaldtown Site Location



**Table 1: Macdonaldtown Site Details**

DETAIL	MACDONALDTOWN
Street Address	Burren Street, Erskineville NSW 2043
Lot and DP Number	Part Lot 50 in DP1001467
Geographical Coordinates	624700N; 343200E
Owner	Rail Corporation NSW
Current/Proposed Land Use	Vacant / Commercial-Industrial (for rail-related operations)
Local Government Area	City of Sydney
Parish/ County	Petersham - Cumberland

### 2.1.2 Macdonaldtown Site Photographs

**Photograph 1:** View of site, looking west.**Photograph 2:** View of site, looking east.**Photograph 3:** View of site, looking north to adjacent stabling yards.**Photograph 4:** Proposed access road along southern site boundary, adjacent railway lines.

### 2.1.3 Macdonaldtown Site History

The Macdonaldtown site operated as a gasworks plant between 1892 and 1958. A history of the Eveleigh Gasworks is provided as Appendix P (Rail Services Australia, 1999). The Eveleigh Gasworks (now referred to as the Macdonaldtown Gasworks) was completed in 1892 and consisted of two

separate but parallel works, with one producing gas from coal for lighting nearby stations and signals, and the other producing a richer gas from shale for carriage lighting. During this time gas was produced from coal and shale. Due to the use of inferior coal in the 1950s the plant was damaged and subsequently ceased the manufacturing of gas. The plant was demolished (other than the southern gasholder) in 1958. The Southern Gasholder appears to have been in use for gas storage up until the 1970s. After that, the site has been largely unused and vacant, other than for the occasional storage of railway equipment. An above-ground gasholder structure (southern gasholder) is the most prominent relic that remains extant from previous operations as a gasworks site. The remainder of the site has little infrastructure or vegetation, other than some trees along the western boundary between the gasholder and the residential dwellings, and planted trees along the northern boundary.

#### 2.1.4 Description of the Existing Environment

A series of environmental investigations have been performed on the site to detail the nature and extent of contamination resulting from historical gasworks operations including:

- Significant Risk of Harm Declaration (NSW EPA 2000) Appendix A;
- Phase I and Phase II Contamination Assessments (CH2M Hill 2001) Appendix B;
- Delineation and Classification Sampling (GHD 2005) Appendix C;
- Human Health & Ecological Risk Assessment Vol 1 & 2 (SKM 2006) Appendix D;
- Delineation & Characterisation Sampling and Review of Remedial Options (CH2M Hill 2007a) Appendix E;
- Remedial Action Plan (CH2M Hill 2007b) Appendix F;
- Site Audit Report – Delineation and Characterisation Sampling and Review of Remedial Options (HLA-Envirosciences Pty Ltd 2007) Appendix G;
- Site Audit Report - Remedial Action Plan (ENSR Australia 2008) Appendix H;
- Remedial Strategy (JBS 2011e) Appendix I; and
- Interim Audit Advice (GHD 2011) Appendix J.

For the purposes of remediation the Macdonaldtown site has been divided into eight (8) separate areas, which are illustrated in Figure 3 and include:

- Western Lot – To the north of the residential properties;
- Retaining Wall – Contains retaining wall with stabling yards on higher level to the north. Planted trees of small size (9 – 12 m) are along the northern (higher) side of the retaining wall;
- Gas Holders – Northern Gas Holder was present in this portion of the site. Free tar is present within soils. On the western side it drops steeply (~4m) to the adjoining residential properties. Some planted trees, mainly along the boundary with residential properties;



Source: CH2M Hill 2007b

- South West - On the western side it drops steeply (~4m) to the adjoining residential properties. Rail corridor to the south, and noise wall along the southern boundary of this area;
- Gas Purifiers – Relatively level due to fill and levelling after decommission of the Gasworks. Free tar is present within soils;
- South Central – Contamination hotspot present. Rail corridor to the south, and noise wall along the southern boundary of this area;
- Retort – Area where Retort House once stood (now demolished). Relatively level due to fill and levelling after decommission of the Gasworks. Tar impacted soil present; and
- North West - Relatively level due to fill and levelling after decommission of the Gasworks. Two contamination hotspots present.

Much of the site surface is compacted gravel with patches of grasses and weeds. The underlying geological formation is Wianamatta Group Ashfield Shale comprising black to dark-grey shale and laminate, with some natural soils and fill material present (CH2M Hill 2007b, JBS 2011e).

Scattered trees border portions of the western and northern boundaries. A retaining wall exists along the northern boundary adjacent to the Macdonaldtown stabling facility. The site has a gentle slope to the southeast, except for the western boundary where a steep embankment drops around 4m towards the ground level of adjacent residential dwellings.

Most above-ground structures have been demolished other than the framework of the previous southern gasholder that stands approximately 12 m high adjacent to the western boundary. This gasholder is listed on the State Heritage Register. The northern gasholder and other structures, including the Retort House, Administration Buildings, Tar Wells, Condensers and Coal & Shale Storage, are no longer visible above the surface, but have underground structures remaining in some locations.

Both fill (comprising ash and coke gravel, rubble, sand, gravel and some reworked clays) and natural soils on the site have been impacted by tar associated with the Gasworks. The contaminants that were considered to drive the health risks were benzene and Benzo (a) pyrene, and these were considered to have a direct relationship to the tar source material and the ash/coke surface fill.

The volume of impacted material and the preferred approach to site remediation are identified in the Remedial Action Plan (CH2M Hill 2007b, Appendix F), and summarised in the Remedial Strategy (JBS 2010) as presented in Table 2 overleaf. These areas correspond to the areas indicated in Figure 4, and Figure 7 - Figure 9 illustrate the contaminated areas in depths of 0 - 2m, 2 – 4m, and >4m..

Groundwater at the Macdonaldtown site was described in the Remedial Strategy (JBS 2011e) and in the CH2M Hill Remedial Action Plan (RAP, 2007b) as a shallow perched groundwater layer and a deep bedrock layer. The groundwater flow direction is toward the south/southeast with flows influenced by underground structures (including the gasholders annuli and underground waste pits and services) with the possibility of some interconnectivity between the shallow and deep groundwater systems.

The shallow plume appears to begin near the northern boundary of the Former Cleaning Shed and Gasworks areas and extends in a south-west direction for some 75m. The data indicate that the down-gradient edge of the plume is located at the East Hills Line - at the southern edge of the site boundary. The lateral extent of the plume appears to be confined in the west to the rear boundary of the residential properties, while to the east, the plume is estimated to extend 50m to the east of the former gasworks area (CH2M Hill 2007b).

Table 2: Summary of impacted areas and RAP preferred remedial approach (JBS 2011e)

Remediation Area	Impacted Area	Estimated Volume (m <sup>3</sup> )	Description	RAP Preferred Remedial Approach
Tar wells	Base annulus and immediate area	1000	Soil / fill impacted by free tar	Stabilisation for off-site disposal
	Tar well contents	100	Tar sludge	Off-site disposal as liquid waste with pre-treatment as required to improve handling
Northern gasholder	Base annulus and immediate area	2100	Soil / fill impacted by free tar	Stabilisation for off-site disposal to landfill, with pretreatment as required to improve handling
	Gasholder contents	640	Impacted water	Off-site disposal as liquid waste
		320	Tar sludge	Off-site disposal as liquid waste with pre-treatment as required to improve handling
	Buried wastes inside annulus	1900	Demolition materials	Off-site disposal as 'Asbestos/Industrial' <sup>1</sup> (i.e. with pre-treatment to remove free tar or oversize component)
Former gasworks area	Shallow fill / soils	9225	Tarry soils – fill and natural clays	Stabilisation for off-site disposal to landfill, with pretreatment as required to improve handling
	Deeper soils	2375	Tarry soils – natural clays and weathered shales	Stabilisation for off-site disposal to landfill, with pretreatment as required to improve handling
	TP16 Hotspot	115	Tarry soils – fill and natural clays	Stabilisation for off-site disposal to landfill, with pretreatment as required to improve handling
Site surfaces		2950	Ash and coke gravels	Off-site disposal to landfill
Retaining wall		1765	Gravel sand and demolition wastes	Off-site disposal to landfill. With processing (i.e. segregating oversized component) recycling or beneficial reuse may also be an option
Hotspots	BH14	100	Fill and natural clays	Off-site disposal to landfill
	MW13s	140	Fill	Off-site disposal to landfill
	MW04s	100	Fill and natural clays	Off-site disposal to landfill
Pipework	Varying across site	Unknown	Tar / scrap metal	Treatment to remove tar from pipework. Tar to be disposed to landfill, scrap metal possibly disposed to landfill as demolition waste



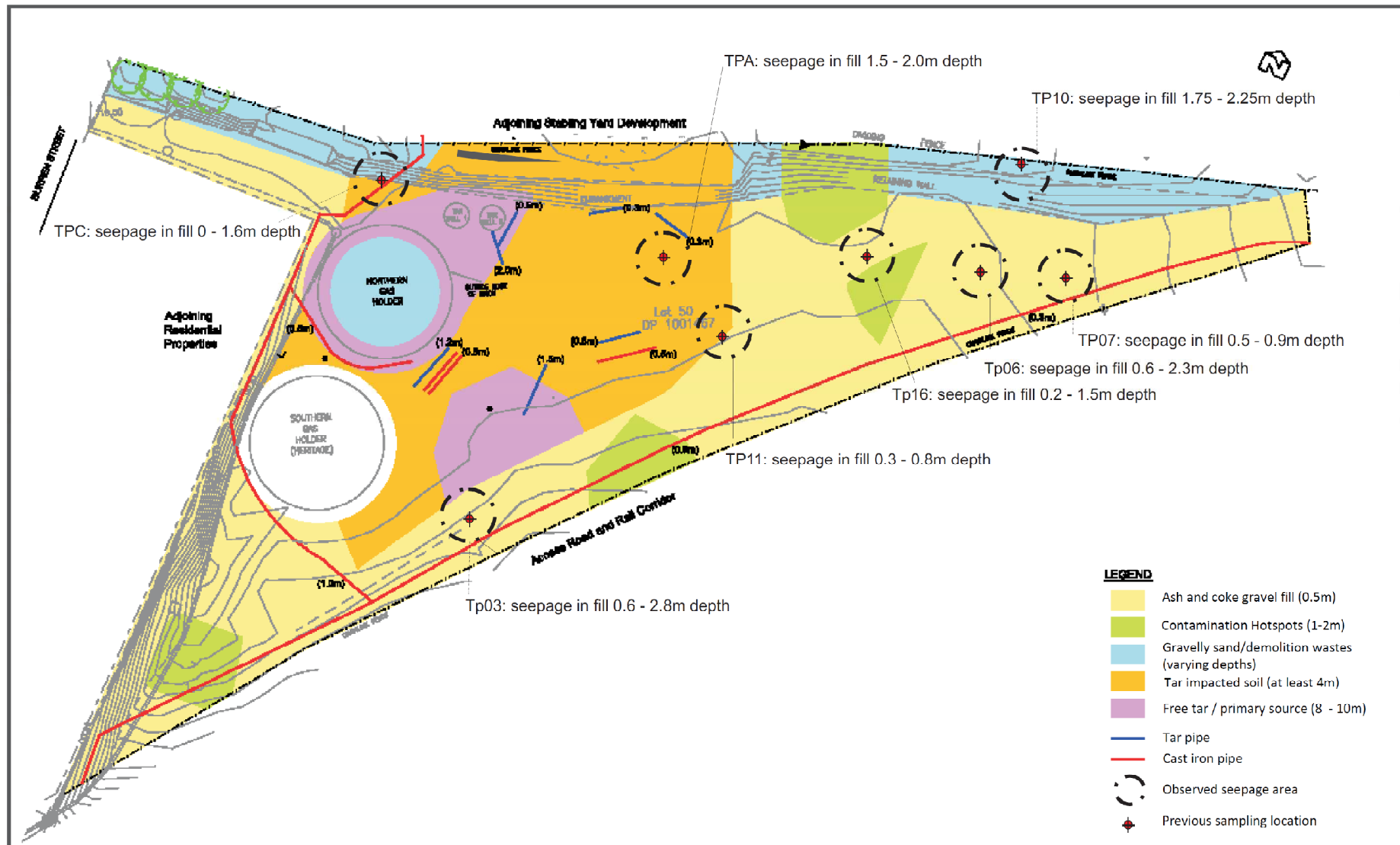


Figure 4: Areas of proposed Remediation.

The extent of the middle to heavy-end hydrocarbon plume in the deeper aquifer appears to be larger than the shallow aquifer. While the northern, eastern and western boundaries of the plume are similar to the shallow plume, the down-gradient extent of the plume appears to cover a distance of some 160m from the former gasworks area, with its edge near the southern boundary of railway land along Railway Parade. The data indicates that the deep aquifer plume is located entirely on RailCorp owned lands (CH2M Hill 2007b).

Table 3 summarises the range of contaminant concentrations detected in groundwater sampled from Macdonaldtown. The majority of groundwater generated from remedial works at the site is likely to be derived from the fill layers, where contaminant concentrations were generally less than those detected in samples of groundwater collected from the underlying natural shale.

**Table 3: Summary of Groundwater values (from JBS 2011e)**

Analyte	Criteria	Shallow Groundwater Concentrations			Deep Groundwater Concentrations		
	ANZECC 2000	Range (µg/L)	Location of Maximum	Site Area	Range (µg/L)	Location of Maximum	Site Area
Electrical Conductivity	200-300 <sup>1</sup> (µS/cm)	442 - 2010 (µS/cm)	MW35S	Central northern	717 - 3820 (µS/cm)	MW03D	Central Southern
Cd	0.2	nd - 2.6	MW13s	Southwest	nd - 1.5	MW06d	Gasholders
Cr(total)	-	nd - 15	MW04s	South Central	nd - 7	MW04d	South Central
Cu	1.4	nd - 220	MW42s	Northeast	0.001 - 208	MW42d	Northeast
Pb	3.4	nd - 174	MW42s		nd - 140	MW03d	South Central
Ni	11	nd - 10	MW04s	South Central	nd - 92	MW36d	Offsite
Zn	8	0.033 - 1,570	MW13s	Southwest	0.015 - 869	MW42d	Northeast
Cyanide (total)	7	0.02 - 0.479	MW20s	Gasholders	nd - 14.9	MW03d	South Central
Benzene	950	nd - 704	MW07s		nd - 14,000	MW03d	
Toluene	-	nd - 117	MW07s		nd - 792	MW03d	
Ethylbenzene	-	nd - 213	MW07s		nd - 317	MW03d	
Total Xylenes	550 (o & p)	nd - 417	MW07s		nd - 5,010	MW03d	Gasholders
Total PAHs	16 (naphthalene)	nd - 1,677 (naphthalene 1,460)	MW07s		nd - 4,208 (naphthalene 3,840)	MW07d	

Note: 1 typical range of EC in NSW lowland rivers as provided in ANZECC 2000 Table 3.3.3

The site is currently accessible via a sealed road through the Macdonaldtown Stabling Yard to Burren Street, and via a sealed service road along the western side of the Erskineville railway lines with an entrance on Swanson Street arterial road. Access during remediation works is proposed to be primarily via Swanson Street.

Land to the north and east of the site is used for rail infrastructure, including railway lines, train stabling and train washing. Land to the west is used for residential purposes. South of the site is the Erskineville rail line. All boundaries are secured via fencing, with double fences to Burren Street residences. A drain also exists between these fences and noise walls have been previously erected on the southern boundary of the site.

### 2.1.5 Current Dust / Particulate Levels

There are three OEH air monitoring stations available in proximity to the Macdonaldtown site to assist in

determining a typical background level of fine particulates (JBS 2011a). The monitoring sites are Randwick approximately 4km to the south-east, Earlwood approximately 8km to the south-west, and Rozelle approximately 4.5km to the north-west.

Levels of fine particulates, reported as PM<sub>10</sub>, from these locations are based on measurements using an oscillating microbalance and corrected to 0°C. The maximum 24h level of PM<sub>10</sub> recorded using the most recent available monitoring data was 70µg/m<sub>3</sub>, and monthly averages, approximately equivalent to the anticipated level of an annual average have been reported at 13 to 29µg/m<sub>3</sub> (JBS 2011a).

The Air Quality Study assumed that current coarse particulates would be 50% of the level of total particulates; that is estimated maximum 24h level of coarse particulates was 70µg/m<sub>3</sub>, and an estimated monthly averages of 13 to 29µg/m<sub>3</sub> (JBS 2011a).

### 2.1.6 Current Noise Levels

The background noise data was recorded from the western boundary of the Macdonaldtown site, and the day-time (7am-6pm) Rating Background Noise Level was 45 dB(A) L90 (Acoustic Logic 2012).

### 2.1.7 Macdonaldtown Remediation Strategy

Following the original investigations for contamination (CH2M Hill 2001 and GHD 2005) and the subsequent identification of the need to remediate (SKM 2006), a Remedial Action Plan (RAP) was prepared for the site and documented in *Remedial Action Plan, Former Macdonaldtown Gasworks, Burren Street, Erskineville* (CH2M Hill 2007). A Site Audit Report (SAR) was subsequently prepared on the RAP by ENSR AECOM and documented in *Site Audit Report on Remedial Action Plan, Former Macdonaldtown Gasworks Site, Burren Street, Erskineville, NSW*, (ENSR AECOM 2008), which concluded that, in the opinion of the appointed Site Auditor, “...the remediation approach presented in the RAP could be implemented ...in order for the site to be made suitable for the future use for rail-related activities”.

Additional investigations and refinement of the options for remediation by JBS Environmental Pty Ltd (JBS) has lead to a refined Remedial Strategy (JBS 2011e) which has also been endorsed by an Auditor (GHD) under the requirements of the CLM Act. The Remedial Strategy (JBS 2011e) forms the basis of the proposed works on site.

## 2.2 CHULLORA SITE

### 2.2.1 The Chullora Locality

The Chullora site is proposed as an optional, and temporary area to treat excavated contaminated material sourced from the Macdonaldtown site. This area may be required due to the limited space at Macdonaldtown, and is therefore assessed as part of this proposal. This site has been identified to allow flexibility in the remediation treatment process. The need for the use of this option will be determined by the remediation contractor.

To identify potential off-site treatment locations, RailCorp performed a review of its property portfolio to identify sites meeting the following criteria:

- Generally vacant (i.e. not leased and not permanently occupied)

- In the Sydney Metro area to reduce transport distances
- Relatively flat
- Greater than a few thousand square metres in area
- Of an industrial landuse, with minimal sensitive receptors

The review found that only the Chullora site met all of RailCorp's selection criteria.

The Chullora site is owned by RailCorp (Lot 1, DP 883526), and is located in the north-eastern corner of the Chullora Railway Workshops and Yards. The site is accessed from Worth Street in Chullora. It is within the Strathfield Council local government area. The site is currently used for the temporary storage of railway materials, including sleepers and rails.

The Chullora site is mostly cleared, open land, with the area identified approximately 2.3 hectares (Figure 5). It is likely that only a portion of the 2.3 hectares will be utilised for the remediation works. The site is generally flat, with a slight slope to the north. Some trees are present in the northeast and middle of the site.

There are three (3) semi-permanent site structures present, a rail loop and two sheds which may be removed prior to any soil treatment works commencing. The inoperative closed loop of rail and temporary sheds were installed by a recent lessee and can be decommissioned. The removal of these semi-permanent site structures or decommissioning of the closed loop of rail is not part of this proposal, and if the site is required for this project would be subject to standard RailCorp internal approval processes. These structures have not been identified as having any heritage significance (Godden Mackay Pty Ltd 1990, Appendix Q).

URS prepared an 'Environmental Assessment of Chullora Railway Workshops' in 2008 (Appendix L). The URS (2008) study was an overview investigation of potential sources of contamination, and drew on sixteen previous assessments, and identified the Chullora site area as part of an 8 ha area of lands referred to as 'Area G: North Eastern Portion Including former Rail Reclamation Area'. Whilst it was detected that the site adopted assessment criteria for copper, lead, and zinc were exceeded in some instances, it was concluded that the contamination identified would not preclude use of the site for industrial purposes (Table 4).

Residential properties are located approximately 150m to the east at Marlene Crescent, and approximately 150m to the south on the other side of the Hume Highway. Strathfield Golf Course is to the north, across the rail lines, and Chullora rail yards to the west (Figure 5).

**Table 4: Chullora site potential contamination for 'Area G: North Eastern Portion including former Rail Reclamation Area' (from section 10.8 of URS 2008)**

Area	~ 80 000 m <sup>2</sup>
Number of soil locations	14 soil bores
Soil sampling strategy achieved	Systematic, on large grid (> 50 m grid spacing).
Number of groundwater wells	8 wells
Groundwater sampling strategy achieved	Located along the northern (down-gradient), eastern and southern boundary of the Area. The northern and eastern boundaries are also the boundaries of the Site.
Number of sediment samples	1 sediment sample (swamp near well 307)
Key soil contamination identified	No contaminants detected above the relevant screening level guidelines.
Key groundwater contamination identified	<ul style="list-style-type: none"> <li>Metals/metalloids – considered to be representative of background conditions discussed in relation to the whole of site (Section 10.1)</li> </ul>
Key sediment contamination identified	Arsenic, mercury, nickel and zinc exceeded the ISQG-low and copper and lead marginally exceeded the ISQG-high screening level guidelines. Although sediment from this swamp location is unlikely to migrate to off-site waterway, it indicates that sediment generated from stormwater run-off may potentially transport contaminants off-site into waterways.
Data Gaps	<p>Very limited coverage by either soil and groundwater investigations, however, no point sources of contamination have been identified within this area. The sources of contamination area whole of area issues involving fill material covering the area and rail recycling activities undertaken over large portions of this area.</p> <p>Although this area has a low potential to host significant contamination, because of the limited sampling completed in this area, there remains the potential for unidentified contamination to be present.</p>
Characterisation	Based on the available data no contamination has been identified that would preclude the use of this area for industrial land use.

## 2.2.2 Current Dust / Particulate Levels

There are three OEH air monitoring stations available in proximity to the Chullora site to assist in determining a typical background level of particulates (JBS 2011b). The monitoring sites are Chullora approximately 500m to the west, Earlwood approximately 8km to the south-east, and Rozelle approximately 10km to the east.

Levels of fine particulates, reported as PM<sub>10</sub>, from these locations are based on measurements using an oscillating microbalance and corrected to 0°C. The maximum 24h level of PM<sub>10</sub> recorded from the Chullora monitoring station using the most recent available monitoring data was 64µg/m<sup>3</sup>, and monthly averages, approximately equivalent to the anticipated level of an annual average have been reported at 14 to 26µg/m<sup>3</sup> (JBS 2011b). The Air Quality Study assumed that current coarse particulates would be 50% of the level of total particulates; that is estimated maximum 24h level of coarse particulates was 64µg/m<sup>3</sup>, and an estimated monthly averages of 14 to 26µg/m<sup>3</sup> (JBS 2011b).

### 2.2.3 Current Noise Levels

The background noise data was recorded to the east of the Chullora site, at the base of an escarpment adjacent to the nearest residential receivers, and the day-time (7am-6pm) Rating Background Noise Level was 46 dB(A) L90 (Acoustic Logic 2011a).

### 2.2.4 Chullora Site Photographs



**Photograph 5:** Grassed at Chullora showing inoperative rail loop and shed in the background.



**Photograph 6:** Inoperative rail loop at Chullora site.





Figure 5: Chullora Site Location (from JBS 2011b)

## 3 Proposed Development

Project approval is sought for excavation, treatment and disposal of contaminated soils located at the Macdonaldtown site, including the option, if required, for treatment of soils at Chullora.

### 3.1 NEED FOR THE PROJECT

Past use of the site as a gasworks has left a legacy of contamination. This contamination has been determined by the Office of Environment and Heritage (OEH) to pose a significant risk of harm to human health and the environment as defined under the *Contaminated Land Management Act 1997*. As the responsible landowner, RailCorp has obligations for remediation of the site.

The objective of the remediation is for the site to no longer pose a significant risk of harm to human health and the environment and to allow the beneficial use of the site for rail related activities.

### 3.2 ALTERNATIVES CONSIDERED

Options for remediation of the Macdonaldtown site were originally considered by CH2M Hill as part of preparation of a *Remedial Action Plan* (CH2M Hill 2007b). Short-listed options included:

- No action
- Institutional Controls including an Environmental Management Plan (EMP) and site access restrictions;
- Insitu Physical/Chemical Treatment including chemical oxidation and soil vapour extraction;
- Insitu Thermal Treatment;
- Exsitu Biological Treatment including biopiles, composting and land-farming;
- Exsitu Physical/Chemical Treatment including solidification/ stabilisation/ immobilisation and chemical extraction;
- Exsitu Thermal Treatment including incineration/co-burning and thermal desorption;
- Containment including capping and containment;
- Off-site Disposal; and
- Reuse and Recycle.

Further review of treatment methodologies has been undertaken: *Remedial Strategy – Former Macdonaldtown Gasworks, Burren Street, Erskineville NSW* (JBS 2011e). The Remedial Strategy prepared by JBS Environmental provided a re-assessment of the preferred remedial methods outlined in the original Remediation Action Plan (RAP), and also gave consideration to alternate remedial methods that could be applied to the site. The re-assessment was primarily based on newly available information on the likely project constraints and requirements, commissioned as part of the EA process.

The following options were considered:

- No Action;



- Institutional controls i.e. Environmental Management Plan-site access restrictions (no active remediation);
- Containment including capping;
- Off-site disposal;
- Thermal desorption;
- Stabilisation/ Immobilisation; and
- Bioremediation (at Macdonaldtown).

The options were assessed in terms of their effectiveness, technology risk, timeframe, permissibility, compatibility, health and safety risk, cost and ongoing management.

The preference is to treat contaminated materials at the Macdonaldtown site, as transportation emissions and risks (e.g. vehicle accidents and spills) are reduced. However, due to the adjacent residential dwellings and limited space, treatment on site will only occur if a suitable methodology, technology and space are available. The Chullora site provides an alternative site for treatment, if required.

As part of the assessment of possible options, JBS Environmental determined *in-situ* chemical oxidation and thermal treatment not to be appropriate for the project. Based on the range and distribution of contamination present, the assessment concluded that no single remedial method provided a solution that was cost effective, timely, and appropriate to the site as a whole. Rather, based on the characteristics of the material encountered, the assessment identified four methods (including two treatment methods), that could be used in combination on the site (JBS 2011e).

The two treatment methods considered by JBS Environmental as most appropriate for the project involve treatment of contaminated materials by bioremediation and/or cement stabilisation. Additionally, based on the anticipated quantities of material and indicative program of works, the configuration of treatment works will most likely involve bioremediation of material on the Macdonaldtown site and cement stabilisation works on the off-site treatment area located at Chullora.

### 3.3 PROJECT STAGES

The project will be undertaken in three main stages:

1. Pre-remediation (site establishment, clearing, and additional investigations);
2. Remediation (treatment, stabilisation, bioremediation, containment and capping, or off-site disposal); and
3. Post-remediation (validation, re-instatement and monitoring).

The components of these stages and their respective locations (Macdonaldtown and/or Chullora) are outlined in Table 5. Locations of areas for treatment at Macdonaldtown are provided (Figure 7 - Figure 9). The various areas and depths for treatment at Macdonaldtown has been considered in the proposed site setup and staging (Figure 10 - Figure 13). A diagram of the proposed setup at Chullora is also provided (Figure 14). The proposed project works are discussed in the following sections.

**Table 5: Summary of Main Stages and Components of Project**

STAGE	COMPONENTS	MACDONALDTOWN	CHULLORA (If required)
1. Pre remediation	Site establishment and clearing	✓	✓
	Additional geotechnical and archaeological investigations (as necessary).	✓	
2. Remediation (Includes remediation stages I, II, III and site establishment stage II) (see Figure 10 - Figure 14)	Pre-treatment	✓	✓
	Off-site disposal	✓	✓
	Thermal Desorption (including LPG storage)	No longer proposed	No longer proposed
	Stabilisation/ Immobilisation		✓
	Bioremediation	✓	
	Containment and capping.	✓	
3. Post remediation	Site Validation.	✓	✓
	Re-instatement	✓	✓
	Program of Monitored Natural Attenuation (for groundwater monitoring)	✓	

Each of these components is described in the following sections.

### 3.4 REMEDIAL WORKS PROPOSED

#### 3.4.1 Pre-Remediation Stage

Prior to the commencement of remedial works, the following documents will be prepared and implemented:

- A Remedial Health and Safety Management Plan (RHSMP);
- A Construction Environmental Management Plan (CEMP) will be prepared and implemented by the RailCorp remediation contractor, and will include:
  - Controls identified in the EMP submitted with this EA (Appendix ZA);
  - Controls identified via the Statement of Commitments;
- Incident Management Plan;
- A Remedial Works Validation Plan;
- Pre- and post- work dilapidation study for residential properties adjoining Macdonaldtown to assist in preventing dilapidation during remedial works;
- Geotechnical and detailed Structural Engineer assessments of retained structures, in particular in the vicinity of the Southern Gasholder and the western boundary;
- Via the CEMP a detailed Earthworks Specification (as per Pells Sullivan Meynink 2010 in Appendix W); and
- Via the CEMP a Waste Management Plan (WMP) to include details on the waste tracking procedures and waste classification program to be implemented.

These pre-remediation requirements form the first in a series of commitments by RailCorp in undertaking the project. These commitments are presented under subject headings (ie. Construction, Soil and Water etc) and summarised in Section 8. Throughout the EA when such commitments are made they will be highlighted in call out boxes and referenced to Section 8 headings as below.

C1	A Construction Environmental Management Plan (CEMP) is to be prepared and implemented by the remediation contractor, which is to include: <ul style="list-style-type: none"> <li>Controls identified in the EMP submitted with this EA (Appendix ZA)</li> <li>Controls identified via the Statement of Commitments</li> </ul>
S1	Via the CEMP a Remedial Health and Safety Management Plan is to be prepared and implemented.
S3	Incident Management Plan is to be prepared and implemented.
SW1	A Remedial Works Validation Plan is to be prepared and implemented.
G1	Pre- and post- work dilapidation study for residential properties adjoining Macdonaldtown to assist in preventing dilapidation during remedial works.
G2	Geotechnical and detailed Structural Engineer assessment of retaining structures, in particular in the vicinity of the Southern Gasholder and the western boundary.
SW5	Via the CEMP a detailed Earthworks Specification (as per Pells Sullivan Meynink 2010 in Appendix W) is to be prepared and implemented.
W1	Via the CEMP a Waste Management Plan (WMP) is to be prepared and implemented, and to include details on the waste tracking procedures, waste classification program, licensing requirements, disposal protocols and incident responses to be implemented.

#### *Site establishment*

Site establishment at both Macdonaldtown and Chullora will be undertaken as per the requirements of the EMP. Further, site specific management protocols will be outlined in the CEMP and implemented by the eventual contractor (See Commitment C1 above).

The proposed Macdonaldtown Remediation requires substantial site-establishment effort, including, but not limited to the following:

- **Safety Management** – Safety management activities, mitigation measures and controls will be implemented as per the requirements of the RHSMP;
- **Environmental Controls** – Environmental management activities, mitigation measures and controls will be implemented as per the requirements of the EMP and CEMP;
- **Training** – Where identified in the RHSMP, EMP and/or CEMP, training requirements will be fulfilled prior to or during site establishment (as appropriate);
- **Community Consultation** – Community and other relevant stakeholders will be notified of the intention to begin works prior to mobilisation to site. Appropriate community consultation will be undertaken throughout the project (Section 7);
- **Security** – Security measures will be implemented on-site to ensure the continued safety of the site and local residents (as necessary);
- **Fencing** – The site is currently enclosed by 1800mm chain-wire fence with noise abatement walls present on the Southern boundary. As a minimum, this fencing (or an equivalent

barrier) will be maintained throughout the life of the project;

- **Vegetation** – Vegetation will be cleared from the site as necessary for the completion of the remediation works. Where possible native vegetation will be retained. Flora and fauna are discussed further in Section 6.8.3;
- **Site Offices** – Temporary site offices will be erected on-site and remain for the life of the project. Offices will be removed following completion of works;
- **Plant** – Excavation and treatment plant will remain on-site throughout the project and will be operated as per the requirements of the EMP/CEMP. Plant will not be mobilised to site until appropriate safety and environmental controls are implemented; and
- **Storage Areas** – Storage of equipment and treatment additives to support remedial works will be undertaken as per the requirements of relevant licensing agreements (where required) and the EMP/CEMP. Storage areas will be established prior to receipt of equipment or additives.

The proposed Chullora treatment facility is a temporary installation and will only be operated for the treatment of contaminated materials from the Macdonaldtown Gasworks Site. The treatment facility will be contained within the larger RailCorp Chullora Industrial Site. The nature of the facility and the proposed works require substantial site-establishment effort, including, but not limited to the following:

- **Safety Management** – Safety management activities, mitigation measures and controls will be implemented as per the requirements of the RHSMP;
- **Environmental Controls** – The primary environmental control will be the temporary enclosure and air treatment system (Figure 14), but will also include environmental management activities, mitigation measures and controls will be implemented as per the requirements of the EMP and CEMP;
- **Training** – Where identified in the RHSMP, EMP and/or CEMP, training requirements will be fulfilled prior to or during site establishment (as appropriate);
- **Community Consultation** – Community and other relevant stakeholders will be notified of the intention to begin works prior to mobilisation to site. Appropriate community consultation will be undertaken throughout the project (Section 7);
- **Security** – The RailCorp Chullora facility is a secure industrial compound. The proposed treatment site will be established within the bounds of the larger facility. No public access is expected in the vicinity of the treatment facility, however where considered necessary, additional security measures will be implemented;
- **Fencing** – The RailCorp Chullora facility is bound by a chain-wire fence. The treatment facility will be established within the bounds of the larger facility and will be enclosed via the installation of temporary barriers. Barriers will clearly delineate the extent of the treatment facility;
- **Vegetation** – Limited vegetation is present on-site and largely consists of exposed soil and grass. Vegetation will be cleared from the site as necessary for the completion of the treatment works. Flora and fauna are discussed further in Section 6.8.3;
- **Ground Preparation** – Some additional materials (such as road-base or bitumen) may be installed to improve surface conditions for the operation of plant and equipment;
- **Site Offices** – Temporary site offices will be erected on-site and will remain for the life of the project. Offices will be removed following completion of the works;
- **Plant** – Excavation and treatment plant will remain on-site throughout the project and will be operated as per the requirements of the EMP/CEMP. Plant will not be mobilised to site until appropriate safety and environmental controls are implemented;
- **Storage Areas** – Storage of equipment, treatment additives and pre and post treatment waste soils will be undertaken as per the requirements of relevant licensing agreements

(where required) and the EMP/CEMP. Storage areas will be established prior to receipt of equipment, additives or waste soil; and

- **Decommissioning** – All plant, equipment and materials will be removed from the site following completion of the treatment works.

In accordance with OEH Interim Construction Noise Guideline, normal hours of work will be between 7am and 6pm Monday to Friday and 8am to 1pm on Saturdays. No work shall be conducted on Sundays, public holidays or outside these hours unless approved by RailCorp as crucial to the control of potential environmental emissions from the site. Noise impacts and controls are discussed further in section 6.3 (also refer to Acoustic Logic 2011a, b).

C3	<p>Via the CEMP works will be carried out within the following times:</p> <p>7:00 am and 6:00pm Monday to Friday</p> <p>8:00am to 1:00pm on Saturdays.</p> <p>No work shall be conducted on Sundays or public holidays, or outside the above hours, unless approved by RailCorp and deemed to be crucial to the control of potential environmental emissions from the site.</p>
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### 3.4.2 Remediation Stage

A flowchart of the proposed strategy to remediate the site is provided in Figure 6.

#### *Pre-Treatment*

Due to their physical properties, some materials present on the Macdonaldtown site will require treatment prior to removal for further treatment or off-site disposal. The following pre-treatment works will be required:

- Pre-treatment of tar sludge for off-site disposal by either heating or inclusion of additives such as fly ash to improve handling
- Lowering moisture content, crushing and/or homogenisation of fill, soil and shale impacted by free tar or displaying other tar impacts
- Segregation of oversized materials in demolition waste and fill obtained from existing retaining walls and in the vicinity of hotspots at BH14, MW13S and MW04S
- Extraction of tar contents from gasworks pipes manually or by other methods such as using heat or chemicals
- Removal of impacted water in below ground infrastructure on the site (Northern and Southern Gasholders, tar wells etc)

Pre-treatment works for groundwater and tar impacted materials at the Macdonaldtown site are described in the Remedial Strategy (JBS 2011e) as:

*'Tar sludge present in the tar wells and Northern Gasholder will most likely be removed from site by specialised vacuum trucks licensed to transport liquid waste. Under these circumstances the tar sludge may be treated in situ to improve handling and pumped directly into the vacuum trucks without the need for a separate above ground treatment area. The heating or requirement for additives to enable pump out of tar sludge will be dependent on several site specific conditions at the time of remediation including volume and depth of tar sludge, proportion of soil or other inclusions, size and power of pump utilised and capability of the disposal truck to maintain the handling properties of the sludge during transport.'*

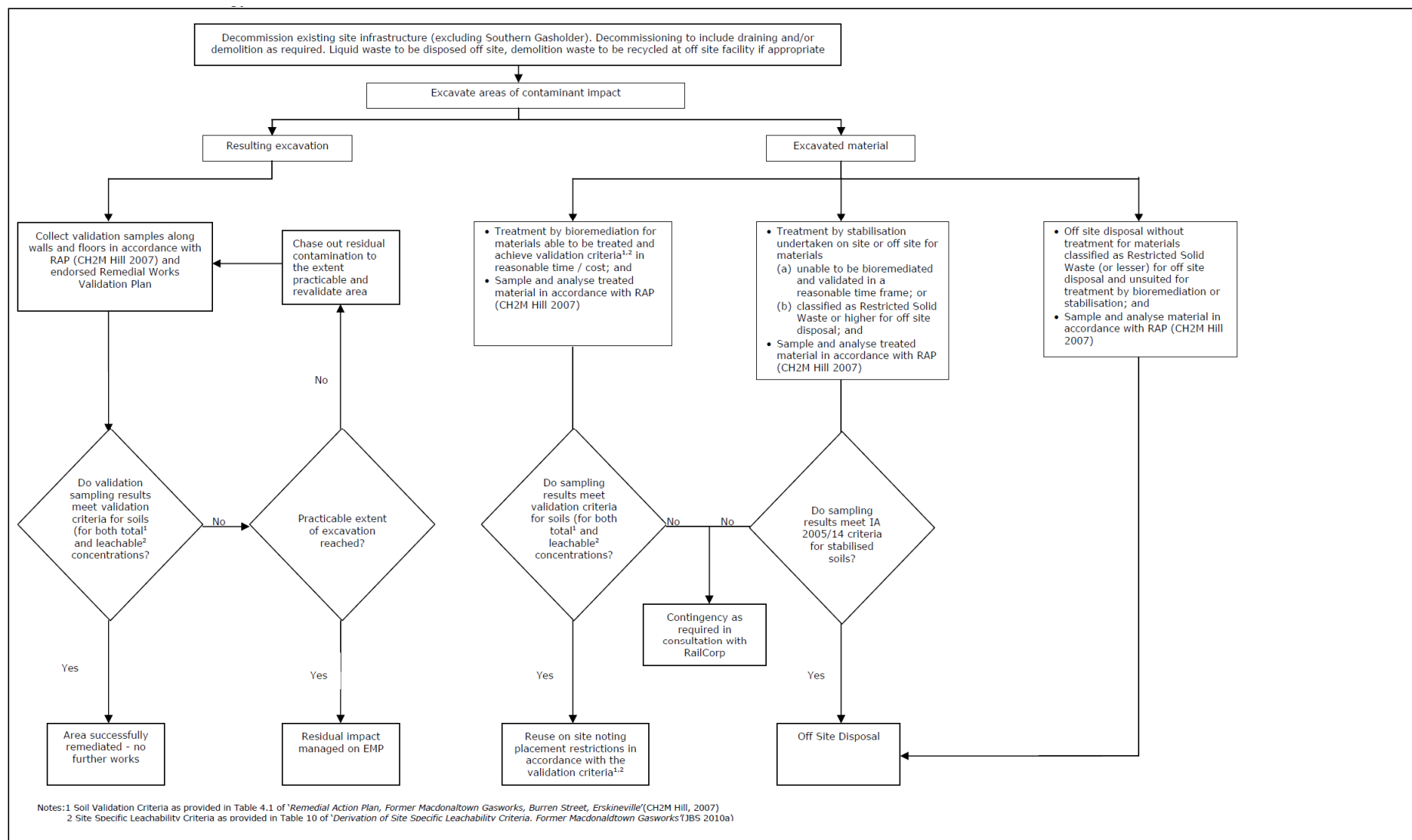


Figure 6: Flowchart of proposed Remedial Strategy (from JBS 2011e).

*Extraction of tar contents from gasworks pipes may be undertaken as follows:*

- *Where the pipes require preservation, then treatment in the form of heating or additives to mobilise and extract the contents; or*
- *Where the pipes need not be preserved, and assuming proper soil and water controls are in place, then it may be possible to sever the pipes into smaller sections for manual extraction of the contents.'*

Relevant controls, particularly air and noise quality management controls, will need to be followed for any pre-treatment works.

#### *Considerations for Treatment of Contaminated Material*

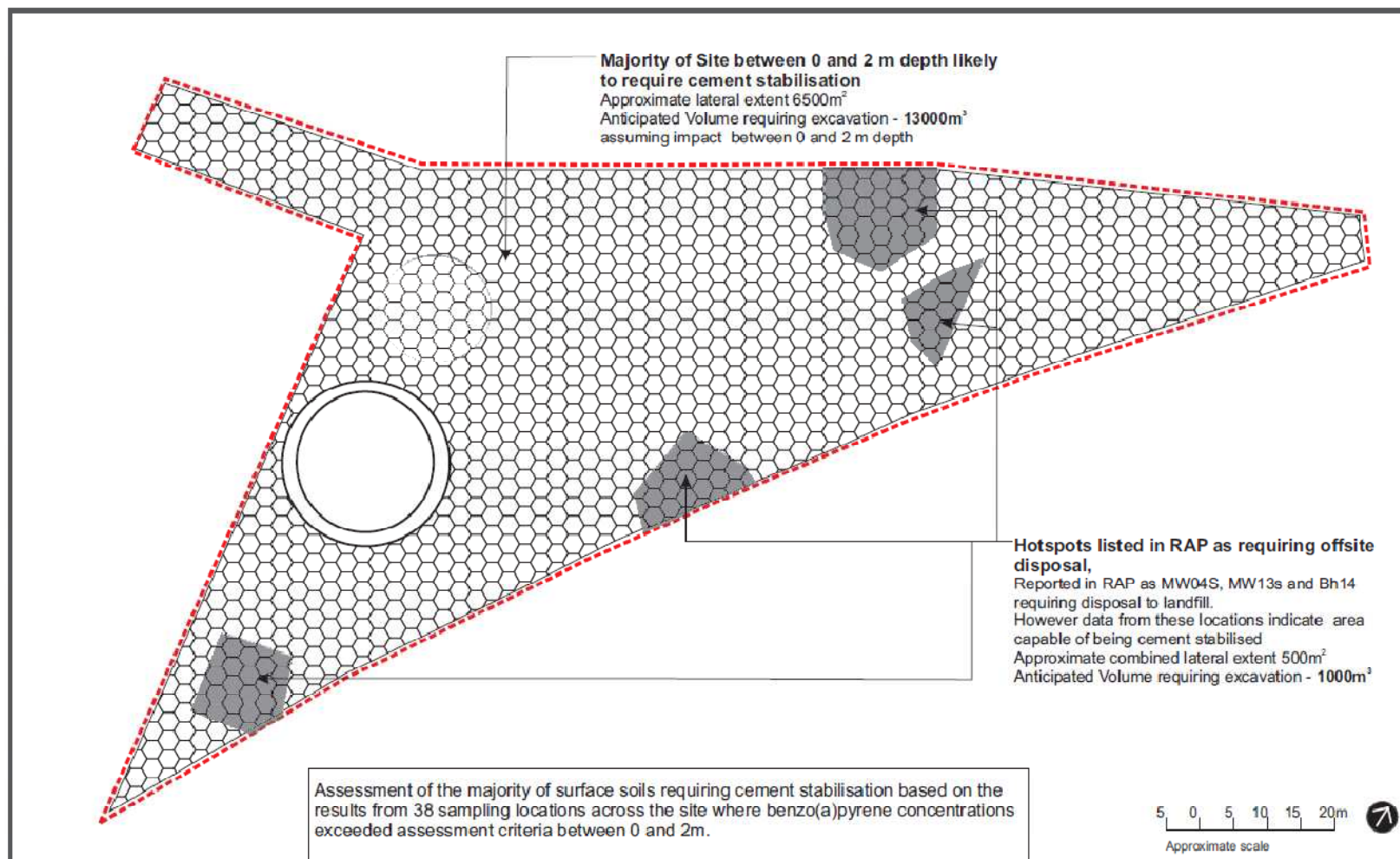
The estimated extent of areas requiring excavation and treatment at the Macdonaldtown Site are represented graphically in Figure 7, Figure 8 and Figure 9 (JBS 2011e).

The Remedial Strategy (JBS 2011e) identifies two possible objectives for treating contaminated material via cement stabilisation or bioremediation:

1. Treating coal tar contaminated material such that a reduced waste classification may be achieved for disposal off-site to landfill, in accordance with NSW EPA 'General Immobilisation of Contaminants in Waste – Coal tar Contaminated Waste From Former Gasworks Sites' approval number 2005/14 (IA 2005/14). Excavated material that requires off-site disposal as Hazardous Waste will need to be treated in this manner, or an additional specific immobilisation approval from DECCW for cement stabilisation obtained. The Contractor may choose to similarly treat material that requires off-site disposal as Restricted Solid Waste should their cost benefit analysis indicate worthwhile savings can be achieved in the project timeline or budget;
1. Treating coal tar contaminated material on the Macdonaldtown site such that it can be reused on site. This will require demonstration of the following for the material undergoing treatment by bioremediation on site – compliance with the site specific total concentrations (as provided in Table 4.1 of the RAP) and the material does not pose a risk to groundwater migrating off-site and is compliant with the site specific leachability criteria for the site.

For the option of treatment using cement stabilisation, the Remedial Strategy (JBS 2011e) states:

*'In the benchscale immobilisation trial conducted by JBS (Appendix A) the results indicated that two of the three materials tested were capable of achieving the required UCS value of 1 MPa (NSW EPA 2005) with a minimum addition of 12.5% cement. The other parameters tested in these materials also showed full compliance with the requirements of IA 2005/14, and under this order would be suitable for off site disposal to landfill as General Solid Waste. The third material failed to meet the required UCS value even with 20% cement addition, and was assessed to be not stabilised. The failure was assumed to be related to the clay content of this material, which was noted to be 87% and well above the general range of 60% to 80% material considered suitable for cement stabilisation. As all other parameters in the failed material showed full compliance with the requirements of IA 2005/14, the stabilisation issue may be overcome by using an increased ratio of cement in the treatment process provided the mixing ratio provided in IA2004/14 Condition 1.3 is not exceeded.'*



- Approximate extent of impacted area (as adapted from CH2M Hill 2007)
- - - Site Boundary
- Area of Impact Likely to be treatable with bioremediation
- Area of Impact Likely to require cement stabilisation

Figure 12 Areas Suited to Treatment (Between 0 and 2m depth)

As adapted from Figure 4 CH2M Hill 2007

Figure 7: Areas for treatment (0 – 2m depth).



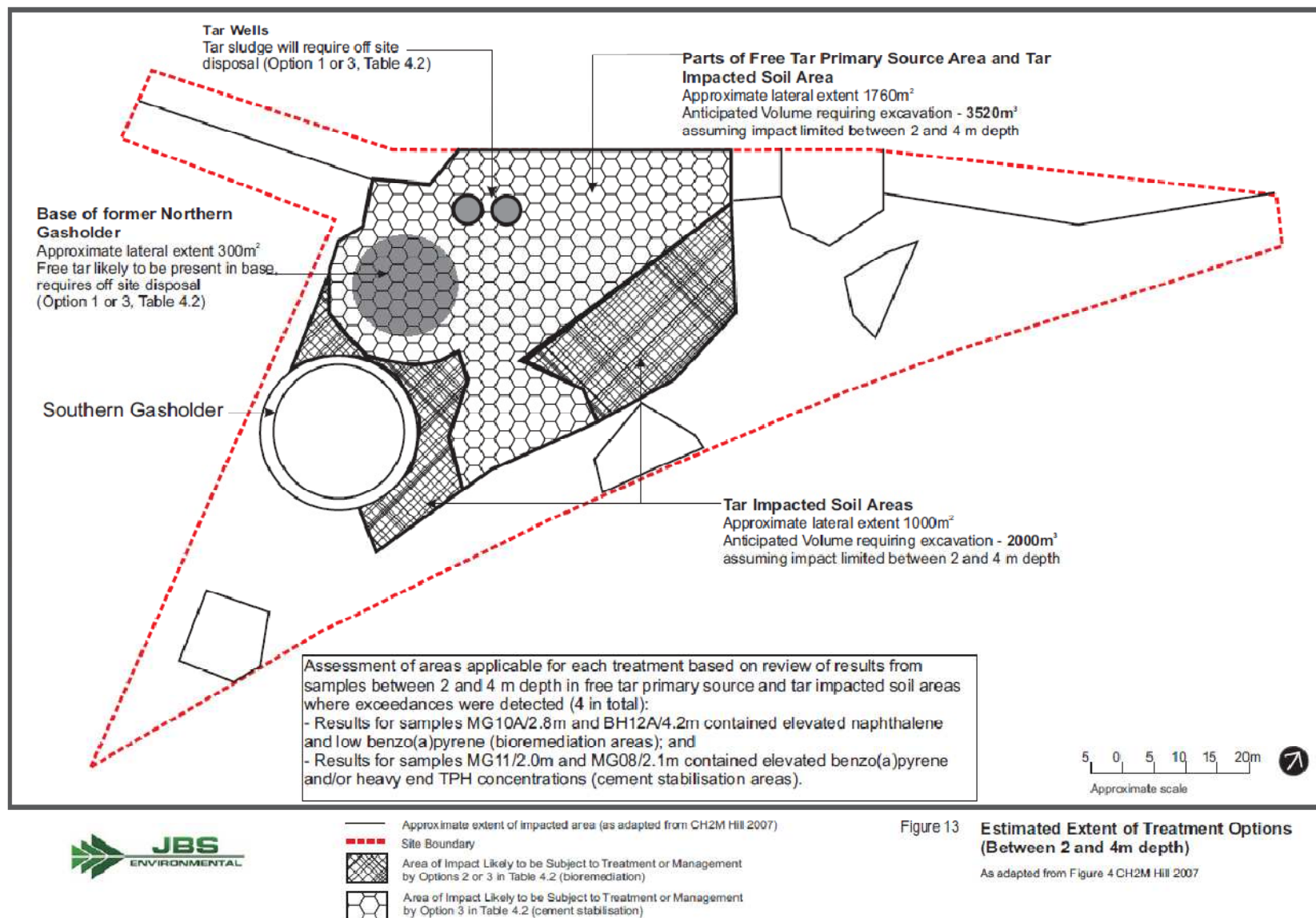
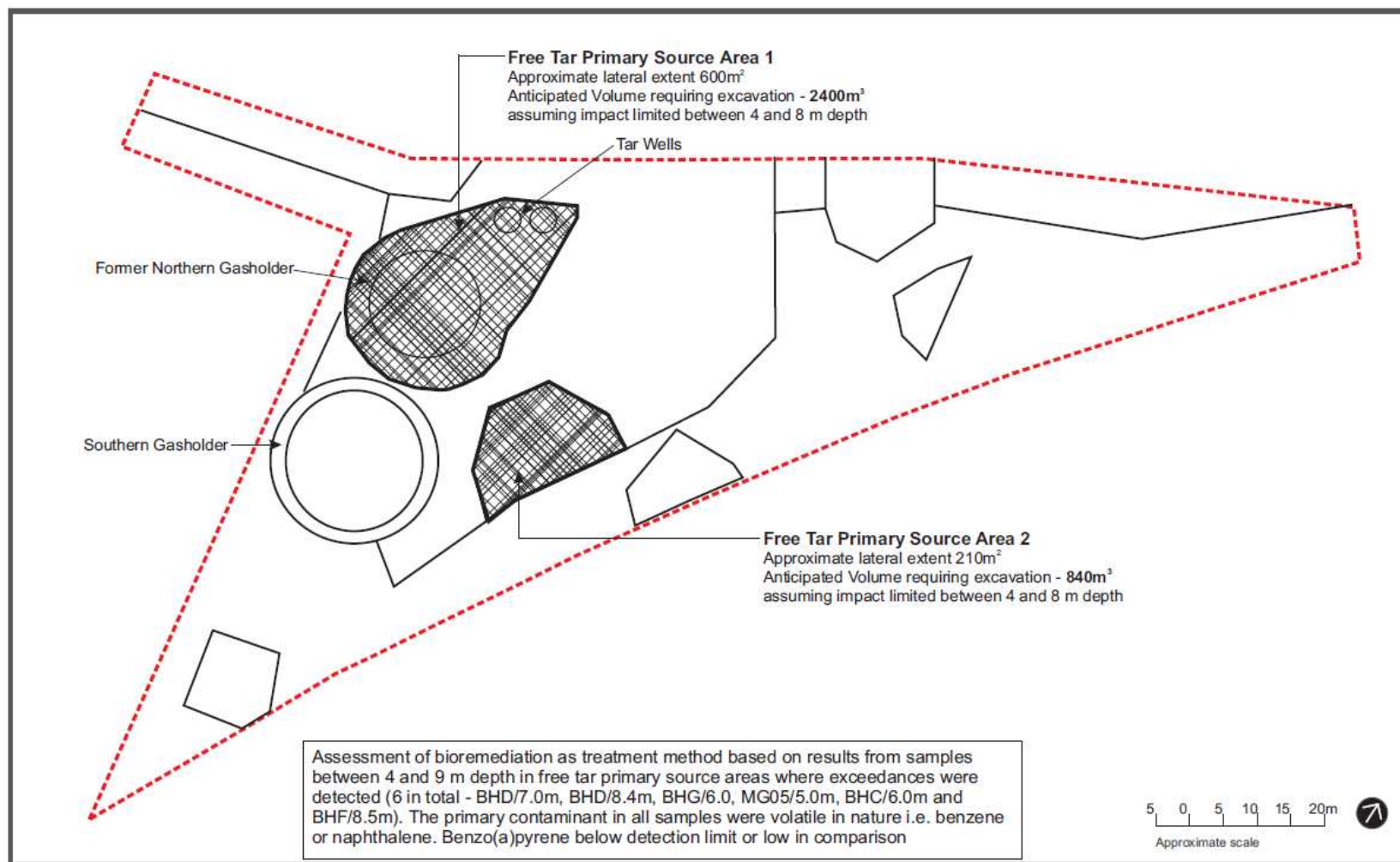


Figure 8: Areas for treatment (2 – 4m depth).



- Approximate extent of impacted area (as adapted from CH2M Hill 2007)
- - - Site Boundary
- ▨ Area of Impact Likely to be subject to Treatment or Remediation in accordance with Option 2 or 3 in Table 4.2

Figure 14 Estimated Extent of Treatment Options (Greater than 4m depth)

As adapted from Figure 4 CH2M Hill 2007

Figure 9: Areas for treatment (>4 depth).

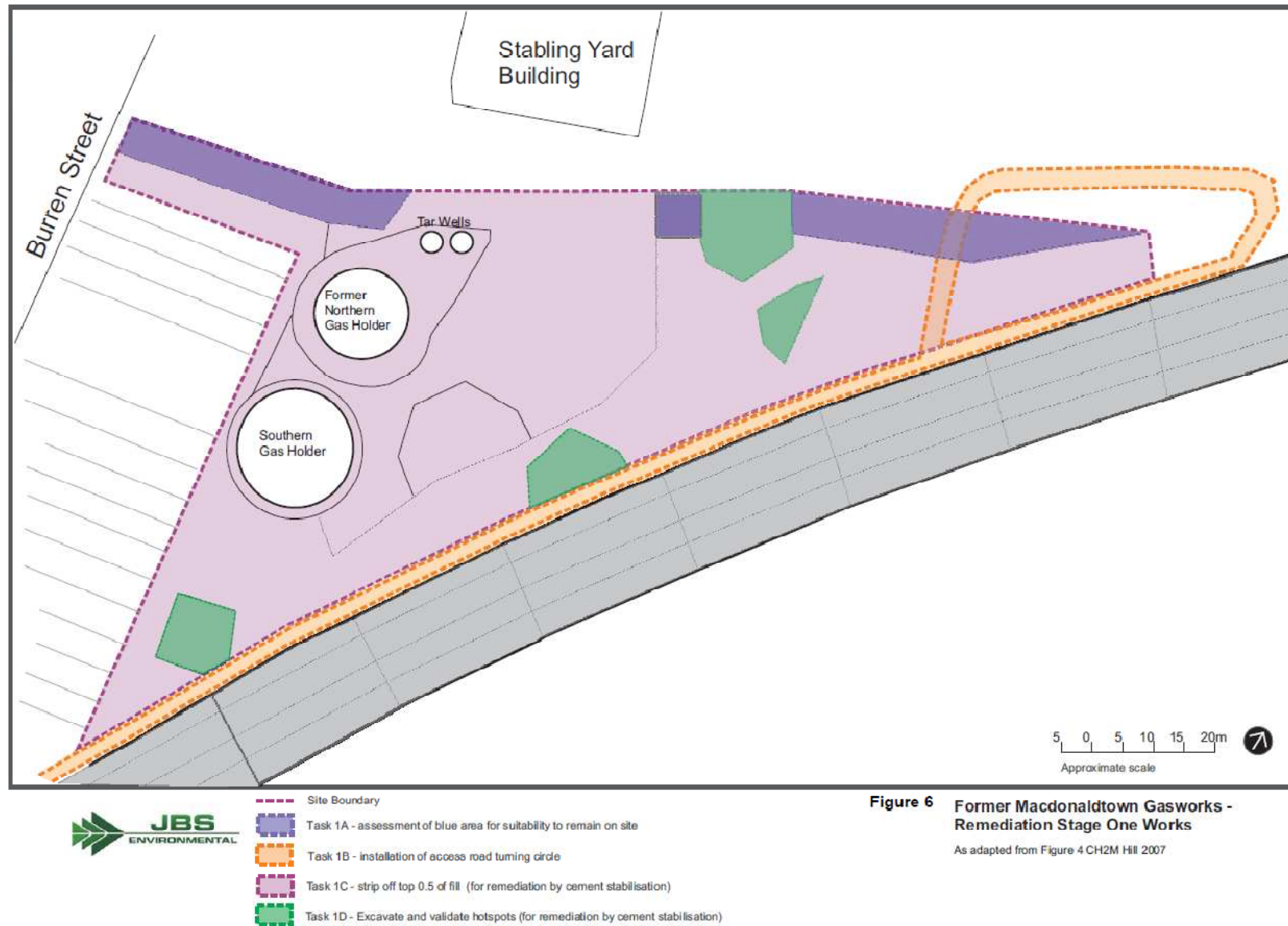


Figure 10: Stage one of remediation phase.

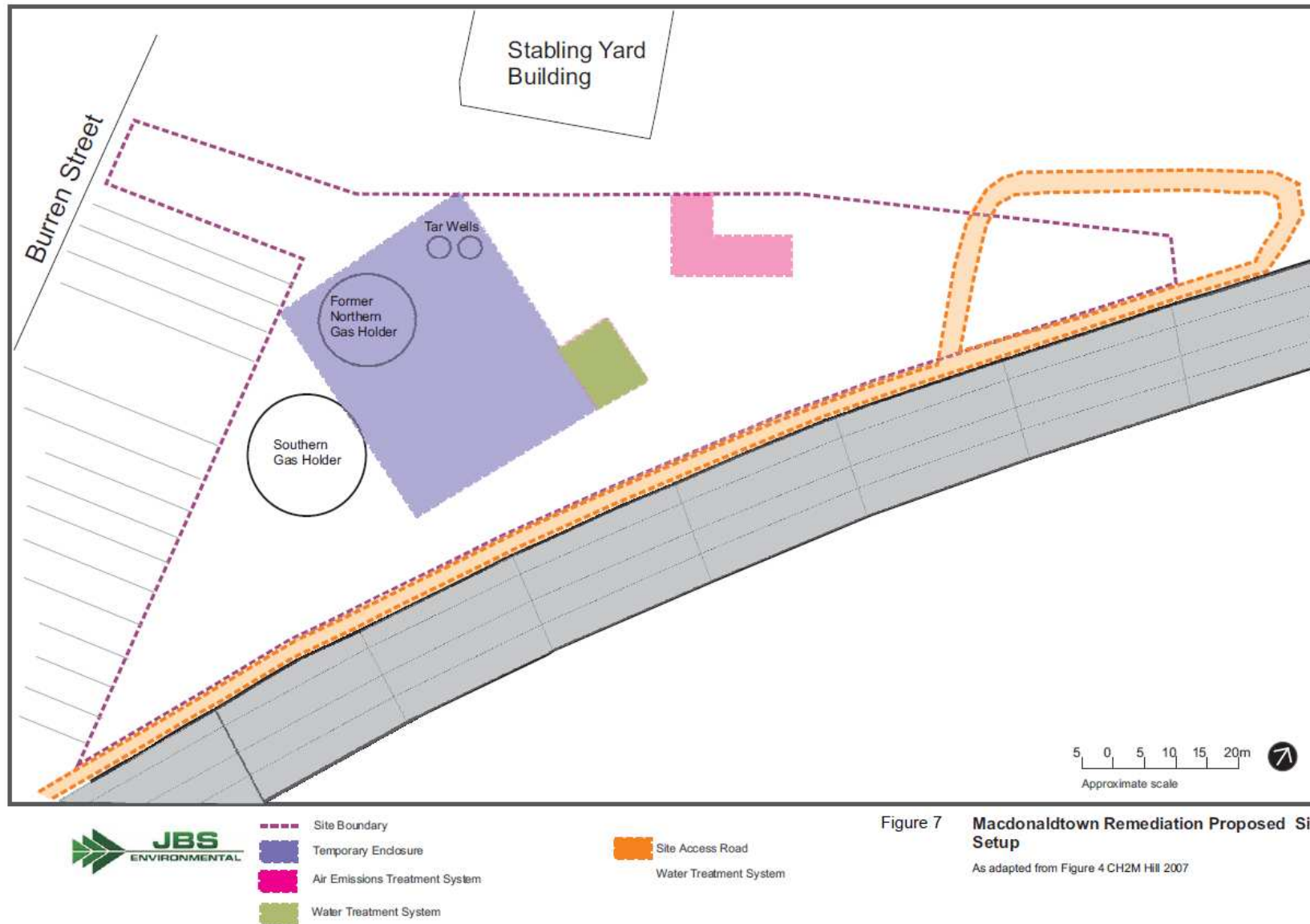
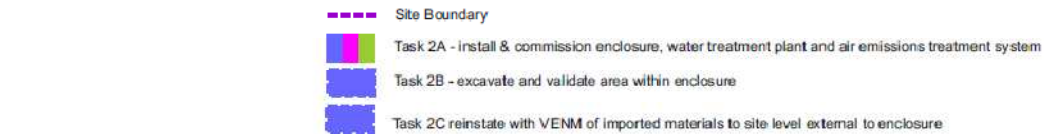


Figure 11: Diagram of proposed site setup at Macdonaldtown.





As adapted from Figure 4 CH2M Hill 2007

**Figure 12: Stage two of remediation phase.**

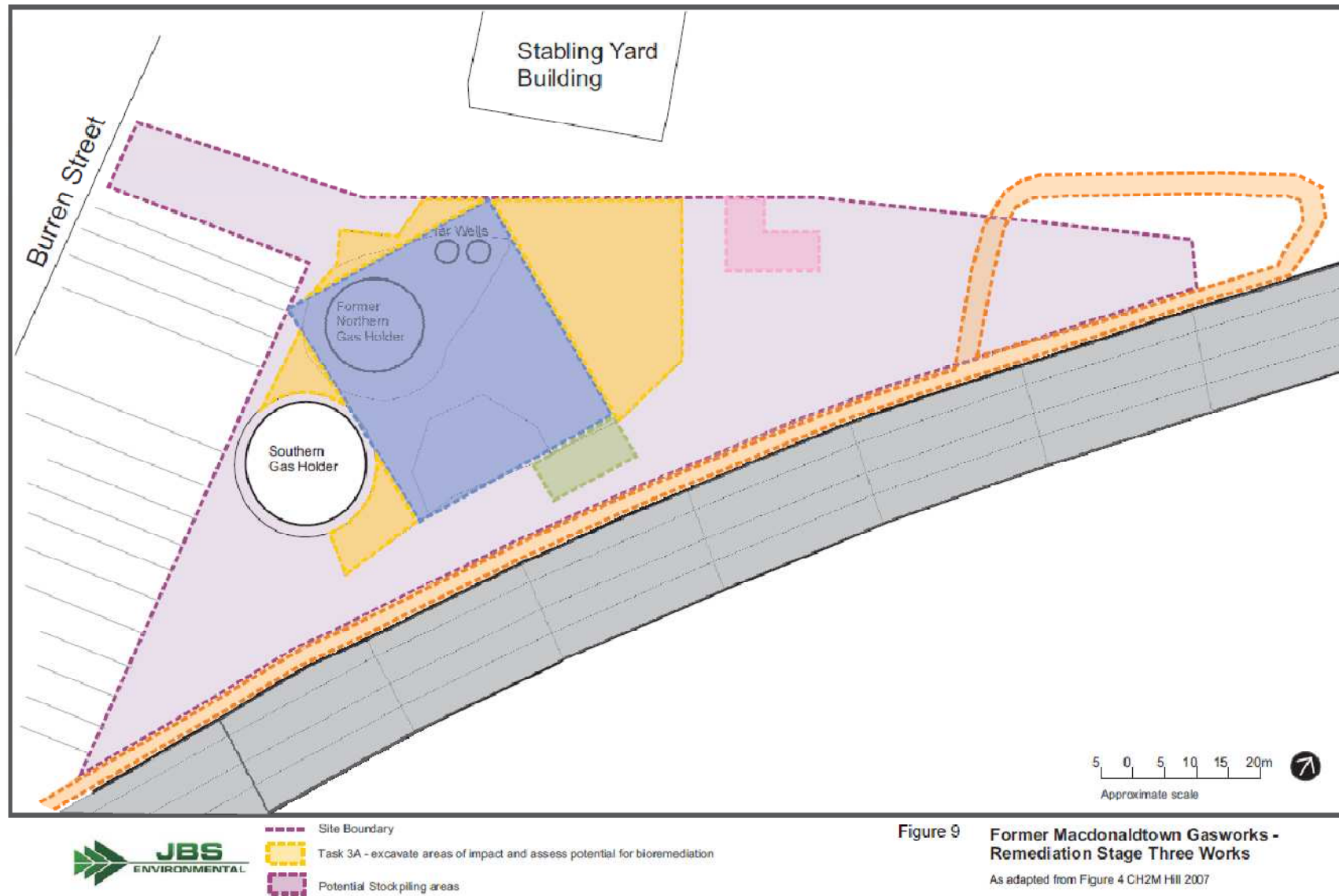


Figure 13: Stage three of remediation phase.

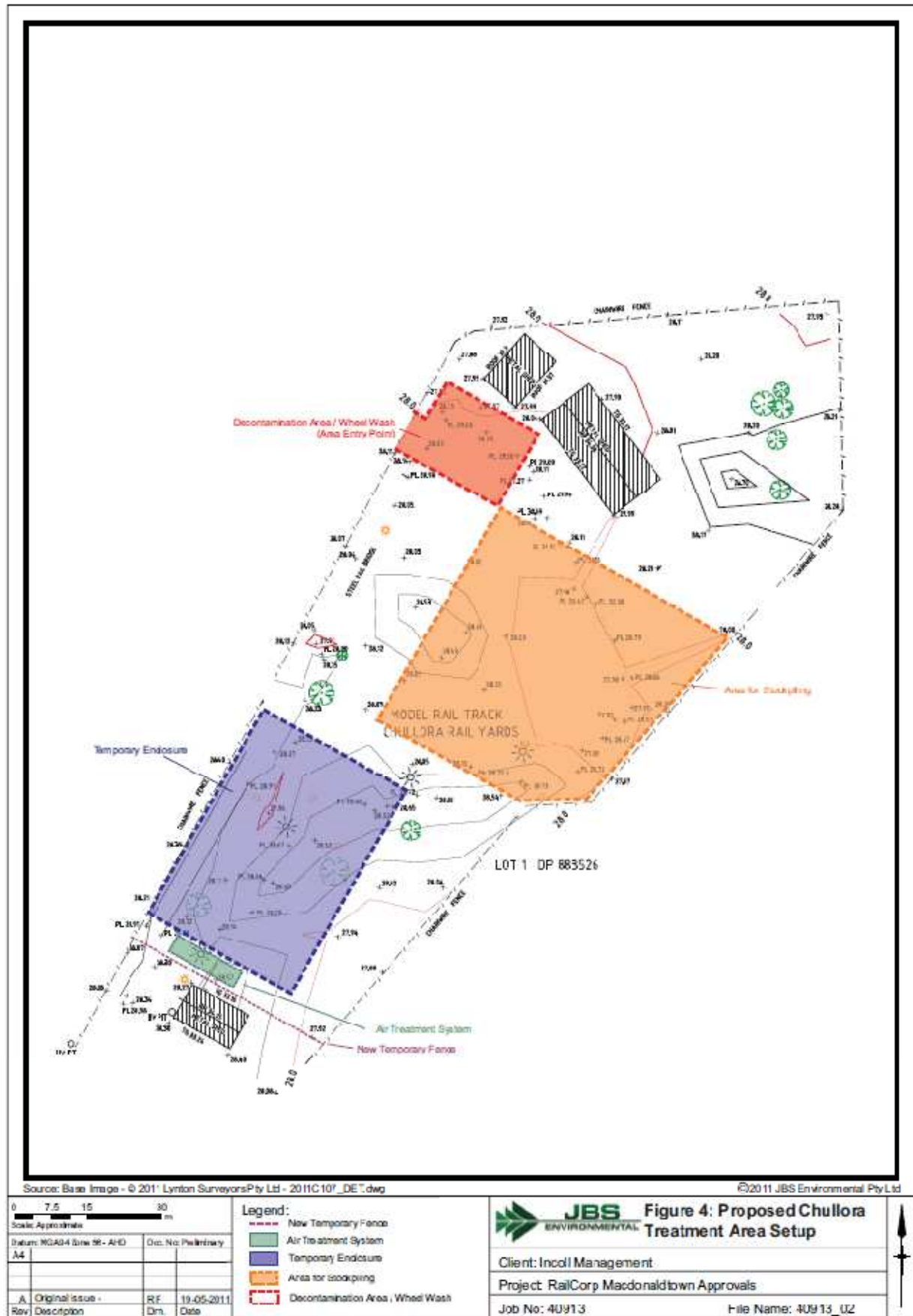


Figure 14: Diagram of site setup at Chullora (if required),

No bioremediation trials were conducted during development of the Remedial Strategy, however bioremediation has been demonstrated as an effective remediation technology on former gasworks sites when used in conjunction with other technologies. Use of bioremediation, wherever possible, as an auxiliary process in the proposed works, has the potential to realise significant cost savings and reductions in the volume of material disposed to landfill.

It is noted that bioremediation will not be applicable to all excavated source materials from the site. In this context, the Remedial Strategy (JBS 2011e) recommends:

- Bioremediation should only be undertaken on material impacted by volatile contaminants, i.e. areas of the site impacted with heavy metal contamination cannot be bioremediated.
- Where excavated material requires remediation of PAHs the decision to bioremediate should consider the form of the contamination and proportion of individual compounds present, noting that:
  - Bioremediation of material impacted by free tar is unlikely to be practicable; and
  - Bioremediation is applicable to material impacted with lighter end PAHs such as naphthalene, while bioremediation of the heavy end PAHs may not at all be possible in a reasonable timeframe or may require the application of additives for breakdown.
  - The effectiveness of the bioremediation process will also be dependent on the layout of the bioremediation area and the frequency of turning adopted.

It is not anticipated that free tar will be encountered external to the temporary enclosure. However as a precaution, a contingency has been included in the Demolition and Remediation EMP for such an occurrence (under EMP18 - Management of Unexpected Free Tar, JBS 2011f).

#### *Storage options and treatment rates*

Storage space at Macdonaldtown is limited by its small size (7,732 m<sup>2</sup>), and the fact that excavation works and machinery must all be stored within this area (see Figure 11 - Figure 13 for potential Macdonaldtown site layout). Estimated treatment rates are provided in Table 6.

It is due to these space limitations that the Chullora site has been identified as an option for the temporary storage and treatment of impacted material. The Remedial Strategy (JBS 2011e) provided indicative estimates of volumes of material that can be handled at the Chullora site (Table 7), with each process assessed individually, and assuming minimal area only is required for truck loading, supply and plant storage.

**Table 6: Indicative Estimated Treatment Rates (from JBS 2011e)**

Process	Likely treatment rate	Comments/ Assumptions
Treatment by Cement Stabilisation	1000 T per day <sup>1</sup> , can be streamlined to achieve up to 1400 T per day	Daily excavation rates are unlikely to match treatment of 1000 tonnes per day. Considerations should be given to either use of smaller mixing plants in line with excavation rates, or if large daily treatment volumes are planned whether sufficient space exists for pre-treatment stockpiling and post treatment curing
Treatment by bioremediation	500 m <sup>3</sup> per 3 weeks (average) <sup>2,3</sup>	Bioremediation may not be applicable to all contaminants requiring remediation

Notes: 1 achieved using semi-trailer sized mixing plant

2 assumes maximum volume possible stored on treated site, staggered such that all 500 m<sup>3</sup> is subject to daily exposure, with no more than 150m<sup>2</sup> uncovered at any one time.

3 treatment rates will vary if bioremediation to be completed within tented enclosure.



**Table 7: Estimated volume of material capable of being stored in Chullora Treatment Area (from JBS 2011e)**

Process	Area Occupied	Indicative Volume capable of storage on site at one time	Comments/ Assumptions
Storage	0.5 ha <sup>1</sup>	8,250 m <sup>3</sup>	Stockpile max 5 m high, 10m wide, in 5 rows running lengthwise across area
Treated Stabilised soil – layed out for curing period	0.5 ha <sup>1</sup>	2,500 m <sup>3</sup>	Treated soil placed in 0.5m high blocks for curing
Soil in wind rows for bioremediation	0.5 ha <sup>1</sup>	1250 m <sup>3</sup> (storage on site at any one time)  approximately 50 m <sup>3</sup> uncovered (i.e. being treated at any one time)	Soil for bioremediation place in 1 m high windrows in 8 rows running lengthwise across site.  Assumes that the maximum number of rows that can be uncovered at any one time should be consistent with the requirements of the air quality management plan that no more than 150 m <sup>2</sup> of material should be exposed to the atmosphere. A one metre length of one metre high windrow will contain approximately 0.5m <sup>3</sup> of soil and have an exposed surface area of 1.4m <sup>3</sup>

Notes: 1 actual volumes will depend of dimensions of available area

#### *Cement Stabilisation Treatment (Chullora site)*

Treatment by cement stabilisation at Chullora will require appropriate plant and infrastructure in order to manage reception, handling, treatment and storage of waste received from the Macdonaldtown site, as well as and the subsequent storage, handling and disposal of the treated waste. The proposed layout of the Chullora facility is illustrated in Figure 14, and a summary of the works is provided in Table 8. Additional detail associated with the layout and the operation of the facility is provided in the Remedial Strategy (JBS 2011e), Chullora Air Quality Management Plan (AQMP, 2011d), and the EMP (2011f).

**Table 8: Summary of proposed treatment works at Chullora (if this option is utilised) (from JBS 2011f)**

Stage	Task	Comments
Preliminary	Project planning and licensing	-
Site Establishment	Conduct baseline environmental assessment of treatment site	-
	Set up of site offices, sediment and erosion controls	-
	Installation of temporary enclosure and associated air extraction/treatment system. Installation of cement stabilization plant within the enclosure	Likely locations shown on Figure 14.
Treatment	A – commission air and water treatment system	-
	B – receive materials for treatment. Onsite stickpiling until minimum treatment volume achieved	-
	C – once minimum volume achieved treatment of soils by cement stabilization within the enclosure	-
Disestablishment	Decommissioning of air and water treatment plants, disestablishment of enclosure and site offices	-
	Conduct post works environmental assessment of treatment area	-

Major Equipment required for the completion of works at the Chullora facility is summarised in Table 9, and further discussed in the Remedial Strategy (JBS 2011e).

**Table 9: Summary of major equipment at Chullora (if this option is utilised) (from JBS 2011f)**

Stage	Description of Works	Major Equipment
-	Receipt, Stockpiling, Treatment and Disposal of Soil	Pug Mill – size to be determined 20T excavators – external to enclosure 20T excavator – internal to enclosure Air treatment system, including: <ul style="list-style-type: none"> <li>- Diesel generator</li> <li>- Extraction Fan (2 x 1.5m diameter)</li> <li>- Granular activated carbon filter</li> </ul> Semi trailers arriving and departing from site Water Truck Tipper trucks

A temporary purpose-built enclosure is proposed for the Chullora facility rather than a more permanent engineered constructed building given the:

- Need to minimise disruption to the normal operations of the adjacent Chullora Rail Yards; and
- Need for the area to be restored to its original condition on completion of the treatment program.

All cement stabilisation works are to occur within the enclosure, and any soils undergoing post treatment curing shall be retained within the enclosure until complete (JBS 2011e). To control air quality for potential emissions, the temporary enclosure will be maintained under a constant negative pressure during working hours, via an air filtering system for extraction and treatment of air. Air emissions from the enclosure via the air filtering system will be treated using granular activated carbon (GAC) filters. Air quality is discussed further in section 6.1 of this EA.

#### *Perched Groundwater*

Any perched groundwater drained out of the fill material and shallow soil to enable excavation of the areas to be remediated will require treatment prior to off-site disposal.

Based on observations recorded during previous testing on the site, excavation of fill material as part of the remediation program may encounter significant volumes of perched groundwater. A water treatment system (WTS) is proposed as part of the remediation strategy to process groundwater generated either during excavation, or pumped out of the fill prior to excavation. The objective of using the WTS is to treat the collected groundwater to an acceptable level, such that it may be discharged to stormwater, to sewer or used in operation e.g. as wheel wash water or for dust suppression. Discharge of perched groundwater to stormwater will comply with City of Sydney requirements.

#### *Considerations for Disposal of Material*

Off-site disposal to suitably licensed landfill will be determined either through successful remediation or reclassification and disposal following cement stabilisation.