TECHNICAL REPORT

St Peters Interchange – Landfill Closure Management Plan (LCMP)

FD (100%)

Project:	New M5 – Design and Construct
Contract Number:	15.7105.1373
Document Number:	M5N-GOL-MNP-900-300-WT-9400-F

Document Approval

Rev.	Date	Prepared by	Reviewed by	Approved by	Remarks
A	27 January 2016	[redacted]	[redacted]	[redacted]	SDD
B	11 February 2016	[redacted]	[redacted]	[redacted]	SDD
C	24 March 2016	[redacted]	[redacted]	[redacted]	FD
D	11 April 2016	[redacted]	[redacted]	[redacted]	FD (Issue to EPA)
E	08 June 2016	[redacted]	[redacted]	[redacted]	FD (Revised issue to EPA)
F	04 August 2017	[redacted]	[redacted]	[redacted]	FD (Updated as per direction from DPE)

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1. Introduction

This LCMP outlines key strategies for landfill closure and management of the Alexandria Landfill. It largely adopts the LCMP prepared by AECOM (2015l) that was submitted as Appendix F of the EIS submission for the Westconnex Stage 2 project, as updated by Golder to reflect the current condition of the site and proposed landfill closure design.

The Site comprises Lot 2 in Deposited Plan (DP) 1168612, 10 Albert Street, St Peters, NSW; refer to Drawing M5N-GOL-DWG-900-116-EV-0022 in Annexure A. The Site was acquired by RMS on 20 December 2014 to facilitate the development of the proposed St Peter Interchange (SPI) for the WestConnex New M5 (WCX M5).

This LCMP provides a landfill closure and environmental management and monitoring framework to be implemented both during and post landfill closure. The term closure refers to the cessation of landfilling and recycling activities within the licenced areas of the site. This LCMP documents the proposed final landform, capping detail, leachate, gas management and monitoring protocols proposed to be adopted as part of the landfill closure process.

This LCMP includes appendices that outline environmental management of the rehabilitated landfill site, including the Landfill Environmental Management Plan (LEMP). The document does not outline construction and/or environmental management works required for construction and development of the SPI. These are summarised in the Construction Environment Management Plan (CEMP) prepared by CDS.

Please Note: The Rev F revision of this document is in regard to odour management and has been issued as per a direction from the Department of Planning and Environment (DPE). The changes made in Rev F are limited to the following:

- Section 1 (this section);
- Section 6; and
- Annexure K (new annexure).

1.1 Background

The Alexandria Landfill site has been acquired by RMS and is the proposed location of the St Peter Interchange (SPI) for the new WestConnex (WCX) M5 tunnel. As such the landfill is required to be closed and remediated to accommodate the proposed road infrastructure and open space land uses. The construction of the road interchange will require the excavation and land forming of existing landfill materials, including waste, to accommodate the interchange and tunnel design. It is proposed that excavated landfill waste materials are to be capped and contained on-site within an engineered waste mound with capping of the remaining in-situ landfill materials.

Under the Environmental Protection Licence (EPL) for the site these works are required to be completed in accordance with a Landfill Closure Management Plan (LCMP). This LCMP has been prepared in accordance with the NSW EPA (2016) *Environmental Guidelines, Solid Waste Landfills, Second Edition 2016.* This LCMP should be read in conjunction with the Alexandria Landfill Remediation Action Plan (RAP) for the site which provides the overarching remediation strategy framework and associated remediation activities to facilitate remediation of the site.

This LCMP relates to the Alexandria Landfill site, but excludes the neighbouring sites known as Bradshaw Mountain and Canal Road which, once remediated and redeveloped, form the Core SPI site. Site-specific RAPs will be prepared for each of these associated sites.

1.2 Objective

The objective of this LCMP is to outline key landfill closure activities and a framework for appropriately monitoring and managing environmental, health and safety risks associated with operations at the Site during the landfill closure phase and post closure phase in accordance with the SWTCs, Conditions of Approval and regulatory requirements outlined in this plan.

The report will be reviewed by a NSW EPA accredited Site Auditor prior to being implemented.

1.3 Purpose and Scope

The main purpose of the LCMP is to satisfy the contractual obligations presented in the Projects Scope of Works and Technical Criteria (SWTCs) and to meet regulatory requirements, including the Conditions of Approval (COA) as outlined in the following sections.

1.4 Contractual obligations

The relevant conditions outlined in the SWTC, impacted by this report are summarised in the following table:

Table 1: SWTC Appendix B.30 requirements (Landfill Closure Works)

No.	Condition	Addressed where
1.1.2 a)	Unless otherwise approved by NSW EPA, the Landfill Closure Works must be undertaken under the Contaminated Land Management (CLM) Act in accordance with the NSW EPA's 'Draft Environmental Guidelines – Solid waste landfills (second edition 2015) or any subsequent amendments.	RAP[1]
1.1.2 b)	The remediation of Worksites must be sufficient to allow the certification of the suitability of the Worksites for the Final Land Use by the Site Auditor, in accordance with the NSW EPA Contaminated Site: Guidelines for the NSW Site Auditor Scheme (2nd edition).	RAP
1.1.3 a)	The project company must: (i) make application to NSW EPA to effect transfer of WDA's Landfill EPL to the Project Company, such that the EPL is transferred by the Date for Access for the Alexandria Landfill Site; (ii) maintain the currency of and compliance with the Landfill EPL during Landfill Closure Works up until the Date of Completion; and (iii) make application to NSW EPA to affect transfer of the Project Company's Landfill EPL to RMS or the RMS nominee on the Date of Completion and ensuring that the Landfill EPL only contains conditions that are relevant to Post Closure Works.	EPLs have been consolidated and are understood to be in the process of being transferred to CDS

[1] Consistent with guidance applicable under the *Contaminated Land Management Act* 1997 (*CLM Act),* as well as the *POEO Act*, the EPA's *Guidelines for Assessment and Management of Sites Impacted by Hazardous Ground Gases* (HGG) (EPA 2012) have also been considered.

1.1.3 b)	The Project Company must : (i) make application to Sydney Water and affect transfer of the TWA from WDA to the Project Company by the Date for Access for the Alexandria Landfill Site; (ii) maintain the currency of and compliance with the TWA up until the Date of Completion; and (iii) make application to Sydney Water to affect transfer of the TWA from the Project Company to RMS or the RMS nominee on the Date of Completion and ensuring that the TWA only contains conditions that are relevant to Post Closure Works.	It is understood that the TWA will be transferred to CDS
1.1.3 c)	The Project Company must operate and maintain the Alexandria Landfill Site as part of Landfill Closure Works from the relevant Date for Access up to and including the Date of Completion, and comply with all relevant Statutory obligations or otherwise as the holder of the Landfill EPL and TWA and the Environmental Documents.	CEMP
1.2.1 b)	The Project Company must, for the Worksites (i) Prepare a RAP certified by the Site Auditor prior to commencing Project Works and Temporary Works; and, (ii) Remediate the Worksites is accordance with the RAP prior to the relevant Dates of Completion; (iii) Prepare remediation and validation reports documenting the suitability of the Worksites for the proposed land use and, (iv) Provide certification, including staged certification if required, that each Worksite has been remediated to the satisfaction of the Site Auditor prior to the relevant Dates for Completion or Access Expiry Date, whichever is earlier.	RAP
1.2.2 a)	The Project Company must undertake the Landfill Closure Works. The Landfill Closure Works includes:	
i)	the preparation of a LCMP, including any RAP's identified by the LCMP, or required to specify the detailed design of the LCMP requirements, certified by the Site Auditor and approved by the NSW EPA prior to the commencement of Landfill Closure Works and in accordance with the Environmental Documents. The Project Company must, as a minimum incorporate the comments of the NSW EPA-accredited Site Auditor included in the document titled "WestConnex New M5 Main Works, Draft LCMP, NSW EPA-accredited Site Auditor Review" in the LCMP prior to submitting the plan to be certified;	Site Auditor comments have been addressed throughout the LCMP. The document has been submitted to the EPA and Contractor appointed Site Auditor for review and approval.
ii)	the design, construction and commissioning of the following landfill infrastructure elements as a minimum:	
A.	a new leachate collection, pumping and treatment system;	Leachate collection – Section 3.8 Leachate pumping and treatment – M5N-GOL-

		DPK-900-302-WT-9405 SPI
B.	new leachate storage systems if required;	Separate report M5N-GOL-DPK-900-302-WT-9405 SPI
C.	upgrades to the existing leachate collection, pumping and treatment system where appropriate, noting that the existing leachate treatment system will be modified by RMS or others to be compliant with the Landfill EPL and TWA for the expected quantity of leachate generation at the time of relevant Date for Access for the Alexandria Landfill Site;	Leachate collection – Section 3.8 Leachate pumping and treatment – M5N-GOL-DPK-900-302-WT-9405 SPI
D.	a new landfill gas collection and treatment system;	Section 3.7 M5N-GOL-DPK-900-302-WT-9410 SPI (Gas Design)
E.	groundwater management systems during the construction phase of the LCMP;	CEMP
F.	new groundwater barrier systems to minimise groundwater inflow to the former landfill;	VB Wall report M5N-GOL-DPK-900-302-WT-9420 SPI
G.	new leachate and landfill gas barrier systems if required;	Sections 3.7 and 3.8
H.	new stormwater and sediment collection, pumping and treatment system;	Design packages M5N-AJV-DPK-900-300-DR-9020 M5N-AJV-DPK-100-300-DR-1405
I.	new landfill monitoring systems;	Annexure G (LEMP)
J.	upgrades to the existing landfill monitoring systems if required;	Annexure G (LEMP)
K.	new security fencing and/or safety barriers as required;	Covered in design reports for relevant landfill infrastructure. M5N-GOL-DPK-900-302-WT-9410 SPI (Gas Design) M5N-GOL-DPK-900-302-WT-9415 SPI (Capping Design)

L.	new facilities including amenities suitable for carrying out Post Closure Works	Reported separately
M.	suitable access provisions that ensure that future motorway operations are not interrupted for routine Post Closure Works;	M5N-AJV-DPK-900-300-RD-9000 (Landform and Roads)
N.	earthworks to achieve the final landform including the construction of new landfill cells as required;	M5N-GOL-DPK-900-302-WT-9415 SPI (Capping Design) M5N-AJV-DPK-900-300-RD-9000 (Landform and Roads)
O.	permanent stabilisation of all slopes including the former quarry walls;	Design packages M5N-GOL-DPK-900-400-TW-9965 M5N-GOL-DPK-900-302-WT-9415 SPI (Capping Design)
P.	ground improvement works to minimise settlement and to minimise the effects of settlement as required;	M5N-GOL-DPK-900-302-WT-9415 SPI (Capping Design) M5N-GOL-DPK-900-302-WT-9430- SPI (Ground Improvement)
Q.	decommission the existing groundwater extraction system;	M5N-GOL-DPK-900-302-WT-9415 SPI (Capping Design)
R.	A new groundwater system, which:	
	I. provides a permanent, continuous barrier to limit the inflow of groundwater from the Botany Sands aquifer into Alexandria Landfill:	M5N-GOL-DPK-900-302-WT-9420 SPI (VB Wall)
	II. alleviates the requirement for any long-term water licensing requirements under the Water Act 1912 or Water Management Act 2000; and	M5N-GOL-DPK-900-302-WT-9420 SPI (VB Wall)
	III. includes the design and construction of a low-permeability groundwater cut-off wall that: 1. will provide a long-term alternative to groundwater interception and dewatering; 2. extends to a minimum depth that intersects with the underlying residual clay soils along the complete alignment of the wall; and	M5N-GOL-DPK-900-302-WT-9420 SPI (VB Wall)

	3. is aligned to include the RMS (Canal Road) site to mitigate groundwater movement into, and out of, the Botany Sands aquifer at this location	
(iii)	New landfill capping systems and revegetation suitable for the Final Land Use	Landfill capping system – Section 3.6 Revegetation –separate report
(iv)	the staged decommissioning and removal, where appropriate, of the existing leachate collection, pumping and treatment system that is not required to be incorporated into the new leachate collection, pumping and treatment system;	reported separately
(v)	operation and maintenance of the Alexandria Landfill Site from the relevant Date for Access up to and including the Date of Completion;	CEMP Annexure G (LEMP)
(vi)	preparation of a construction quality assurance report, to the satisfaction of the CQA(Eng) and Site Auditor, in accordance with the requirements of the NSW EPA 'Draft Environmental Guidelines – Solid waste landfills (second edition 2015) for submission to the NSW EPA and subsequent approval of the surrender of the Landfill EPL, prior to the Date for Completion;	Section 3.10 Annexure I
(vii)	provision of certification to RMS or the RMS nominee, including staged certification if required, that the Landfill Closure Works have been carried out in accordance with the LCMP and the relevant RAPs to the satisfaction of the CQA(Eng) and Site Auditor prior to the Date for Completion;	Section 3.10 Annexure I
(viii)	preparation and finalisation of a comprehensive LEMP in accordance with the requirements of section 5 of SWTC, Appendix C.2 (Project Company Documentation Schedule), for Post Closure Works to the satisfaction of RMS by no later than six months prior to the Date of Completion;	Annexure G (LEMP)
(ix)	preparation and finalisation of a comprehensive training package including the provision of training for landfill maintenance and monitoring for the Post Closure Works to the satisfaction of RMS, by no later than three months prior to the Date of Completion; and	To be addressed
(x)	provision of Landfill Documentation, as described in section 1.1.1, prior to the Date of Completion.	To be addressed

1.5 Regulatory Conditions

1.5.1 Conditions of Approval

Conditions of Approval (COA) issued with the Infrastructure Approval dated 20 April 2016 that specifically address landfill closure are identified in the following table:

Table 2: Alexandria Landfill Conditions of Approval

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No.	Condition	Addressed where
B32	The Proponent must submit a copy of the final Landfill Closure Management Plan to the Secretary prior to the commencement of any closure or construction works at Lot 2 DP 1168612, 10-16 Albert Street, St Peters (the Alexandria Landfill), the. The Plan must be accompanied by a statement which sets out where the following have been addressed in the Landfill Closure Management Plan:	
	(a) the environmental and monitoring framework to be implemented following the cessation of waste disposal and material recycling activities at the Alexandria Landfill and associated waste recycling and transfer facility;	LCMP (this report) Annexure G (LEMP)
	(b) existing operational consents and approvals for use of the site as a waste storage and recycling facility;	Section 1.5 and 1.6
	(c) the proposed future use of the site;	Section 3.3
	(d) the closure and stabilisation of the site including details of final capping designs and future landform;	Section 3.4 and 3.6
	(e) a groundwater monitoring bore network, to monitor the movement of groundwater within and immediately outside the cut-off wall;	Annexure G (LEMP) (see also Annexure I of VB Wall design report)
	(f) material tracking;	Section 3.11
	(g) occupational health and safety requirements;	Section 3.12
	(h) community engagement processes;	Section 3.13
	(i) specific measures for the management, monitoring and reporting of;	
	(i) dust and odour;	Annexure G (LEMP) CEMP
	(ii) asbestos;	Section 3.15
	(iii) leachate and gases;	Section 3.8 and Section 3.7 CEMP Annexure G (LEMP) M5N-GOL-DPK-900-302-WT-9410 SPI (Gas Design)
	(iv) stormwater; and	Section 3.9
	(j) any outstanding clean-up notices.	LCMP Section 3.14

LCMP – FD (100%)

No.	Condition	Addressed where
	(k) evidence that the EPA has reviewed the Landfill Closure Management Plan and has no outstanding concerns.	Section 1.7 Annexure J
	Where any of the above details have not been included in the final Landfill Closure Management Plan, then the Proponent must provide the details in the statement accompanying the plan required by this condition.	A separate statement to the EPA has been prepared by CDS

This document will need to be revised and updated as Site conditions evolve and roles and responsibilities change during the landfill closure phase and future development of the Site.

1.6 Regulatory Requirements

The following laws, and relevant associated regulatory instruments, have been considered in the preparation of this LCMP:

- *Protection of the Environment Operations (POEO) Act* 1997
- *Environment Planning and Assessment (EP&A) Act* 1979*;*
- *Water Act 1912; and*
- *Water Management Act 2000.*

1.6.1 ALF Scheduled Activities EPLs

All licensed landfills must meet the requirements of the *POEO Act 1997* and the Regulations made under that Act. The site is licenced for “Road Construction” under EPL number 4627.

The EPL establishes the limits to the accepted waste types, quantities, waste management and operating conditions at the facility and any additional limiting conditions including pollution of waters, noise and odour limits. The EPL also specifies the air and water monitoring and recording requirements. The anniversary date for the EPL is 1 December.

1.6.2 Environmental Guidelines Solid Waste Landfills, NSW EPA (Second Edition 2016)

The *NSW EPA (2016) Environmental Guidelines Solid Waste Landfills* (NSW EPA Landfill Guidelines) provide guidance for the environmental management of landfills in NSW by specifying a series of best practice measures called ‘Minimum Standards’. They involve a mix of design and construction techniques, effective site operations, monitoring and reporting protocols, and post-closure management.

The NSW EPA will use these guidelines to assess applications for new or varied landfill licences under the *POEO Act 1997* and to administer these licences during the operational and post- closure periods of landfills.

Regardless of the planning assessment process under the *EP&A Act 1979*, these guidelines form the basis of the NSW EPA’s requirements for the content of the LCMP for the Site.

1.6.3 Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases, NSW EPA (2012)

In addition to NSW EPA (2016), hazards posed by landfill gas will be assessed under NSW EPA (2012) in the form of multi-tiered risk assessments for emissions of landfill gases through sub-surface, surface or in building accumulation.

1.6.4 EIS mitigation and management measures

The EIS outlines a number mitigation and management measures, which are outlined in the following table.

Table 3: EIS mitigation and management measures

No.	Mitigation and management measure	Addressed where
CM01	The closure and ongoing management of the Alexandria Landfill would be undertaken in line with the LCMP (see Section 17.3.4 and Section 5.9.1) and remedial action plan. This includes a landfill closure, environmental management and monitoring framework.	LCMP (this report) Annexure G (LEMP)
CM02	A site specific management plan would be prepared for the Alexandria Landfill to manage the excavation of parts of the landfill during construction. […]	CEMP

1.7 EPA review of LCMP

The Landfill Closure Management Plan M5N-MNP-900-300-WT-9400-D was submitted to the EPA on 11 April 2016 for review. Following review, the LCMP has been included in the Project Environmental Protection Licence 4627. Condition O6.8 to O6.16 of the EPL reference the LCMP and require that the former landfill must be closed substantially in accordance with the LCMP.

The EPA has further advised they have no outstanding concerns on the LCMP, refer to attached letter dated 26 May 2016, reference: DOC16/248636-03 in Annexure J.

The Remediation Action Plan, which includes the LCMP as Annexure C, has been submitted to the NSW EPA Site Auditor for the project for certification and preparation of a Site Audit Statement, SAS B, verifying that by implementing the RAP, the disturbed area can be remediated to a standard consistent with the intended land use. The Auditor has provided interim advise stating the structure, content and scope of the RAP are appropriate and adequate to enable the Site Auditor to comply with the requirements of *Section 4.3* of the *NSW Environment Protection Authority's (EPA) Guidelines for the NSW Site Auditor Scheme (2nd Edition) 2006.*

1.8 Previous Assessments

Numerous investigations have been completed by AECOM on behalf of RMS. The following key AECOM reports that have been reviewed and referenced for the preparation of this LCMP:

- AECOM, 2014a. *Draft Phase 1 Environmental Site Assessment, Alexandria Landfill Acquisition Area, St Peters, NSW* (Revision A, 14 August) (Phase 1 ESA)
- AECOM, 2015l. WestConnex New M5, Alexandria Landfill Closure Management Plan (LCMP), 18 November 2015 (AECOM Doc Ref: 60327128_RPT01_20151109), submitted as Appendix F of the EIS submission
- AECOM 2015m. *Draft Phase 2 Environmental Site Assessment, Alexandria Landfill,* Revision A, 6 May 2015) (Phase 2 ESA)

A summary of the other key provided AECOM reports is provided in the accompanying ALF RAP.

1.9 Definitions and Abbreviations

The key technical terms and abbreviations used through this report are defined in Table 4 and

Table 5 respectively.

Table 4: Definitions

Term	Description
The Contractor	CPB Contractors Dragados Samsung Joint Venture.
Project Company	Sydney Motorway Corporation Pty Limited (SMC)

Table 5: Abbreviations

Term / acronym	Definition
ACM	Asbestos Containing Material
AHD	Australian Height Datum
ARCP	Asbestos Removal Control Plans
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
CoA	Minister's Condition of Approval (issued with Infrastructure Approval)
COD	Chemical Oxygen Demand
CPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
CQA	Construction Quality Assurance
CQAP	Construction Quality Assurance Plan
CQAR	Construction Quality Assurance Report
DADI	Dial-A-Dump Industries Pty Ltd
DP	Deposited Plan
EIP	Effluent Improvement Program
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ESA	Environmental Site Assessment
GCL	Geo-composite Layer

HDPE	High Density Polyethylene
HGG Guidelines	Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (EPA 2012)
ICCG	International Center for Climate Governance
ID	Identification
LCC	Landfill Closure Contractor
LCMP	Landfill Closure Management Plan
LEMP	Landfill Environmental Management Plan
LLDPE	Linear Low Density Polyethylene
LNAPL	Low Non Aqueous Phase Liquid
LTADM	Long Term Average Daily Mass
LTP	Leachate Treatment Plan
mAHD	Metres Australian Height Datum
MDM	Maximum Daily Mass
NA	Not Applicable
NGER	National Greenhouse and Energy Reporting
NSW	New South Wales
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulphate Soils
PCBU	Person conducting a business or undertaking
POEO Act	Protection of the Environment Operations Act 1997
Project	WestConnex New M5
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
RMS	Roads and Maritime Services
SBR	Sequential Biological Reactor
SMC	Sydney Motorway Corporation Pty Limited (formerly WDA)
SMP	Site Management Plan
SVOCs	Semi-volatile organic compounds
SWC	Sydney Water Corporation
SWLMP	Surface Water and Leachate Management Plan

SWMS	Safe Work Method Statements
SWTC	Scope of Works and Technical Criteria
TBC	To Be Confirmed
TC	Tender Condition
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
TSC Act	*Threatened Species Conservation Act 1995*
TWA	Trade Waste Agreement
USTs	Underground Storage Tanks
VB Wall	Vertical Barrier Wall
VOCs	Volatile Organic Compounds
WAMC	Waste Assets Management Corporation
WCX	WestConnex
WDA	WestConnex Delivery Authority

2. Site Description

2.1 Site Location and Identification

The site location and identification details are shown in Table 6 below.

Table 6: Site Description – Alexandria Landfill

Item	Description
Site Owner	Roads and Maritime Services (RMS)
Site Address	10 Albert Street, St Peters, NSW
Legal Description	Lot SP DP 35749, Lot 1 DP 88087, Lot A DP 335583, Lot B DP 376645, Lot A DP 391775, Lot B DP 394647, Lot X DP 421363, Lot 14 DP 606737, Lot 2 DP 1168612
Local Government Authority	Marrickville Council and City of Sydney Council
Current Zoning	IN1 General Industrial (City of Sydney Council and Marrickville Council) and SP2 Classified Road (City of Sydney Council)
Current Land Use	Landfill and waste recycling premises
Proposed Land Use	Motorway interchange and open space recreational
Site Elevation	-12 to 12 m Australian Height Datum (AHD)
Site Area (Total)	19.69 ha
Site Layout Plan	Drawing M5N-GOL-DWG-900-116-EV-0025 (refer Annexure A)

2.2 Site History

Detailed information regarding the historical land uses and activities at the Site has been presented in the AECOM (2014a) Phase 1 Environmental Site Assessment (ESA) report. A summary of the Site history has also been documented in the AECOM (2015m) Phase 2 ESA investigations report and the EIS[2] Technical Working Paper: Contamination Appendix O (AECOM, 2015o). Based on the content presented in the above documents a summary of the key information is outlined below and in Table 7:

- The ALF site was previously occupied by the Austral Brick Company bricks works and quarry which operated from 1908 to 1962. The brickworks infrastructure (buildings, kilns, offices, etc.) was located within the north-eastern and southern areas of the site. The shale was mined from a large quarry which covered much of the western half of the site.
- The former brickworks remained vacant and unused following closure of Austral bricks works and its demolition during the 1970s until City of Sydney Council used the quarry as a landfill from 1988 to 2002.
- In 2002 Alexandria Landfill Pty Ltd acquired operation of part of the ALF which was licensed as a general solid waste landfill. The rest of the ALF was acquired by Boiling Point Pty Ltd which was operated by Dial-A-Dump Industries Pty Ltd (DADI) as a waste recycling and transfer facility.
- In December 2014 the site was acquired by WestConnex Delivery Authority (WDA, now Sydney Motorway Corporation (SMC)) and in October 2015 the ownership of ALF was transferred to RMS.

Table 7: Site Historical Land Uses – Alexandria Landfill

Year	Main Land Use
June 2016	CDS JV took possession of the site.
December 2014 to October 2015	Non-operational landfill and waste recycling and storage facility occupied and managed by WDA (now SMC).
December 2014	Ownership of ALF transferred to RMS.
2002 to December 2014	Non-putrescible landfill operated by Alexandria Landfill Pty Ltd, while the waste recycling and storage facility operated by Dial-A-Dump Industries Pty Ltd (DADI).
1988 to 2002	Landfill operated by the City of Sydney Council as a general solid waste landfill.
1962 to 1988	Abandoned brick works and quarry and potential small scale non-licensed landfilling activities. Brick works buildings and structures demolished in 1970.
1908 to 1962	Quarry and brick works operated by Austral.
Prior to 1908	Unknown but likely mainly agricultural and minor residential or commercial/industrial use by the various land owners.

[2] The EIS required for the Project Approval includes a series of Technical Working Papers to address the Secretary's Environmental Assessment Requirements (SEARs). The Technical Working Paper; Contamination (AECOM, 2015o) addresses the SEARs relating to contaminated sites.

In regards to the extent and nature of the waste landfilling activities the following is noted (AECOM 2014a):

- During the 1990s acceptance of waste at ALF appeared to have been less regulated and therefore uncontrolled contaminated materials may have been disposed during this period.
- From 1988 to1996 the landfill was reported to be filled with non-putrescible solid waste, incinerator ash, demolition waste (including asbestos), industrial and commercial waste and incinerated green waste. The green waste was incinerated on the site in a pit burner. Reports stated that after 1996 the landfill ceased accepting asbestos waste and no longer incinerated green waste. The green waste materials were buried and composed about 9% of the total accepted landfill materials.
- In 1999 landfill operators were accepting non-approved contaminated wastes. The nature and volume of illegal waste accepted and the areas filled are unknown.
- Between 2002 and the present, ALF was licensed to accept general solid waste (non-putrescible, no garden or wood waste), shredded tyres and asbestos.
- Approximately 900,000 m^3 of fill has been disposed within the landfill, representing approximately 47% of the total landfill capacity. The filling history of the landfill indicates that the eastern portion of the landfill was filled in preference to the western portion.
- The base of the landfill is not lined and therefore fractures and joints within the underlying Ashfield shale may be providing migration pathways for contaminated leachate and gas to enter the Botany Sands Aquifer or Ashfield Shale Aquifer.
- BM was previously occupied by the brick works operation. It included large buildings constructed of brick and fibre cement materials (which may potentially have contained asbestos). It does not appear that historical land fill occurred at this location as part of the ALF (AECOM 2014a). However, potential soil contamination at the base of the current stockpile of crushed sandstone, and elsewhere on the BM site, may exist as a result of the historical brick works and associated historical building demolition activities. A photograph from approximately 1994, presented in the AECOM (2014a) Phase 1 report, provides a view of the buildings fronting Campbell Lane.

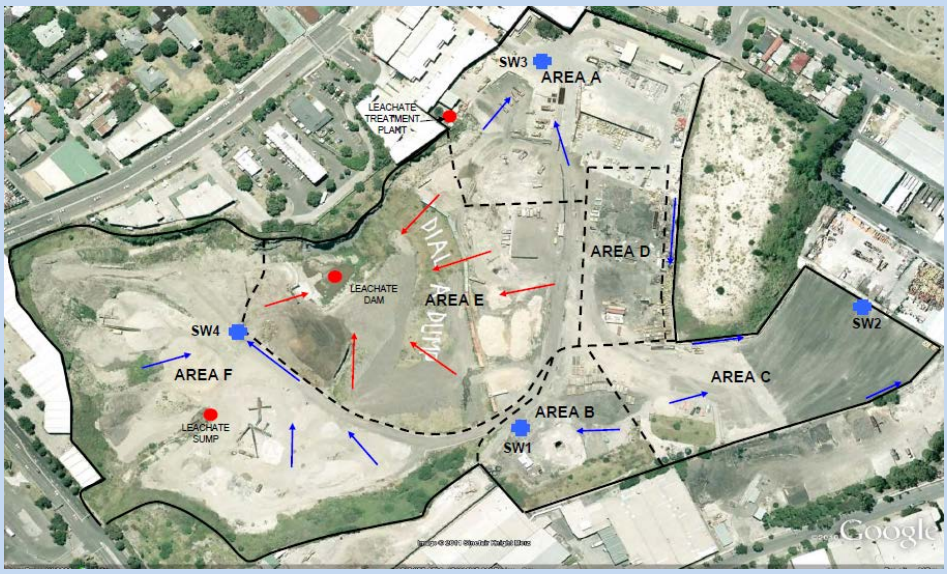
2.3 Site Conditions and Surrounding Environment

The site conditions and surrounding environment are detailed in the Phase 1 ESA (AECOM 2014a) report with summary information also provided in the Phase 2 ESA AECOM (2015m) report, and the EIS Technical working paper: Contamination Appendix O (AECOM, 2015o).

A summary of the key information is provided in Table 8.

Table 8: Site Conditions and Surrounding Environment – Alexandria Landfill (AECOM 2015m)

Item	Description
Site boundary	The ALF site has security fencing along all the boundaries except for the boundary with the Canal Road site. The BM site also has a security fence along its boundary with the ALF site.
Topography	As a result of historical quarrying activities and landfilling, the Site surface contains a depression at a maximum depth of approximately – 12 m AHD in the south-west portion of the site. The northern and eastern extent of the site, outside the depression, is relatively level as a result of historical filling. The north-west portion of the ALF pit consists of gentler grades, sloping towards the deepest part of the depression in the south-west portion of the site. The western walls of the site rise steeply from the pit to the Site boundary. The highest point of the site is the stockpile on BM, where the highest elevation is 22 m AHD. The stockpile slopes steeply on all sides. Crushed sandstone has recently (2015) been relocated from the southern portion of the stockpile, for placement along the north-west wall of ALF pit wall to stabilise the embankment.
Buildings	ALF presently contains the following buildings: - Weighbridge office; - Demountable office buildings on stilts along the Albert Street boundary; - The two storey site office located in the north-west corner of the site. The ground floor is constructed of brick and the first floor is a temporary/demountable structure; and - A workshop is located in the north-west portion of the site adjacent to the leachate treatment plant (LTP).
Roads	A haul road runs from the site entrance on Albert Street to the base of the landfill. The northern portion of the road is sealed (concrete) while the portion of the haul road descending into the landfill pit is unsealed.
Site Activities	Landfilling and acceptance of waste materials has not occurred at the site since it was acquired by WDA in December 2014. Since that time the activities at the site have included: - Ceasing of landfilling operations; - Processing and removal of stockpiled materials within the waste transfer facility and associated infrastructure; - Removal of portions of Stockpile 21 for off-site disposal ; - Continued pumping of leachate and operation of the LTP; and - Construction of a support berm to increase slope stability along the Princes Highway boundary of the site (the steep embankment of the pit). This support berm comprises: o Soil excavated from BM; o Batters with a slope of 1.5H:1V; o Two berms with a width of 3 m and reinforced concrete drains;

	o Strip drains for drainage; and o Hydromulch for erosion protection.
Odour	Leachate odours have been noted within the Site, particularly in close proximity to the leachate sump risers.
Surface Water	ALF contains the following surface water catchments according to the Surface Water and Leachate Management Plan (SWLMP) (IGGC, 2012): - **Northern Area (Area A) including recycling premises, weighbridge, workshops, offices, parking:** Storm water flows into surface drains which discharge to a main subsurface stormwater drain that connects to the off-site drain in Canal Road. - **South-East areas (Areas B and C) including the stockpiling and processing areas:** Surface water discharges to stormwater drains after sediment control and treatment. - **North-East Area (Areas D and E) including waste transfer areas and the landfill premises:** Surface water that accumulates is transferred to the leachate dam. The water is pumped from the dam to the LTP. The treated water from the LTP is discharged to the sewer under a Trade Waste Agreement (TWA) with Sydney Water. - **Southern and South-Western Areas (Area F - Lower Recycling Premises):** Surface water is collected by drain and sump with sediment control and discharge to stormwater with treatment and monitoring. - The figure below (Ian Grey Groundwater Consulting Pty Ltd (IGGC 2012) shows the areas discussed above.  It is inferred that surface water from BM will run off in a radial direction and be captured by the existing ALF surface water catchments or local stormwater drainage networks located on Campbell Lane.
Local Groundwater Use	- The site is located within Zone 2 of the Botany Groundwater Management Zone. Residents within Zone 2 are advised that domestic groundwater use is banned, including the use of water for drinking, watering gardens, washing windows and cars, bathing, or to fill swimming pools.

	- Sydney Park, located approximately 50 m north of the site, has a leachate system which pumps and treats groundwater / leachate from within Sydney Park and discharges to the sewer under a TWA. - No other groundwater uses are known. However, there could potentially be other users on surrounding industrial or commercial properties.
Environment Protection Licences	The site operates under EPL 4627: Road construction. The licence includes: - the processing, handling, movement and storage of materials and substances used to carry out the road construction; and - the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the road construction.
Surrounding Land Uses	**North**: The Site is bounded to the north by Albert Street, Holland Street, Campbell Lane and Campbell Road. Low-medium density residential properties are located along these roads, with Sydney Park situated across Campbell Road. Commercial and industrial buildings are also located to the north-west and north-east of the Site. **East**: Land immediately adjoining the eastern boundary of the Site consists of industrial buildings and a vacant portion of land that is owned by the Sydney City Council. Burrows Road and Alexandra Canal are situated further east, with more industrial properties situated between Burrows Road and Alexandra Canal. **South**: ALF is bounded by Canal Road to the south followed by an industrial estate. Commercial and industrial buildings are situated south-west of the Site. These premises are, bounded by Canal Road and Princes Highway. **West**: Land to the west of the Site consists of commercial and retail premises. The activities at these premises include commercial dry cleaning, fast food outlets, a hotel, mechanical workshops, retail shops, warehouses/workshops and other commercial operations. The Princes Highway is situated further to the west followed by a mixture of retail/warehouse premises and mixed low and high density residential developments.

2.4 Geology and Hydrogeology

Information on the geology and hydrogeology at the Site is provided in the following reports:

- Phase 1 ESA (AECOM 2014a);
- Phase 2 ESA (AECOM 2015m);
- Alexandria Landfill Closure Hydrogeological Assessment report (AECOM 2015n); and
- A summary in the EIS Technical Working Paper: Contamination Appendix O (AECOM 2015o).
- A summary of the key information provided in these documents is presented in the following sections.

2.4.1 Geology

According to the Sydney 1:100,000 Geological Series Sheet 9130 (DMR, 1983) natural soils within the Site comprise Quaternary sediments consisting of alluvium (gravel, sand, silt and clay) underlain by Ashfield Shale of the Wianamatta Group.

The Ashfield shale within the site consists of dark grey laminate and sideritic siltstone which contains ironstone bands up to 100 mm in thickness. The shale was previously quarried at the site to an approximate maximum depth of -32 m AHD. The quarry area was historically referred to as the Ralford Pit (excavated until ~ 1975).

A cross-section of the Ralford Shale Pit from McNally and Branagan (1998) is shown below in Figure 1. The Ashfield Shale is underlain by Hawkesbury Sandstone at an unknown depth but is expected to be within 5 to 10 metres from the base of the quarry (AECOM 2015m and 2015n).

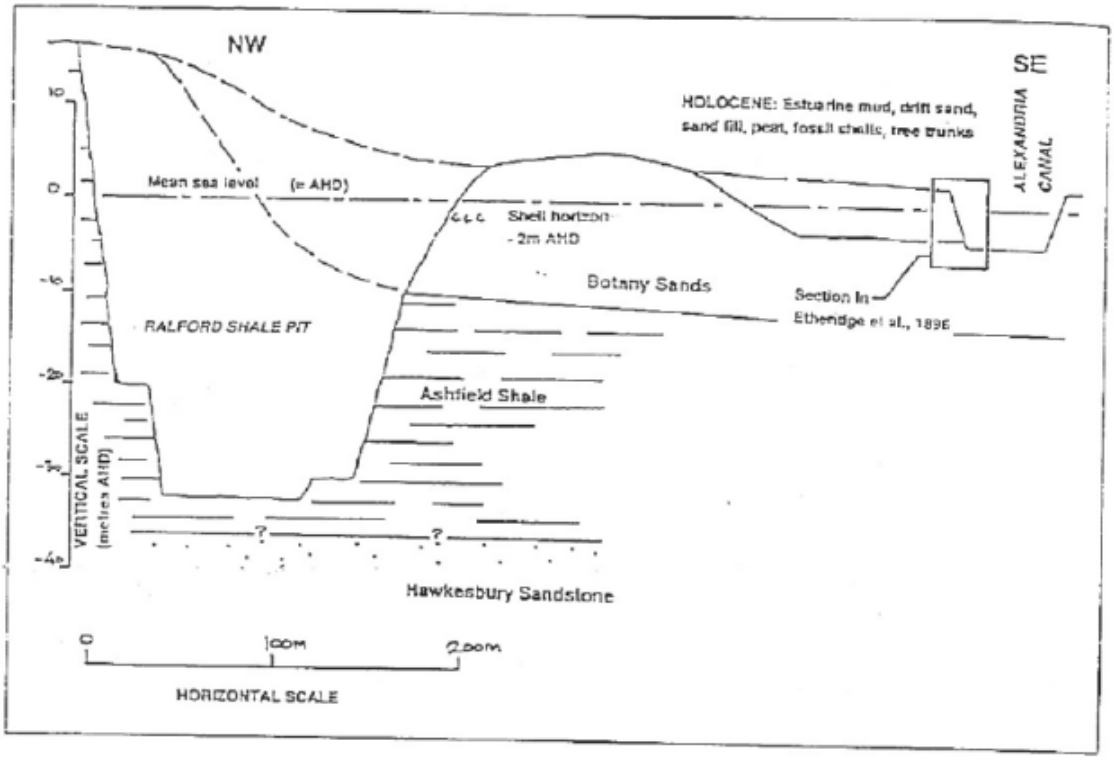


Figure 1: Geological cross section of the ALF from 1985 (extracted from Fig 5 in McNally and Branagan 1998, as presented in AECOM 2014a).

A former Holocene shoreline runs through the centre of the Site in an orientation parallel to the current Alexandra Canal (McNally and Branagan, 1998). Deposits of the Botany Sands are exposed along the south-eastern boundary of the former quarry. The Holocene sediments in the eastern half of the Site have been described to consist of the following unconsolidated layers (from ground surface):

- Fine sand, yellow and grey with shell and charcoal fragments;
- Shell band, with quartz sand and carbonised wood;
- Sand with abundant fine shell fragments;
- Sand increasing with clay content with depth;
- Clay, dark grey with yellow staining;
- Discontinuous peat beds (0.2-0.3 m thick); and
- Clay, grey-blue, plastic, slightly sandy.

Table 9 summarises the geologies encountered during the Phase 2 ESA intrusive works undertaken by AECOM (2015m).

Table 9: Geologies Encountered During AECOM (2015c) Intrusive Works

Geology	Description of profile and depths encountered
Fill	• Fill consisted of a mixture of soils, gravels, cobbles and highly variable refuse. The main types of refuse encountered in the boreholes were: timber and wood/plant waste, bricks, concrete, ceramics, glass, metals, ash, plastics, building/roof insulation, fabric and paper. A high proportion of decomposing timber and wood waste was encountered • Petroleum hydrocarbon, chemical and leachate odours were encountered in several boreholes. • Encountered fill depths ranged from 1.3 m below ground level (bgl) in the northern portion of the site to 41 m bgl in deepest portion of the former quarry. • The depth of fill in the south-east portion of the site (outside the footprint of the former brick pit quarry) ranged from 1.5 to 9 m bgl.
Natural Soil	• Natural soil underlying the fill ranged from not present within the former brick pit quarry to 9.3 m thick in the eastern portion of the site. • The average thickness of the natural soil in the eastern portion of the site, outside the former quarry pit, was 7.5 m. • The natural soils encountered were typically consistent with alluvial sediments described by McNally and Branagan (1998), excluding identification of a layer consisting of clayey sands with trace shells rather than abundant shells.
Bedrock	• The maximum coring depth was 51 m bgl (-44.26 m AHD). The general geology beneath the site was laminite underlain by siltstone and then sandstone. • The base of the quarry pit was mainly siltstone and laminate, with the exception of part of the southwest portion of the pit which was directly underlain by sandstone. • The degree of fracturing in the bedrock underlying the site was described in the cored borehole logs.

2.4.2 Hydrogeology

McNally and Branagan (1998) presented a conceptual model of the groundwater system within the St Peters Quarry which illustrated that the water table was at approximately sea level prior to excavation of the quarries within the Botany Sands aquifer. According to the model, groundwater from the Botany Sands aquifer and shale fractures will have seeped into the quarry basements prior to filling with landfill material causing ponding of the groundwater (AECOM 2015m).

McNally and Branagan (1998) noted that following filling of the quarry with landfill material, rainfall, runoff and water infiltration from other sources (e.g. Alexandra Canal) was likely to have caused leachate in the fill to mound and hydraulically connect the Botany Sands aquifer to the underlying shale aquifer.

The conceptual model also details the construction of a leachate pumping system and illustrates how capping of the filled quarry will lower the water table (AECOM 2015m).

- Based on the groundwater monitoring network, where wells are screened in the landfill, Botany Sands aquifer and underlying bedrock the following is noted regarding the groundwater flow direction (AECOM 2015m):
- The inferred groundwater flow direction for the groundwater in the Botany Sands and landfill was towards the main the leachate sump (LP1) located in the southwest portion of the site (shown in the photograph in Table 8), with flow from all directions.
- It appears that groundwater from the bedrock on the north, north east, west and south west sides of the site is also flowing towards LP1 and is connected to groundwater within the landfill.
- Deeper groundwater was present in the eastern and down-gradient side of the Site however it is unclear, due to the limited number of groundwater monitoring wells screened in the bedrock, whether groundwater is flowing towards or away from the site in the eastern portion of the site.

Subsequent hydrogeological assessment by AECOM (2015n) noted that (as summarised and presented in the EIS Technical Working Paper: Contamination Appendix O (AECOM 2015o)):

- Leachate is generated from groundwater derived from the Botany Sands, Ashfield Shale and surface water run-off percolating through the fill material. Groundwater, as leachate, is pumped from the pit in the main leachate sump (LP1) and treated before being discharged off-site to the sewer in accordance with a TWA.
- The Botany Sands is a shallow unconfined aquifer perched on top of the Ashfield Shale, in which groundwater levels will be expected to be at just above sea level in an undisturbed environment.
- The Ashfield Shale is a semi confined fractured rock aquifer where the dominant groundwater movement is along secondary structural features rather than the rock mass. Natural groundwater levels will be expected to be close to sea level with regional groundwater flow to the south. Local groundwater flow is expected to be radial flow towards the centre of the landfill due to the influence of the leachate pumping from the main leachate sump (LP1).
- The interpretation of hydrographs generated during the investigation indicated the fill material, shale and Botany Sands respond quickly to rainfall recharge. The levels in the shale respond and decline rapidly whereas the decline in the Botany Sands and the fill material is slower. Superimposed over the hydrographs for the shale and Botany Sands were cyclic tidal influences.
- Groundwater gauging and the plotting of the groundwater levels confirmed there was radial drainage within the fill and shale (surrounding the landfill) centred on the leachate pump.

2.4.3 Flood Potential

As reported in the Phase1 ESA (AECOM 2014a), the site is not affected by a policy adopted by the Council that restricts the development of site because of flooding or tidal inundation, however due to the depression within the site, flooding would likely occur if the current leachate system was not in operation or after periods of heavy rainfall.

2.5 Summary of Land Contamination

Land contamination issues at the Site are associated with its historical use as a landfill and waste transfer and recycling facility. They principally relate to the fill material and the associated leachate and landfill gas generation.

It is understood that approximately 900,000 m^3 of fill material has been disposed within the landfill, which comprises approximately 47% of the total landfill capacity. The base of the ALF is not lined and, as such, fractures and joints within the underlying Ashfield shale may be providing migration pathways for contaminated leachate and gas to enter the Botany Sands and Ashfield Shale Aquifers.

2.5.1 Contaminants of Potential Concern

Based on the most recent investigations completed at the site on behalf of WDA, the key CoPC are identified as including: heavy metals; polycyclic aromatic hydrocarbons; petroleum hydrocarbons (measured as total recoverable hydrocarbons (TRH)), dioxins, asbestos, methane, carbon dioxide, carbon monoxide, hydrogen sulphide and ammonia.

2.5.2 Soil Contamination

During the approximate period 1988 to 1996 the ALF was reported to have been filled with non-putrescible solid waste, incinerator ash, demolition waste (including asbestos), industrial and commercial waste and incinerated green waste.

Previous environmental assessment reports stated that after 1996 the ALF did not accept asbestos waste and no longer incinerated green waste. The green waste material was directly buried and comprised approximately 9% of the total fill material.

In 1999 the landfill operators were accepting non-approved contaminated waste. The type and extent of illegal waste that was accepted, and the areas that were filled, are unknown. These non-approved waste disposal practices are understood to have continued for over a period of four years. Between 2002 and present, ALF has been licensed to accept general solid waste (non-putrescible, no garden or wood waste), shredded tyres and asbestos. However, landfill and resource recycling activities ceased in December 2014 when RMS acquired the Site.

Contamination within the landfill waste is highly variable both laterally and vertically. CoPCs in the waste material at the Site were detected at concentrations exceeding human-health and ecological based assessment criteria for both the open space and commercial/industrial land use scenarios.

The CoPCs include: lead; carcinogenic PAHs, TRH, dioxins and asbestos (AECOM, 2015m).

The depth of contamination encountered ranged from 3.2 to 23 m bgl, with no consistency in the nature of contamination due to the varied landfilling history at the Site.

2.5.3 Groundwater Contamination

Groundwater monitoring at ALF has been undertaken from 1997 to 2015 and has included sampling of monitoring wells screened within the fill materials, Botany Sands and the underlying shale or sandstone bedrock. The CoPCs were identified in samples collected from the groundwater monitoring wells that are screened in the fill material (i.e. landfill leachate) and/or the surrounding groundwater.

The CoPCs with concentrations in excess of the adopted site assessment criteria, include: ammonia, TRH, heavy metals and benzene.

Light Non-Aqueous Phase Liquid (LNAPL), in the form of diesel/oil, was previously identified in one monitoring well (MW306, AECOM 2015m) that is located in the centre of the ALF site. This well is screened within the landfill waste material.

2.6 Landfill Gas

Recent investigations found elevated concentrations of landfill gases at the site including: methane, carbon dioxide, carbon monoxide and hydrogen sulphide.

Results of methane monitoring that were undertaken as part of the Phase 2 ESA (AECOM, 2015m) indicate the Site is classified as Characteristic Gas Situation 4 (moderate to high risk) based on the Modified Wilson and Card Classification (MWCC) (NSW EPA, Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases, 2012).

The investigation also detected concentrations of landfill gases at the locations adjacent to the site boundary greater than the NSW EPA Environment Guidelines, Solid Waste Landfills (1996) value.

2.7 Existing Landfill Features and Operations

Following acquisition by WDA on 20 December 2014, landfilling and waste recycling activities have ceased and the Site has remained in caretaker mode in preparation for the commencement of landfill closure works, subject to receipt of environmental approvals.

A summary of the relevant existing landfill features including leachate, surface water, stormwater, groundwater, landfill gas and air monitoring systems and infrastructure at the site is provided in the Sections below. The existing site layout and infrastructure has been considered as part of the landfill closure planning for the site.

2.7.1 Site Infrastructure

At the time of the Phase 1 ESA (AECOM 2015a), site infrastructure consisted of the following:

- Roads: A partly unsealed haul road runs from the site entry to the base of the landfill and a temporary access track is located on the on the Bradshaw Mountain stockpile.
- Fencing: The site is bound be security fencing along all boundaries of the site except for the boundary between the Canal Road property and the Site.
- Buildings: The Alexandria Landfill presently contains the following buildings:
    - Weighbridge office.
    - Demountable office buildings on stilts along the Albert Street boundary.
    - A two storey site office located in the north-west corner of the Site (part brick and part temporary/demountable structure).
    - A workshop is located in the north-west portion of the Site adjacent to the leachate treatment plant.
- Remnants of the old brick works walls remain on the street boundaries of the site near Bradshaw Mountain.

2.7.2 Recent changes to the site

The site has been cleared by RMS and their subcontractors of waste stockpiles as can be seen in the aerial photograph, dated 18 December 2015 and 29 November 2014, respectively (Figure 2 and Figure 3).

Based on a site visit and view of aerial photographs, key changes that were implemented on the site between November 2014 and December 2015 are:

- Removal of various stockpiles across the site;
- Ceasing of recycling and waste processing operations;
- Removal of containers in the eastern part of the site;
- Removal of temporary structures;
- Processing and stockpiling of crushed concrete in eastern part of the site;
- Improvements to surface water management, including minor grading of surfaces and construction of a sediment basin in the eastern part of the Site;
- Construction of a support berm to increase slope stability along the Princes Highway boundary of the site. This support berm comprises:
    - Soil excavated from ‘Bradshaw Mountain’;
    - Batters with a slope of 1.5H:1V;
    - Two berms with a width of 3 m and reinforced concrete drains;
    - Strip drains for drainage ;
    - Hydromulch for erosion protection;
- Construction of a sedimentation basin in the eastern part of the site.

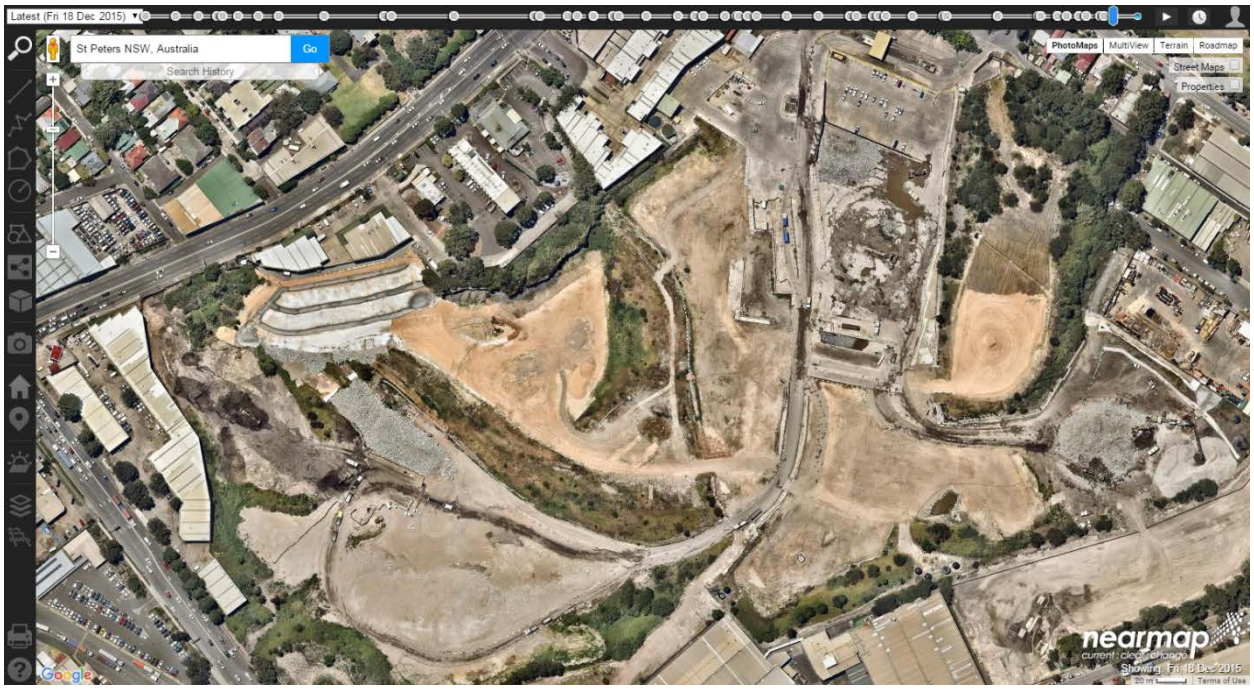


Figure 2: Aerial Photograph 18 December 2015 (Source: Nearmap)

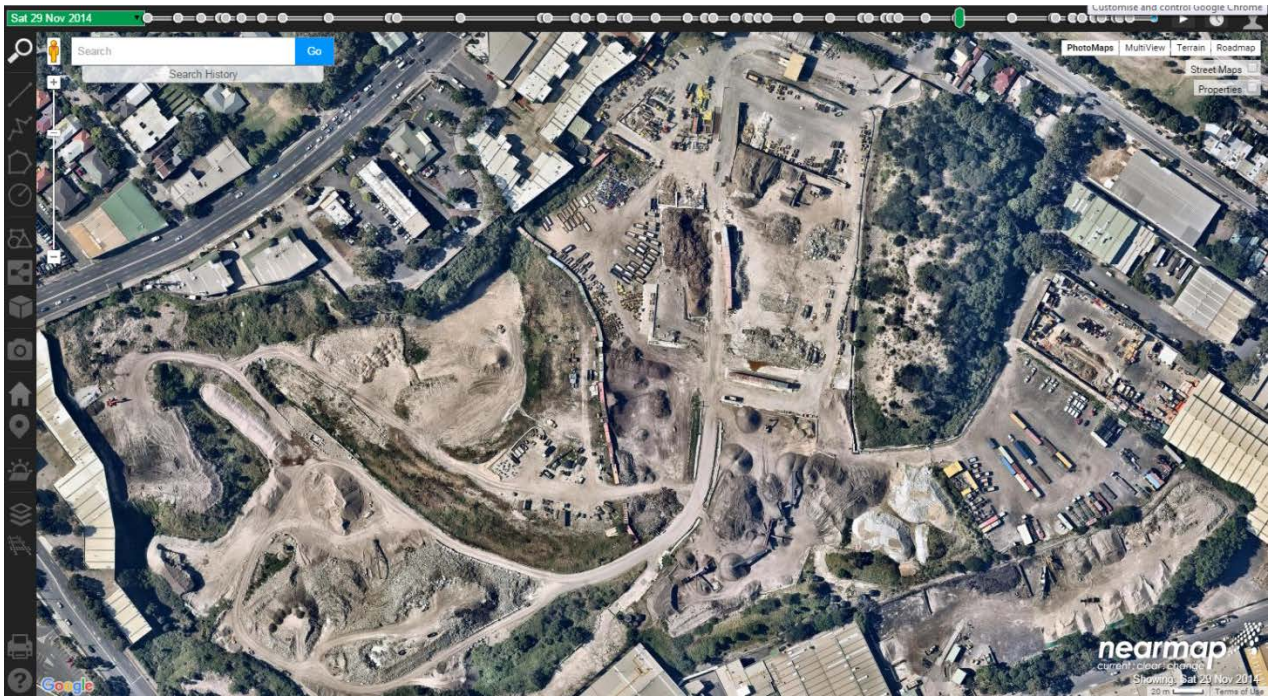


Figure 3: Aerial Photograph 29 November 2014 (Source: Nearmap)

2.7.3 Landfill Cap

As described in Section 2.2, it is understood that the site has been actively used for landfilling and waste recycling and transfer and that no final landfill cap has been historically constructed. Interim day cover may have been used to cover landfilled waste as part of the historic landfill capping regime.

2.7.4 Existing Leachate Management System

Based on the information presented by AECOM in TM 1 and the LCMP (AECOM, 2015l), we understand the existing leachate management system comprises the following components. It should be noted that 'as built' information for the existing leachate management system is not available and the following information is based on the design documentation and site observations reported by AECOM and JPG Engineering (who conducted the site inspection referenced in the AECOM TM1).

- **Leachate subsurface drainage:** The design comprises 150 mm diameter slotted polyvinyl chloride (PVC) pipes that discharge into a 375 mm diameter reinforced concrete pipe (RCP), in a herringbone arrangement. Although the design does not appear to include a granular drainage layer, review of the borehole logs included in the Phase 2 ESA indicates a layer of sandy materials is present at the base of the existing landfill in some locations including BH330, BH343, BH385 and WCX_BH_045.

  Based on available information, it is not clear whether the drainage system was constructed on rock at the base of the original quarry excavation. It is possible that the system was constructed after some waste placement had occurred in the excavation such that the system is founded on waste materials. If founded on waste, there would be increased risk of loss of functionality of the system over time due to differential waste settlement.

- **Main leachate sump:** The subsurface herringbone drainage network drains to a leachate sump located at the south-western end of the landfill. The design elevation of the base of the sump is approximately -24.5 mAHD. The total length of the riser pipe is understood to be 17.28 m deep, with an invert of 13.28 mbgl, indicating that the elevation of the top of the riser pipe is approximately -7.2 mAHD and that the riser pipe extends approximately 4 m above existing ground level. The design for the sump comprises 2.1 m diameter concrete vertical pipes, with a single submersible pump and an agitator located at the base. An internal overflow pipe is located at approximately 1.5 m below existing ground level.

  The standing water level was measured by JPG Engineering to be 9 m and 7 m below the top of the sump on 30 December 2014 and 2 February 2015, corresponding to approximate elevation -16 mAHD and -14 mAHD, respectively. We note that conditions O5.15 and R4.3 in EPL4627 require that the leachate level in the riser is maintained below -16.0 metres AHD and at least 0.5 metres below the standing groundwater level.

  Leachate is pumped automatically from the sump to the Leachate Treatment Plant (LTP), located at the northern boundary of the landfill, via a 110 mm OD HDPE pipeline that runs to the southwest boundary and then along the western and northern perimeter boundaries of the landfill. (Refer to Section 5.3 for LTP details.) The leachate system is reported to likely account for the 80 - 100 m^3 per day of leachate currently being discharged to sewer.

- **Intermediate leachate risers:** An intermediate leachate riser is located within the licenced landfill premises area, in the location of the former leachate pond. A surface leachate sump is located north east of the main leachate riser. Leachate from both these locations is understood to be pumped into the main leachate sump via 75 mm and 63 mm OD HDPE pipelines, respectively.

- **Former secondary leachate system:** A secondary leachate system was understood to have been used between approximately 2003 and 2011 to collect shallow leachate and contaminated run off from the active tipping area. The system comprised an interception drain and injection trench (approximately 1 m wide and 7.5 m deep) and drained into the main leachate system by infiltration. We understand the system is no longer in use.

Treated leachate is pumped from the LTP to a sewer discharge point in Albert Street under Trade Waste Agreement (TWA) 29304 with Sydney Water Corporation (SWC). The requirements of the TWA are outlined in Section 5.6 of the LEMP included in Annexure G.

2.7.5 Leachate characterisation

Based on information presented in the Phase 2 ESA (AECOM, 2015m), it is understood that leachate quality has been monitored quarterly and/or annually since 1996 until February 2015. During this time, the ammonia concentrations at the leachate extraction sump (LP1) have fluctuated and have been typically been reported as between 100 and 300 mg/L.

As part of the Phase 2 ESA (AECOM, 2015m) eight monitoring wells were installed in the landfill to monitor leachate (MW304, MW305, MW306, MW307, MW308, MW311, MW313 and MW314).

Concentrations of ammonia and TRH were lowest near the edges of the landfill pit and highest in the central portion and closest to the leachate sump (LP1). A thin layer (<5 mm) of low non aqueous phase liquid (LNAPL) (potentially a mixture diesel and oil) was detected in MW306 in the central portion if the landfill.

Further details on the leachate monitoring wells installed are provided in the LEMP in Annexure G.

2.7.6 Existing Leachate Treatment Plant

As at mid-2015, the leachate treatment plant (LTP) comprised a sequential biological reactor (SBR) system. It is understood that the primary function of the treatment system is to remove ammonia from incoming leachate. WAMC has confirmed that the existing LTP has not been adequately designed to treat incoming leachate from the Site and does not fully comply with existing Sydney Water TWA requirements for the treatment of ammonia. WAMC is consequently preparing an effluent improvement program to ensure future compliance with the existing Sydney Water TWA. The former Sydney Water TWA (No. 29304) listed that the treatment plant contained the following components:

- 1 x 80 kL biological treatment plant (batch discharge).
- 1 x 100 kL biological treatment plant (batch discharge).
- 1 x Rainfall Sentinel MEA 2211.
- 1 x ABB Magmaster electromagnetic flow meter

The LTP has since been refurbished. The refurbishment of the LTP was intended to be an interim measure to increase ammonia treatment efficiency for consistent compliance with a new trade waste agreement issued in June 2015. The refurbishment was conducted by JPG Engineering and included the installation of new equipment, repurposing of some existing equipment and removal of non-serviceable equipment.

Based on site observations made by Golder on 27 January 2016, it is understood that:

- Installation and construction activities are complete and the system is currently in a hot commissioning phase that is to be completed by the end of February 2016
- The plant is currently treating leachate at a rate of 140 kL/day, with treated water discharged to sewer under the TWA.
- If field testing in central sump feed shows ammonia levels are <0.9mg/l then there is an opportunity to discharge to stormwater. This has occurred once since RMS has taken over management of the site.
- At times the Central Sump (Stormwater Sump) is being fed into the treated tank due to low ammonia levels.

- The main part of the old plant that has been retained during the refurbishment is the Treated Leachate & Blending Tank which is concrete. New pipework has been connected to it.
- The new pipework comprises flanged HDPE Pipe (DN110 PN10 SDR17 PE100) for all the leachate lines and flanged DN100 SCH40 stainless steel for the blower air lines as well as around connections for equipment, instrumentation & valves in the leachate lines.
- The bund around the plant has recently been completed using prefab modular panels infilled with concrete and dowelled into the existing base slabs and underlying wall. It is now a consistent 1 m high above existing ground surface. However, the surface undulates around the site, with the western side being higher than the eastern side.

Further information on the existing system is provided in Section 0.

2.7.7 Surface Water and Stormwater Management System

Current surface water management procedures are as follows.

According to the Soil and Water Management Plan for Alexandria Landfill prepared by Ward Civil & Environmental Engineering (WCEE) in August 2015 (WCEE 2015), Current surface water management at the site comprises the following.

Stormwater is managed through a combination of diversion drains and erosion and sediment controls. The Plan outlines the mitigation measures implemented at the site and associated inspection and monitoring procedures. The following mitigation measures are identified;

- Site inductions and regular training to ensure key water management procedures and controls are maintained.
- Installation of erosion and sediment control measures in accordance with Managing Urban Stormwater – Soils and Construction Volumes 1 and 2, 4th Edition (Landcom, 2004) including sediment fencing and check dams as necessary.
- Diversion of clean surface water flows around the worksite.
- Appropriate storage of fuels and chemicals in compliance with AS1940-2004, AS 4452-1997 and suppliers' instructions. Spill kits are located at compound sites and key risk locations in the event of a fuel or chemical spill.
- Plant maintenance and refuelling, chemical mixing and similar activities are located in areas that do not drain directly to a waterway or drainage line.
- Construction of concrete wash out areas are located such that there is no risk of wastewater entering drainage lines or waterways.
- At the crushed concrete storage area on Holland Street, runoff is contained by a shotcrete covered earth berm north east of the site and collected in a concrete lined sump. An emergency spillway drains to two stormwater pits. The water collected in the sump is pumped to a settlement tank prior to discharge to the stormwater system. A water tank is to be installed adjacent to the settlement tank to accommodate any overflow. Clean surface water is diverted around the storage area by a row of sandbags placed along the truck access. (this is the only specific information on stormwater management design)

A weekly inspection of disturbed areas, stockpiles, stormwater pits and inlets and erosion and sediment controls is undertaken as well as prior to and after periods of heavy rainfall. Rainfall forecasts are monitored on a daily basis and daily rainfall levels at the site recorded. In addition to the monitoring of stormwater controls and infrastructure, stormwater is tested prior to discharge. The water quality is monitored in accordance to the WCEE Discharge or Reuse Water Procedure. All non-conformances identified by testing and inspection are recorded and rectified in a timely manner. The stormwater management procedures are periodically reviewed to ensure objectives and targets are met.

2.7.8 Groundwater Management System

The existing understanding of the groundwater management system is summarised in Table 10.

Table 10: Groundwater Infrastructure Summary

Item	Description
Groundwater Extraction	Based on the information presented by AECOM (2015c), the extraction of groundwater from the Botany Sands aquifer began in approximately 2001/2002, with the installation of two groundwater interception systems (designated BS1 and BS2) between Alexandra Canal and the landfilled area. The aim of the system is to intercept groundwater upgradient of the site and reduce the volume of leachate being generated due to groundwater inflow. SMC/RMS have provided comment that the system is currently operational. Details of the system are based on design details, not as-built drawings, summarised as follows (as reported in AECOM 2015c): • **BS1**: The primary Botany Sands extraction system (BS1), located southeast of the landfill site, is an interception drain approximately 20 m long, 2 m wide and extends to a depth of -10 m AHD. The drain comprises a 300mm ID PVC slotted pipe, wrapped in geotextile at the base of the trench, backfilled with coarse brick, sand and gravel. A concrete sump is located at the northern end of the drain. The sump has perforations and is wrapped in geotextile. We presume there is a pump in the collection drain to transfer the groundwater into the storage tanks shown in Figure 1 in TM1, however in their inspection of BS1 on 12 January 2015, JPG noted the power appeared to have been disconnected. Based on an the groundwater contours presented in the Phase 2 ESA, it is also likely that the 20 m trench in the existing extraction system (BS1) is only capturing a portion of the groundwater inflow from the south into the landfill. • **BS2**: The second Botany Sands extraction system (BS2), located approximately 100 m west of BS1, comprises a collection pipe and sump that pumps to one 45 kL and two 27 kL storage tanks with an overflow to the stormwater drain. • **Re-use of extracted groundwater**: AECOM reports that the extracted groundwater is stored onsite in 50,000 litre capacity tanks and has historically been used for dust suppression by water cart (accounting for approximately 21 to 36 kL/day). Excess groundwater is understood to be discharged to the stormwater drainage system on Canal Road. The Memo for Project Manager indicates that a buried HDPE transfer pipeline connects the storage tanks to the LTP system (the Botany Sands Transfer line in Figure 1 in TM1), and that a centrifugal pump connected to the storage tanks allows the transfer of groundwater to the LTP or directly the sewer. • **Approvals**: Groundwater from the Botany Sands aquifer is being extracted by RMS under a licence from DPI Water.
Groundwater Monitoring Wells	The following groundwater monitoring were monitored and sampled as part of the EPL compliance and existing ICCG (2012) SWLMP and were installed between 1997 and 2005: • MW1, MW2d, MW3 and MW4b which are screened in bedrock • One monitoring well MW2s screened in the botany sands The additional four groundwater monitoring wells were installed as part of the Phase 2 ESA (AECOM, 2015): • MW309/MW310, MW312 and MW315 screened in Botany Sands • Further details on the above existing monitoring wells are provided in AECOM (2015m).

2.7.9 Groundwater Quality

Based on information presented in the Phase 2 ESA (AECOM, 2015m), it is understood that groundwater monitoring has been undertaken around the perimeter of the landfill since 1997.

The latest round of groundwater gauging and sampling completed in February 2015 as part of the Phase 2 ESA (AECOM, 2015m) indicates the following:

- Groundwater in the leachate, Botany Sands and up-gradient bedrock was found to be flowing on an inward gradient towards the main leachate sump in the southwest of the site.
- It is unclear if groundwater is flowing towards or away from the sump in the bedrock aquifer in the southeast of the Site (at MW2D).Concentrations of cobalt, copper, nickel and zinc exceeded ANZECC (2000) 95% trigger values for marine ecosystems criteria in the bedrock aquifer and were at similar or higher concentrations as detected in the leachate. Lead slightly exceeded the ANZECC (2000) 95% trigger values for marine ecosystems in the Botany Sands in southern corner of the Site.
- Concentrations of ammonia slightly exceeded the ANZECC (2000) 95% trigger values for marine ecosystems criteria in the wells screened in the Botany Sands and bedrock aquifers.
- Concentrations of TRH, BTEX, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) were not detected in the Botany Sands or bedrock aquifer.

2.7.10 Existing Landfill Gas Management

Based on information presented in the previous LCMP (AECOM, 2015l), it is understood that landfill gas issues have been previously identified along the eastern boundary of the site where gas emissions and odours have been recorded along the interface between waste and natural weathered shale.

At the request of DECC (now EPA), the owners of the site engaged Douglas Partners (2008) to prepare two landfill gas mitigation designs for the perimeter of the facility as well as numerous landfill gas mitigation methods, a plan for construction and a potential monitoring program. It is unknown whether this plan was implemented.

The previous LCMP (AECOM, 2015l) also indicates that the Alexandria Landfill Site-Recycling and Landfill Premises Revised Surface Water and Leachate Management Plan (SWLMP), (ICCG, 2012) identifies a subsurface gas mitigation trench installed in the north-western area of the Site, as shown in Figure 4 below.

Figure 4: Reported location of existing gas mitigation system

LCMP – FD (100%)

No ‘as built’ records are available for the trench; however the Report on Landfill Gas Mitigation Measures Alexandria Landfill, St Peters (Douglas Partners, 2008) provided design plans. As reported in the Draft LCMP (AECOM, 2015l), the gas mitigation trench is understood to comprise a benched trench 4 to 8 m in depth, with two horizontal slotted HDPE piping horizons along the length of the trench, two vertical risers and manifold lines leading to a movable exhaust system located in the landfill. The trench is reportedly filled with coarse (>40mm) aggregate and capped with clay or geotextile

As reported in the LCMP (AECOM, 2015l), the existing landfill gas monitoring infrastructure comprises:

- Surface gas monitoring.
- Existing landfill gas infrastructure:
    - Subsurface gas monitoring at MW4c
    - Subsurface gas mitigation trench
- Additional landfill gas monitoring wells installed as part of the Phase 2 ESA (AECOM, 2015m):
    - On-site monitoring wells LG301 to LG313
    - Off-site monitoring well LG300

2.7.11 Landfill Gas Characterisation

The latest round of subsurface landfill gas monitoring completed as part of the Phase 2 ESA (AECOM, 2015m) in February 2015, included the monitoring of thirteen landfill gas wells (LG300 to LG312) and two groundwater monitoring wells (MW311 and MW313) with a landfill gas analyser and sampling with Summa canisters for bulk and trace landfill gases.

With the exception of the northeast boundary of the site where subsurface methane concentrations were analysed at 74.2% at the boundary (LG308), concentrations of subsurface methane were highest across the central portion of the landfill and lower around the edges of the site.

The concentrations of trace ground gases including BTEX, naphthalene, vinyl chloride, DCFM and 1,2,4-TMB were detected in landfill gas above the adopted criteria during from the round of landfill gas sampling completed as part of the Phase 2 ESA (AECOM, 2015m) in February 2015.

3. Landfill Closure and Rehabilitation

3.1 Landfill Closure Milestones

Key landfill closure milestones and indicative timeframes are presented in Table 11.

Table 11: Landfill Closure Milestones and Indicative Timing

Landfill Closure Component	Indicative Timeframe
Acquisition of Alexandria Landfill by RMS and cessation of landfilling and recycling works	20 December 2014
Site clean-up/establishment works	January 2015 – October 2015
Ongoing monitoring in accordance with EPL 4627, EPL 12594 and TWA 29304	January 2015 onwards
Upgrade of existing site leachate management system	April 2015 – ongoing
Development of landfill closure consent/licensing strategy	January 2015 – January 2016
EIS approval due	April 2016
Review and approval of LCMP by Auditor and EPA	March 2016 to May 2016
Commencement of bulk earthworks and land forming works including landfill capping and gas management system installation and construction works (incorporating leachate plant construction)	June 2016
SPI construction environmental monitoring as per the CEMP	2016 – Completion of SPI construction
Completion of SPI construction and revision of site EPLs	2019
Post closure monitoring	2019 onwards

3.2 Landfill Closure Objectives

The landfill closure objectives selected for the site closure are based on the requirements of NSW EPA Landfill Guidelines (2016), the Best Practice Environmental Management (BPEM): Siting, Design, Operation and Rehabilitation of landfills (VIC EPA 2015), and the regulatory requirements for preparation of this plan. VIC EPA (2015) has been heavily relied on as it clearly defines objectives for landfill design and rehabilitation and is generally considered a best practice guidelines for design and rehabilitation of landfills.

The objectives are outlined in Table 12 and addressed in the relevant sections of this report and the relevant Technical reports.

Table 12: Landfill Closure Objectives

Aspect	Objective	Section
Rehabilitation and Capping	To ensure that landfills are rehabilitated to minimise the seepage of water into the landfill and maximise the collection and oxidation of landfill gas from the landfill.	Section 3.5 and 3.6.
Aftercare and management	To manage the site after closure so that environmental protection and monitoring systems are maintained until the landfill has stabilised.	Annexure G
Landfill gas	Ensure that no safety or environmental impacts are caused by landfill gas, in particular due to lateral subsurface migration of landfill gas.	Section 3.7
Groundwater	To protect the beneficial uses of groundwater and to minimise the risk posed by the landfill to those beneficial uses.	Section 3.8
Water Management	To protect beneficial uses of receiving waters and to avoid any adverse environmental impact on surface and ground waters	Sections 3.8 and 3.9
Construction quality assurance	To ensure that materials, construction methods and installation procedures deliver a landfill meeting design criteria.	Section 3.10
Leachate collection system	To maintain groundwater quality as close as practicable to background levels.	Section 3.8
Environmental assessment	To gain a thorough understanding of the environment where the landfill is to be sited in order to design the landfill to minimise impacts on the environment.	Section 2

3.3 Proposed Final Land Use

The final land use of the Site will comprise a motorway interchange (SPI) with associated ancillary facilities (refer Drawings in Annexure A). The SPI has been designed to connect the New M5 to Campbell Road and Euston Road, St Peters and through to Gardeners Road, Mascot, to enable traffic to travel to and from the inner western suburbs of Sydney, the airport precinct and Port Botany via the existing surface road network. Upon opening of the Stage 3 tunnels in 2023, the remaining ramps within the SPI will be opened to provide connectivity between Western Sydney and the international gateways of Sydney Airport and Port Botany via the proposed Sydney Gateway.

The design for SPI has been prepared to provide fully grade separated connectivity for the New M5 and Stage 3 tunnels to/from:

- Euston Road;
- Gardeners Road; and
- the Sydney Gateway connection, servicing Sydney Airport and Port Botany.

The SPI would be primarily located on the site, however may incorporated land surrounding the Site. Closure of the landfill and remediation/land forming works are required for future beneficial use of the land as part of the WestConnex New M5 Project. The SPI has been designed to incorporate landfill closure considerations including capping, leachate and landfill gas management.

The landfill closure design allows for use of the areas not occupied by motorway as open space, subject to environmental management of the site (refer LEMP in Annexure G and the long-term environmental management plans for the site as outlined in the RAP) and availability of access to the site.

3.4 Proposed Final Landform

The proposed final landform has been designed by CDS and AJJV to enable the future development of the Site as a motorway interchange (SPI). Refer to the design drawings in Annexure A for drawings showing the landform, cross sections and capping details.

Based on the -85% landform design surface and associated amendments, the proposed landform is optimised for the SPI design and comprises the following key features:

- A raised and vegetated waste mound in the south-western portion of the site with a maximum proposed elevation of approximately RL 19 m AHD and with the steepest batter slope of 2H:1V;
- The minimum elevation of the site will be approximately RL -9 mAHD, along the main carriageway, depending on final pavement thickness;
- Allowance for proposed roadway alignments, including embankments and tunnel entrances;
- Inclusion of a new landfill cap (refer Sections 3.5 and 3.6) in the landform; and
- Areas not used for motorway construction and associated infrastructure will be landscaped.

The final landform and topography will make allowance for the construction of the SPI, including proposed future roadway alignments, some of which will be constructed on piles extending through the landfill mass to prevent damage associated with differential settlement. Roadway embankments with foundation support will be used in some areas. The design of the final landform has included provision for the incorporation of a new landfill cap.

The waste mound will be used to contain excess construction spoil (landfill) produced as a result of the proposed land forming works at the Site. The final landform is designed to complement the existing topography of the surrounding area. Those areas not dedicated for motorway land use and associated infrastructure will be landscaped and developed for open space land uses.

3.5 Extent of Landfill Cap

The proposed extent of the capping system is shown in the drawings in Annexure A. Refer to the Capping Design Report for a discussion of the rationale.

The proposed extent of the capping system includes the entire landfill licence area as shown in the Drawings. Three capping system designs are used, Type 1, 2 and 3, as defined in the following section. In addition, roadway pavements and embankments, where present, will form the capping system.

The general rationale of identifying the applicable capping system types is outlined in the following points. The capping system types are described in Section 3.6 below.

- Areas inside the VB wall, within the former main landfill pit area, or on the landform mound, will be capped using a full system (i.e., Type 1 or 2).
- Areas outside the VB wall and outside the main landfill pit area will be capped using a Type 3 system that may omit some capping system components depending on the actual subsurface conditions present.
- Roadway pavements or substantial roadway embankments will form the capping system. Additional capping system construction beneath these areas is not required, with the exception that a subsurface gas collection system may be included in some areas, depending on the pavement design details.

The capping extent does not include the Canal Rd Site and Bradshaw Mountain as these areas are outside of the landfill licence boundary. It is noted, however, that remediation and capping methodologies for these areas are the subject of respective RAPs and may require integration with the landfill cap during detailed design.

3.6 Final Landfill Cap Design

The final landfill cap design is shown in the drawings in Annexure A. Refer to the Capping Design Report for details.

3.6.1 Cap Composition

The final landfill cap design was developed based on AECOM (2015c) and the NSW Landfill Guidelines (NSW EPA 2016).

Five capping system profiles are included as follows:

- Type 1: Low-permeability layer comprising compacted clay only; suitable for landform slopes with inclination 2H:1V to 3H:1V (T2 Waste Mound) .
- Type 1A: Low-permeability layer comprising compacted clay only; increased revegetation layer thickness, suitable for landform slopes with inclination 2H:1V to 3H:1V (outside T2 Waste Mound).
- Type 2: Low-permeability layer comprising compacted clay and geosynthetic clay liner (GCL); suitable for landform slopes with inclination 3H:1V or flatter.
- Type 2A: Low-permeability layer comprising compacted clay and geomembrane; suitable for landform slopes with inclination 3H:1V or flatter (Alternative Option)
- Type 3: Separation layer comprising subsoil and topsoil.

The capping system is designed to function as described below (Type 1 and Type 2).

- *Infiltration Reduction*: Over the majority of the site, infiltration of rainfall into the landfill will be reduced by incorporating a low-permeability layer into the capping system. This layer will be compacted clay layer (CCL), or a linear low density polyethylene (LLDPE) and geosynthetic clay liner (GCL) in flatter capping areas. The low-permeability layer will be covered with revegetation soil

for protection against desiccation and disturbance. The revegetation soil will also support plant growth and water evapotranspiration. In those areas of the site where roadway pavements and/or a substantial thickness of roadway embankment is present, a separate low-permeability capping layer is not included as infiltration reduction will be provided by the pavement and/or embankment material itself

- *Subsurface Drainage*: A subsurface drainage system will be installed immediately above the low-permeability layer to minimise the potential for subsurface water to collect and seep through the layer. This system will also reduce the potential for saturation (waterlogging) of the revegetation soil and the associated vegetation stress and/or loss of surface strength.
- *Shallow Leachate Collection*- A leachate collection and drainage system will be installed immediately below the low-permeability capping layer. This system is designed to capture any water/leachate that may otherwise seep laterally and reach the landform surface. This is a contingency measure in that no known areas of such seepage have been identified. This system has a dual–purpose for landfill gas collection as indicated below.

Shallow gas collection- Refer Section 3.7.2 below.

Table 13 provides details of the proposed capping systems, with the components presented from top to bottom. Capping system cross sections are shown in the Drawings.

Table 13: Proposed capping systems

Component	Type 1 / 1A – Slope of 2H:1V to 3H:1V	Type 2 / 2A – Maximum slope of 3H:1V	Type 3 – Areas outside the VB Wall and main landfill pit (see Drawing)
Revegetation Layer	**Type 1**: Revegetation soil min 500 mm thick including 100 mm of topsoil material and marker geosynthetic layer. Discussion: Thickness of 500 mm provided to protect the sealing layer from disturbance and weathering. 500 mm maximum layer thickness selected to increase capping system slope stability. **Type 1A**: thickness of 1000 mm outside the T2 Waste Mound to allow for deeper-rooted landscaping.	**Type 2**: Intermediate thickness of 700 mm to allow total thickness of Type 2 to match total thickness of Type 2A. **Type 2A**: thickness of 1000 mm to allow for deeper-rooted landscaping	Revegetation soil min 1000 mm thick including 100 mm of topsoil material and marker geosynthetic layer.
Infiltration Drainage System	**Type 1**: Subsoil drainage system installed immediately above the sealing layer. System comprises strip drains on 5 m centres draining to 160 mm solid wall HDPE collector pipes. Collector pipes drain to the subsurface stormwater drainage pipework. **Type 1A**: Same as Type 1, except using 10 m centres for strip drains. Larger spacing reflects reduced slope stability	**Type 2/2A**: Same as Type 1A	nil Drainage system without a sealing layer would not be feasible.

	risk in Type 1A areas (i.e. flatter than Type 1 areas) Discussion: The intent of the infiltration drainage system is to drain the base of the revegetation layer and prevent the layer from saturating. A saturated revegetation layer is undesirable because it may not provide good growing media for vegetation, may increase leachate generation due to increasing water infiltration through the sealing layer, and may destabilise the layer on steeper slopes. Water collected in the system will be uncontaminated (i.e. rainfall infiltration collected above the sealing layer) and can be drained into the stormwater system.		
Sealing Layer	**Type 1/1A**: 600 mm thick compacted clay layer (CCL) with maximum permeability of $1x10^{-9}$ m/s Discussion: System considered to provide an acceptable sealing layer at the site.	**Type 2:** 300 mm thick compacted clay layer with maximum permeability of $1x10^{-8}$ m/s; underlain by geosynthetic clay liner (GCL). Cap Type 2 is proposed to be used where penetrations of the cap are likely, such as near bridge piers, to facilitate cap reinstatement without requiring a specialty geomembrane installer. Discussion: System considered to provide an acceptable sealing layer at the site, while providing sufficient flexibility to account for potential settlement across the site. Comparison to EPA 2016 guidelines provided below. **Type 2A**: cushion geotextile and Linear Low Density Polyethylene (LLDPE) geomembrane underlain by GCL. Cap type 2A is proposed to be used in all areas with a maximum slope of 3H:1V, except near bridge piers and within the footprint of the T2 Waste Mound. Discussion: System considered to provide an acceptable sealing layer at the site, while providing sufficient flexibility to account	nil Layer provides separation between receptors and waste. Refer to RAP.

		for potential settlement across the site. Comparison to EPA 2016 guidelines provided below. Note: GCL and LLDPE use in sealing layer is appropriate for cap Type 2 / 2A because of negligible risk of long-term instability of GCL and/or GCL/Geomembrane interface on 3H:1V slopes.	
Bearing Layer	**Type 1/1A**: 300 mm thick compacted crushed sandstone/ select fill layer Discussion: Layer considered appropriate as a foundation layer for the sealing layer.	**Type 2/2A**: Same as Type 1/1A	Not applicable
Shallow Leachate and Landfill Gas Drainage System	**Type 1/1A:** System installed immediately below bearing layer. System comprises 300 x 300 mm drainage aggregate trenches as follows: • Capping in general landfill area: trenches on 10 m centres with 160 mm perforated HDPE collector pipe; • Capping of landform mound: trenches on 20 m centres with 110 mm perforated HDPE collector pipe Upper end of pipes connect to gas vents; Lower end of pipes connected into 315 mm solid wall HDPE leachate drainage pipes, draining to leachate sumps. Discussion: The system is dual purpose, providing for collection and drainage of any subsurface leachate migrating to the landform surface and for collection and venting of near-surface landfill gas. The larger trench spacing and smaller pipe diameter for capping the landform mound reflects the lower risk of leachate seepage from the mound constructed of relocated waste, as opposed to in-situ waste materials in other areas.	**Type 2/2A**: Same as Type 1/1A.	Nil. Combination of active gas extraction and passive extraction over majority of landfill considered sufficient to control landfill gas.

An assessment of the hydraulic performance of the capping systems selected is provided in the Leachate Design (Water Balance) report. Infiltration modelling for the Type 1 and 2 cap systems indicates infiltration

through the cap of less than 1% to approximately 4.5% of annual precipitation for a range of precipitation conditions.

3.6.2 Growing Media Establishment Following Installation of Cap

Establishing an appropriate substrate growing medium capable of supporting vegetation is important for future landscaping and revegetation activities. In all areas where landscaping is required, a suitable revegetation layer will be applied prior to revegetation activities being undertaken. Revegetation layer requirements will be detailed in a vegetation management plan or similar prepared for the site as part of the overarching landscaping strategy for the Site.

3.6.3 Revegetation

It is anticipated that revegetation will be undertaken using a variety of techniques including direct seeding, tubestock plantings and natural regeneration (from topsoil seedbank). Measures such as fencing and tree guards will be implemented to protect the revegetated areas from predation and browsing. All revegetation works will be undertaken in accordance with a Site specific vegetation management plan developed for the Site.

Vegetation will be selected based on consideration of the following attributes:

- rapid and sustainable establishment;
- ability to stabilise the ground surface and protect the cap from erosion;
- sustain high evapotranspiration rates;
- appropriate root depths to prevent capping system damage;
- ensure growth and coverage through all seasons; and
- survive sub-optimal seasons (such as droughts), and be resilient (able to continue to meet the performance objectives despite extreme weather, fire, weeds, grazing and pests).

3.6.4 Cap Edges and Penetrations

Capping system construction will require modified details at locations where the system terminates or connects to other SPI elements. Initial details for cap edges and for points where structural bridge elements are required to penetrate the cap are provided in Drawings M5N-GOL-DWG-900-116-EV-0032 and 0033 in Annexure A.

3.7 Landfill Gas Management

Refer to the Capping Design and Landfill Gas Design reports for a detailed outline of landfill gas management.

3.7.1 Landfill Gas Management System

The landfill gas management system comprises:

- A landfill gas containment system in the form of a low permeability cap (refer Section 3.6.1);
- A shallow gas collection and passive venting system;
- An active gas extraction and flare system; and
- A landfill gas surface and subsurface monitoring plan.

3.7.2 Shallow Gas Collection

The capping system design includes gas collection measures incorporated immediately beneath the landfill capping system. Specifically, the dual–purpose drainage system underlying the low-permeability capping layer (see shallow leachate collection system above) includes numerous atmospheric vents and will provide a preferential flow path for near-surface landfill gas. The intent of this system is to minimise the potential for any landfill gas reaching the low-permeability layer to migrate laterally beneath the cap and to provide venting at controlled points. This system is passive and will have variable efficiency, depending on atmospheric conditions (i.e., wind, temperature, atmospheric pressure), but is robust (being passive) and is

expected to meet the design intent. The reliability of passive venting, and the practical advantages of a system that continues to operate even when the active system is shut down/disabled, are considered to outweigh the general environmental disadvantage of atmospheric venting.

Passive venting may not be acceptable in the case that methane content and odour-generating potential of gas collected in the under cap drainage system is higher than generally encountered for such systems, or if the active extraction system is less effective in capturing gas than at similar sites. In such cases, specific vents may be throttled, filtered, or connected to the active gas extraction system at local points. The passive vent locations and their physical configuration will be considered further during detailed design.

The passive gas venting system is shown in the drawings in Annexure A. In areas where there is no low-permeability layer in the capping system (i.e. beneath roadways/embankments), the need for alternate shallow gas collection measures will be considered during detailed design.

3.7.3 Active extraction system

As outlined in the landfill gas design report, landfill gas generation models estimate the amount of landfill gas generated at the site at between 100 m^3/hr and 417 m^3/hr. The landfill gas active extraction system has been conservatively designed using the 417 m^3/hr value.

The design includes approximately 20 deep extraction wells, connecting pipework, a gas condensate drainage system, a blower, and a flare for combusting the collected gas. Flare operation will include air pollutant sampling and analysis in accordance with current NSW EPA guidelines for gas combustion plants. The system will be constructed in two stages, with a gas pumping trial included in the first stage to allow revisions, if needed, to the second stage system and to confirm that methane content of the recovered gas is sufficient for flaring.

The active gas extraction system is shown in the drawings in Annexure A and described further in the Landfill Gas Modelling report.

3.7.4 Gas monitoring plan

The potential for lateral gas migration off-site may increase after the installation of the final capping as vertical migration is inhibited. As such, sufficient mitigation measures and monitoring around the boundary must allow for a potential increase in lateral landfill gas flow and concentrations post-closure. This mechanism may be exacerbated in the case of leachate extraction system failure and rising leachate levels resulting in increased gas pressure.

The proposed monitoring network and approach is presented in the LEMP (Annexure G). The system features approximately 40 gas monitoring wells (approximate 50 m spacing) and is designed to provide suitable perimeter overage considering the proximity of potential receptors. Proposed monitoring also includes gas accumulation monitoring in buildings near the site boundary.

3.8 Leachate Management

3.8.1 Leachate Management System

The leachate management system comprises:

- A shallow leachate collection system incorporated in the capping system (refer Section 3.6.1);
- A deep leachate collection system;
- A leachate collection system at the base of the waste mound;
- A system to store and transfer collected leachate to the LTP;
- A leachate treatment plant (LTP); and
- A major stormwater and leachate pump station structure.

Leachate collected in the deep, shallow and waste mound systems will drain by gravity to collection sumps and then will be pumped to a leachate treatment plant. Treated leachate will be discharged to sewer in

accordance with the applicable Trade Waste Agreement. The design for the leachate sumps, pumping system, and leachate treatment plant will have appropriate environmental protection features and are reported separately.

3.8.2 Deep Leachate Collection

Leachate collection from the existing collection system and main leachate riser will be maintained. The landfill closure includes vertical extension of the existing main leachate riser to maintain access for leachate pumping (design reported separately). The riser extension would pass through, and be constructed concurrently with, the waste mound.

An area for potential installation of deep leachate pumping wells through the capping system has been identified as a contingency measure in the case of future loss of main leachate riser function. The area is approximately 100 m east of the existing main leachate riser and is located immediately southeast of the proposed shallow leachate sump LS2. This area is a relatively flat area of the proposed landform and is clear of planned roadways and bridges.

3.8.3 Leachate System for Waste Mound

The base of the waste mound will be formed by cutting and filling existing landfill waste materials to form the surface shown in Drawing M5N-GOL-DWG-900-116-EV-0027 in Annexure A. This surface will be lined with a leachate barrier and overlying leachate collection layer prior to placement of relocated waste to form the waste mound. In addition, a landfill gas collection layer will underlie the leachate barrier.

Specifically, the base of the waste mound will comprise the following materials (listed top to bottom) as shown in Drawing M5N-GOL-DWG-900-116-EV-0029 in Annexure A:

- leachate collection layer: comprises 300 mm thick drainage aggregate blanket with HDPE pipe network, collector pipes at 25 m centres connected into main trunk drain pipes;
- leachate barrier: 500 mm thick compacted clay soil layer (note: a thinner compacted clay soil layer with GCL may be considered for detailed design); and
- gas collection layer: gravel-filled trenches at 25 m centres and connected to gas vents in the waste mound capping system.

The leachate collection system described above will gravity drain to a sump near the northern boundary of the waste mound base and subsequently drain from the sump into the shallow leachate collection system at sump LS1.

Refer to the Capping Design report for additional information on the design of the systems at the base of the waste mound.

3.8.4 Transfer of leachate to LTP

The key components of the system are summarised below:

System overview

- The transfer system is yet to be designed in detail and will be provided in in a separate report. The system of feeder and collector drains gravity drain to four leachate collection sumps (designated LS1 to LS4) which in turn gravity drain or be pumped (as required) to the LTP.
- All pits are to be vented or grated to limit the potential for gas accumulation
- The existing leachate sump riser flows are pumped to the LTP.
- The contingency leachate extraction wells (refer Section 3.8.2), if required, would be pumped to a storage tank and then to the LTP.

Feeder and collector drains – shallow leachate collection system

The feeder drains include approximately 50 gas vents located at high points for passive venting. Clean out points/pits will be included along the collector drains at approximately 200 m.

It is anticipated that liquid will be collected in the shallow drainage system that will be constructed immediately beneath capping system Type 1 or Type 2 (refer Section 3.6.1). Liquid collected in this system is expected to comprise: (a) a portion of any water infiltrating through the capping system; and (b) seepage from perched leachate that may be present in local areas.

Leachate storage tanks at sumps

The capping system design (ref: M5N-GOL-DPK-900-302-WT-9415-B) includes four shallow leachate sumps, LS1 through LS4, which will accumulate leachate from the shallow drainage system. To estimate the flow rates into these sumps for sump sizing and pumping sizing/design purposes, the following approach has been used:

- For source (a) above, it is assumed that 5% of the peak daily infiltration rate through the capping systems, as calculated in the HELP model for 90th percentile rainfall, will be collected;
- For source (b) above, it is assumed that 5 kL/day of shallow perched leachate will be collected. This is considered a conservative estimate as it represents between 5% to 10% of the total leachate collection rate expected for the site;
- The sumps will be sized to account for a 48 hour pump outage;
- Leachate generation from the base of the waste mound will be transmitted to LS1; and
- All flows have been assumed to be proportional to the area of the catchment reporting to each sump.

The resulting flow rates are as follows: LS1- 4 kL/day, LS2- 1 kL/day, LS3- 2 kL/day, and LS4- 1 kL/day. As indicated above, these flow rates are for sump sizing and pumping sizing/design purposes.

Gas management will need to be considered as part of the detailed design. Tanks should be vented to allow gas escape. Drainage inlet pipes should include U-bends to provide a gas entry seal.

Drainage inlet and overflow pipes should include valves for operation and maintenance purposes. Valves to be retainer knife gate valves, or similar, suitable for use in an aggressive environment.

For those leachate collection points involving leachate/water extraction by pumping, overflow can be managed by operation of the pumps controls (i.e. pump control system to include shut-off if levels in the storage tank approach capacity).

For gravity fed leachate collection points, a contingency strategy to manage potential overflow will be implemented. This will involve the installation of gravel filled dry wells adjacent to the collection points inside the waste footprint. This will provide a path for any overflow from the collection point into the exiting waste for eventual recapture into the leachate collection system. The dry wells are anticipated to comprise 300 mm slotted PVC pipe surrounded by a 2m diameter gravel pack, extending to a depth of at least 4 m below ground level. Sizing of the dry wells will be confirmed during detailed design.

Details for pump type required for leachate systems

Pumps used for leachate should be constructed from a durable material suitable for use in an aggressive environment and explosion proof.

3.8.5 Current Leachate Treatment

Prior to RMS's ownership of the Site, the Sydney Water TWA permitted a treated leachate disposal rate of 620 kL/day. Following Site acquisition by RMS, Sydney Water prepared an updated TWA with a revised maximum flow rate of 1 ML/day. Sydney Water has requested the preparation of an effluent improvement program (EIP) to be developed (by October 2016) which outlines the steps to achieve reliable full compliance

with the ammonia TWA discharge limit of < 100 mg/l within 6 months. Possible interim treatment options to be contemplated in the EIP will include biological treatment, blending and off-site disposal of leachate.

The existing LTP system will be upgraded to treat a minimum of 100 kL/day of raw leachate from the Site and be compliant for the next two years (until 2017). Based on a site visits by Golder on 30 October 2015 and 27 January 2016 as discussed in Section 2.7.6, RMS has substantially completed the upgrade.

The layout of the existing leachate collection system is provided in the Drawings in Annexure A. A flowchart of the existing leachate/water management system is provided in Figure 5. A summary of leachate treatment plant upgrades as performed by RMS are provided in Annexure H.

The existing LTP will be replaced with a new LTP to be designed. Refer Section 3.8.5.

Hydraulic Capacities

The schematic flowchart (see Figure 5) summarises the capacity of equipment currently installed at the refurbished LTP, the maximum design flows and the current operations (as observed during the 27 January 2016 site visit). Key factors on the hydraulic capacity of the refurbished LTP include the following points.

- The items in red indicate potential changes and operations that may provide a small increase in treatment capacity by reducing the feed time and increasing the total decant volume.
- The trade waste permit limits the discharge rate to 15 L/s. In addition, it does not allow for sewer discharge when rainfall exceeds 10 mm/hr, which is expected to occasionally limit sewer discharges with the potential to temporarily reduce the capacity of the system.
- Flows from the Central/Stormwater Sump are occasionally directed through the LTP (when ammonia concentrations exceed 0.95 mg/L) but the primary path is discharge directly to the sewer when ammonia concentrations are below 0.95 mg/L.

Treatment Considerations

The current operating status is also shown which contains a higher flow, but a lower ammonia concentration than the basis for the previous system. Figure 5 shows the current and design operational basis for each cycle of the SBR tank. Key components of the refurbished system include:

- The ammonia loading capacity (kg/day) of the refurbished LTP is 100 m^3/day of leachate at a maximum ammonia concentration of 400 mg/L (as N). The current operational experience is that when the flows increase due to stormwater, the ammonia concentration decreases.
- The refurbished system was installed with schedule and space constraints and, therefore, utilized one SBR tank for the full design flow and then reused an existing tank for treated leachate storage and blending. The treated leachate storage and blending tank is equipped with aerators and can be used to provide some additional ammonia treatment in periods of high flow. The treated leachate tank may provide polishing ammonia treatment to water; the intention in the refurbishment is that the treated leachate tank would be utilized if necessary for ammonia concentrations of less than 100 mg/L (as N).
- The refurbished LTP monitors pH and pH control (alkalinity addition by sodium hydroxide dosing) can be added, but is not currently included. Approximately 7.1 mg of alkalinity (as $CaCO_3$) is required per mg of ammonia (as N) removed. At the design condition of 400 mg/l of ammonia (as N) the alkalinity should be 2,830 mg/L (as $CaCO_3$) for complete ammonia removal. As alkalinity becomes limited the pH will drop and reduce the efficiency of ammonia removal. The optimal pH range for ammonia removal is 7.5 to 8, however, the ammonia removal process is not considered inhibited until the pH is less than 6.5. Planning for alkalinity addition may be prudent so that delivery time on the caustic, any required permits or regulatory permission, and space for the chemical totes or tanks can be determined since space is at a premium.

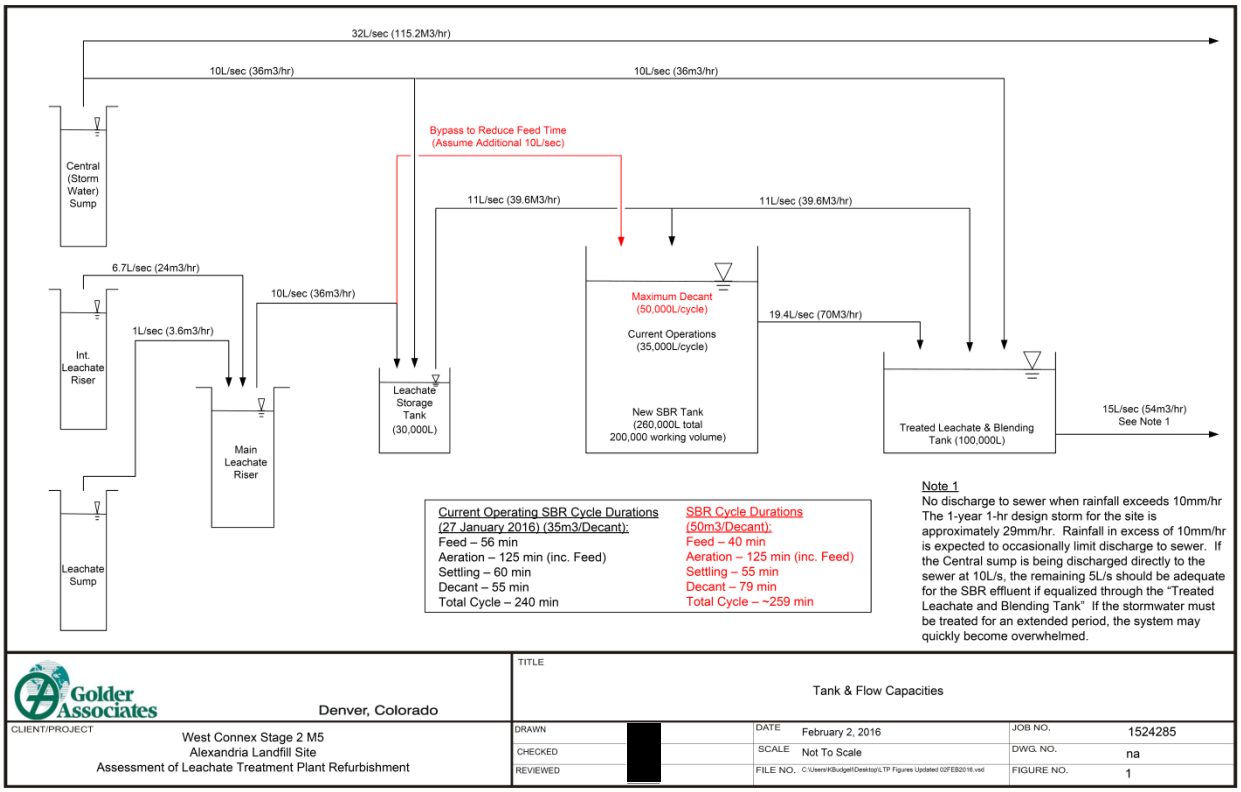


Figure 5: Flowchart for existing water management system at Alexandria landfill

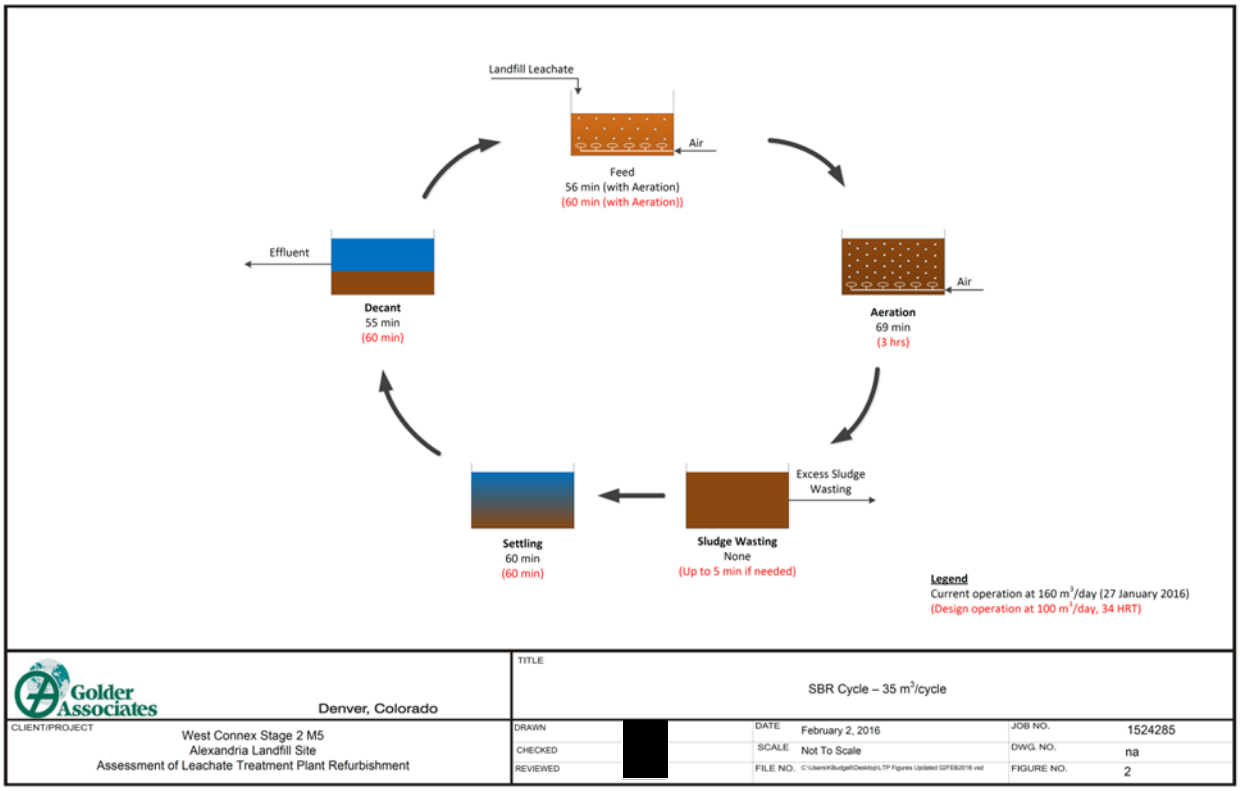


Figure 6: Current and design operational basis for each cycle of the SBR tank

3.8.6 Leachate Treatment Plant

Design information is provided in the Leachate Treatment Plant Functional Specification (design package M5N-GOL-DPK-900-303-WT-9425).

3.8.7 Proposed Stormwater and Leachate Pump Station

The designs of proposed stormwater and leachate pump stations are currently being prepared by AJJV and will be reported separately.

3.9 Surface Water Drainage Management

A stormwater drainage and management system for the SPI site is currently being developed. The system will be designed to collect, store, and convey stormwater runoff from the site such that runoff from design storm events will not pond and infiltrate into the landfill. The system will include appropriate water quality and erosion and sediment control features.

The design of this system will be reported separately.

As presented in the LEMP (Annexure G), this surface water drainage design is subject to development by AJJV Design Package M5N-AJV-TER-900-300-DR-1405 and as per the 15% design, is understood to comprise the following components:

- To manage surface water, the construction and installation of two stormwater pump stations, inclusive of a gross pollutant and hydrocarbon collection facility is proposed.
- Two drainage pump sumps will receive surface water for pumping to the water quality basins;
- Collected water is directed to a two water quality control basins (WQ1 and WQ2) prior to being

discharged to Alexandra Canal;
- All water quality control basins will be able to contain a 1 year ARI rainfall event first flush;
- Since the landfill is closed, surface water should not come into contact with waste. Therefore this water is not considered to be leachate;
- Should leachate seeps be identified in the landfill surface, these will be repaired and any leachate will be captured and treated in the leachate management system; and
- Surface water runoff from the landscaped wast mound is directed towards an existing drain at Canal Road.

3.10 Quality Control and Quality Assurance

The requirements for Construction Quality Assurance (CQA) as outlined in NSW EPA (2016) are as follows:

- Prepare a CQA Plan in accordance with the requirements of Section 11.1 of NSW EPA (2016).
- Preparation of a CQAR by a CQA engineer appointed by CDS, addressing all the requirements of Section 11.2 of NSW EPA (2016) and the CQAP and Technical Specification, including, but not limited to relevant testing results, surveys, photographs and daily records. The CQAR needs to be submitted to the EPA for approval. The completed CQAR, following construction, will also be reviewed by the Site Auditor.

In accordance with NSW EPA (2016) CDS or its landfill construction contractor will appoint a construction quality assurance representative to ensure that the construction is carried out in accordance with the requirements of the CQAP.

An outline CQAP is included in Annexure I.

3.11 Materials Tracking

During the staged remediation the Contractor will be responsible for implementing a materials tracking plan. The plan will describe the system(s) that will be implemented by Contractor personnel, sub-contractors, consultants and other service providers working on the Site for monitoring and controlling all onsite and offsite materials and their movements.

The Plan will apply to all material handling phases that will occur during the project including:

- Excavation (Cut)
- Haulage,
- Placement (Fill)
- Stockpiling and Placing (including for interim locations when crushing screening)
- Importation of materials (clays, tunnel spoil and other engineering materials)
- Off Site disposal

Application of this plan will track all site materials from “cradle-to-grave” through materials handling hold points, stockpile register(s), mudmaps and specific naming conversions. The plan will cover the tracking of all materials relocated/recycled on site, imported to the site including but not limited to the following:

- Wastes from previous landfilling operations (with potential for Asbestos impacts)
- Overburden and other ‘fill’ materials already on the site;
- Crushed concrete and other recycled materials present on site;
- VENM/ENM Clean Fill Materials.

And those materials that are unable to remain on site including but not limited to the following:

- Free flowing liquids / chemicals including tar-like/oily substances;

- Drummed Chemical & Liquid Wastes;
- Chemical tanks (e.g. old fuel storage tanks);
- Aesthetically unusual substances (e.g. crystalline substances, powders, malodourous, fuming and or unusually coloured materials; and,
- Clinical or Biological Wastes.

Any offsite disposal of materials and associated tracking will be managed by the Contractor. Disposal tracking records will be collected from the landfills after any disposal campaign. These records will be cross referenced (appended) to the stockpile register

3.12 Occupational Health and Safety Requirements

Project safety risks, including high risk construction work, have been identified and managed through the implementation of the project's Risk Management Plan and Workplace Health and Safety Management Plan.

The following high risk work activities have been identified through project planning, legislative requirements and the risk assessment:

- People and Plant Interaction
- Excavation and Penetration
- Working in Confined Space
- Lifting Operations & Prevention of Falls
- Isolation of Electrical, Mechanical, Pressurised & Energised Equipment or Services
- Work likely to involve disturbing asbestos
- Working with Contaminated Materials (as identified in the Qualitative Occupational hygienist Assessment)
- Chemicals and Hazardous Substances

All work will be planned and executed using Work Packs which identify risks and controls specific to the task. Work Packs will identify the regulated High Risk Construction Activities and the Safe Work Method Statements (SWMS) which will be consulted with work crews to control safety and health risks.

Risk management practices are embedded in all processes and procedures. This includes but not limited to the following:

- Project Risk Register
- Detailed design reviews throughout the life cycle of the project
- Construction area plan (CAP) prepared during the construction planning for each work area
- Work Packs containing work methodology, SWMS, Inspection and Test Plans, Site Instructions, controls/approvals, constraints, etc.
- Safe work systems to address the specific high risk activities and included in the work packs
- Work Instructions for a routine set of tasks that have been assessed for their risks
- Safe Work Method Statements are developed in consultation with the workers doing the task to ensure hazards are identified and controlled in the field.

3.13 Community Engagement Processes

In accordance with the Community Communication Strategy (CCS), CDS will adopt a well-coordinated and targeted approach to inform adjacent landowners and other key stakeholders regarding the closure of the landfill.

Affected Stakeholders

Properties adjoining the landfill site:

- 310 Princes Highway
- 238 Princes Highway
- 180 Princes Highway
- 178 Princes Highway
- 176 Princes Highway
- 158 Princes Highway
- 156 Princes Highway
- 2 Bishop Street

Local Government Authorities:

- Marrickville Council
- City of Sydney Council
- City of Botany Bay Council

Communication and engagement activities

CPBDS-JV will use a suite of complimentary and targeted communication and engagement activities to inform affected stakeholders about the closure of the landfill, including;

Notification

A notification will be provided to adjoining landowners to inform them about the commencement of works to close the landfill. This notification will detail the works involved in closing the landfill, timing and any potential impacts and mitigation measures. The notification will also provide landowners with the contact details for the project team should they have any enquires or concerns about the works.

One-on-one briefings (doorknock or phone)

Briefings will be conducted with adjoining landowners to inform them about the commencement of works to close the landfill. These briefings will be conducted by the Place Manager and where required a construction representative involved in the landfill closure works.

Council interface meetings

Regular interface meetings are held with the City of Sydney Council and Inner West Council and provide a forum to inform and consult with the council regarding a range of project matters, including the closure of the landfill. These Councils will be briefed and kept up-to-date about the closure of the landfill at these interface meetings

3.14 EPA Clean-up Notices relating to the site

On 19 December 2014 the EPA issued Clean-up Notice No1500750 (former notice) to Boiling Pty Ltd (former owner). The EPA revoked the former notice when RMS took ownership of the ALF site and issued RMS with a new notice No1533773 to take up the clean-up of Stockpile 21.

3.15 Management, Monitoring and Reporting of Asbestos

A Licenced Asbestos Contractor will be contracted to complete the works required to close the Alexandria Landfill. The contractor will prepare an Asbestos Management Plan (AMP) which outlines the requirements for the management, monitoring and reporting of asbestos containing material identified at the WestConnex St Peters Interchange Landfill remediation Project.

LCMP – FD (100%)

As controller of the site, the contractor will be obliged to manage asbestos materials in an effective manner to protect the health of site personnel, contractors and visitors. The purpose of the plan is to describe how the contractor will manage asbestos and asbestos containing material (ACM) during construction of the Project. The AMP has been prepared to satisfy legal obligations under the Work Health and Safety Act 2011 (WHS Act) and Work Health and Safety Regulations 2011 (WHS Regulations) in relation to the presence of asbestos at the Project.

To achieve this objective, the plan specifies work practices and procedures to:

- Maintain the asbestos materials in good condition;
- Develop and implement the recommended hazard control strategies;
- Minimise the risk of inadvertent or accidental damage to the asbestos materials; and
- Monitor the condition of the asbestos materials.
- The hazard control strategies specified are based on current industry knowledge and occupational hygiene best practice.

The plan describes the project asbestos register, asbestos identification information and procedures for accidents, incidents or emergencies of asbestos at the workplace, worker training including consultation information and training.

All active work fronts will be under supervision, and all personnel (as part of the Site Induction for the Landfill Closure works) will be made aware of the potential for asbestos to be discovered on the site. All inductees will undergo asbestos awareness training.

The Superintendent for the Landfill Closure works will be the nominated licencee supervisor for Asbestos works. Additional personal who will work in asbestos exclusion zones, involved in asbestos removal must hold current certification showing that they have successfully completed the approved non-friable Asbestos removal course.

3.16 Landfill Settlement

Significant ongoing settlement of landfill materials is expected to occur after landfill closure and interchange roadworks are completed, with resulting differential settlement having the potential to adversely affect landfill closure components. Potentially damaging differential settlements at the site may arise from two main sources:

- A: Arising from differences in the thickness of landfill waste present beneath the landform surface at different points. This mechanism is not likely to cause significant surface distortions, but could potentially cause drainage grade reversals in surface water drainage, subsurface water drainage pipes, leachate drainage pipes, and/or gas condensate drainage pipes; and
- B: Arising from differences in foundation support for adjacent components, such as the landfill capping system at its connection point with a pile-supported roadway pavement. This mechanism is likely to cause significant surface distortions and connection stresses.

Type ‘A’ differential settlements (i.e. drainage grade reversal risk) have been considered in the capping system and active gas collection system design. The systems have built-in contingency comprising surplus pipe and pipe connections installed in areas most likely to experience surface grade reversal and with potential to become low spots on the final landform. More information is provided in the detailed capping design report (M5N-GOL-DPK-900-302-WT-9415) and the associated design drawings and specifications.

Type ‘B’ differential settlements are dependent on foundation support designs for the roadway structures and their areal extent. These settlements have been assessed fpr detailed design. More information is provided in the detailed capping design report (M5N-GOL-DPK-900-302-WT-9415) and the associated design drawings and specifications. Periodic maintenance, including topping up of landform surface levels, is likely to be required on an ongoing basis in some areas to maintain capping system and surface water drainage continuity.

4. Proposed Management and Monitoring

The landfill post closure phase monitoring requirements are detailed in the LEMP (Annexure G).

The LEMP outlines the proposed monitoring and management post closure, while monitoring during construction is covered in the project wide CEMP.

5. Operational Responsibilities and Reporting Requirements

5.1 Operational Responsibilities

Operational roles and responsibilities are outlined in Section 4.1 of the LEMP (Annexure G).

5.2 Reporting Frequency

Reporting frequencies are outlined in the LEMP (Annexure G).

6. Closure Phase Communications Reporting

Communications protocols, environmental audit schedules and document review mechanisms post closure are outlined in the LEMP (Annexure G). Communication protocols and contact details during construction are outlined in the project wide CEMP. The Odour Management Protocol[3] that applies during construction is included in Annexure K.

[3] The Odour Management Protocol was developed by SMC in conjunction with the Department of Planning and Environment (DPE) and has been included in this document as per direction from the DPE.

7. Certified Statement of Completion

In accordance with requirements outlined in NSW EPA (2016), when sufficient evidence can be provided that the landfill is stable and non-polluting, the occupier may seek to complete all obligations and retrieve any financial assurance by submitting a certified statement of completion to the EPA. This statement must certify that the LCMP has been implemented, remediation work has been completed, and further environmental management of the premises is not required. This stage may not be reached until 30 years or more after the site stops receiving waste.

The certified statement of completion should demonstrate the following criteria have been met:

- Gas concentration levels in all perimeter gas wells have fallen to less than 1% methane (volume/volume) and less than 1.5% carbon dioxide for a period of 24 months.
- Analysis of the discharged leachate composition indicates low levels of contamination posing no hazard to the environment, and surface water and groundwater monitoring indicates no water pollution migrating off site. These matters should be addressed in accordance with the performance requirements outlined in the LEMP in Annexure G and the relevant published water quality guidelines.
- The final landfill capping has been carried out in accordance with the specifications and CQA Plan and a certified statement has been provided by a third party to that effect.
- The landfill final capping has been assessed over some years and found to be in good condition and stable, with acceptable stormwater drainage and with no evidence of erosion, cracking, dead vegetation, ponding, differential settlement or slope instability.
- The level of suspended solids in rainwater running off the final capping should be less than 50 mg/L.
- The methane concentration at the surface of the final capping should not exceed 500 parts per million at any point.
- The closed landfill no longer poses an adverse amenity risk. It does not generate offensive or excessive odour, dust, noise, litter and debris, present a fire risk, or attract scavengers and vermin.
- All other requirements of the Closure Plan and Surrender Notice have been completed and/or satisfied. Once the EPA has approved the certified statement of completion, the last licensee can stop maintaining and monitoring the site and any financial assurance requirements will lapse.

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AECOM, 2015e. Northern Ramps – Landfill Closure New Capping Layer for Alexandria Landfill, Technical Memo 3 (TM3), 18 February 2015 (AECOM Doc Ref: 60327128 TM3 18022015)

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Annexure A – Design Drawings

WESTCONNEX STAGE 2
ST PETERS LANDFILL

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LOCATION MAP

NOTE(S)

1. THESE NOTES APPLY TO ALL PROJECT DRAWINGS IN THE SET UNLESS NOTED OTHERWISE AND SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION.
2. ALL LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM (AHD).
3. ALL CO-ORDINATES ARE IN METRES TO MAP GRID AUSTRALIA (MGA94, ZONE 56).
4. ALL DIMENSIONS ARE IN METRIC UNIT AS SPECIFIED.
5. DIMENSIONS AND LOCATION OF EXISTING STRUCTURES SHALL BE CONFIRMED ON SITE BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.
6. LOCATION AND DEPTH OF ALL SERVICES TO BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.
7. DIMENSIONS SHALL NOT BE SCALED OFF DRAWINGS.
8. DRAWINGS MUST BE PRINTED IN COLOUR TO CORRECTLY IDENTIFY ALL DESIGN FEATURES.

REFERENCE(S)

ROAD LAYOUT TO 85% DESIGN SURFACE UPLOADED FROM PROJECT WISE ON THE 22 APRIL 2016
X-M5N-AJV-XRF-900-300-RD-ROAD_DESIGN_SURFACE.DWG
X-M5N-AJV-XRF-900-300-RD-ROAD_DESIGN_SHARED_PATH.DWG
X-M5N-AJV-XRF-900-300-RD-ROAD_CONTOURS.DWG

BRIDGE AND PIERS TO 15% DESIGN UPLOADED FROM PROJECT WISE ON THE 22 APRIL 2016
X-M5N-AJV-XRF-900-400-BR-SPI_BR1_M9X0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR2_M920.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR3_M9W0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR4_M9Z0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR5_M9S0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR6_M9T0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR7_M930.DWG
X-M5N-AJV-XRF-900-400-ST-SPI-SUSPENDED_SLAB.DWG

STORMWATER DRAINAGE TO 85% DESIGN UPLOADED FROM PROJECT WISE ON THE 22 APRIL 2016
X-M5N-AJV-XRF-900-300-DR-DRAINAGE.DWG

EXISTING SURFACE UPLOADED FROM PROJECT WISE ON THE 22 APRIL 2016
X-M5N-AJV-XRF-100-115-SU-SURVEY_1000.DWG

EXISTING UTILITIES SOURCED FROM LEIGHTON DRAGADOS SAMSUNG JOINT VENTURE
- X-M5N-AJV-XRF-700-900-UT-EXISTING_UTILITIES_SPI_FUTURE.DWG RECEIVED ON THE 17 NOVEMBER 2015

DESALINATION PIPELINE AS BUILT SOURCED FROM WATER DELIVERY ALLIANCE
- WMKE1-SN-2000[D] 100203.DWG DRAWING REFERENCE WMKE1-SN-2000 REV D DATED 05 FEBRUARY 2010, RECEIVED ON THE 19 JANUARY 2016
- WMKE1-SS-2000[G] 100430.DWG DRAWING REFERENCE WMKE1-SS-2000 REV G DATED 18 NOVEMBER 2009, RECEIVED ON THE 19 JANUARY 2016
- DESIGN ELEVATION TAKEN FROM DESAL LINE.DWG RECEIVED ON THE 19 NOVEMBER 2015

BARRIER WALL SOURCED FROM GOLDER ASSOCIATES 30 MAY 2016
- M5N-GOL-DWG-900-116-EV-0011-REVC.PDF
- M5N-GOL-DWG-900-116-EV-0012-REVC.PDF
- M5N-GOL-DWG-900-116-EV-0013-REVC.PDF
- M5N-GOL-DWG-900-116-EV-0014-REVC.PDF
- M5N-GOL-DWG-900-116-EV-0015-REVC.PDF
- M5N-GOL-DWG-900-116-EV-0016-REVC.PDF
- M5N-GOL-DWG-900-116-EV-0017-REVC.PDF

- **SITE BOUNDARY UPLOADED FROM PROJECT WISE ON THE 08 APRIL 2016**
  X-M5N-AJV-XRF-100-115-SU-CADASTRAL_REGIONAL.DWG

DRAWING LIST

DRAWING No.	TITLE
M5N-GOL-DWG-900-116-EV-1021	LANDFILL COVER SHEET
M5N-GOL-DWG-900-116-EV-1022	LANDFILL SEEPAGE AND PASSIVE GAS
M5N-GOL-DWG-900-116-EV-1023	LANDFILL ACTIVE GAS COLLECTION SYSTEM
M5N-GOL-DWG-900-116-EV-1024	LANDFILL SUBSOIL DRAINAGE LAYOUT
M5N-GOL-DWG-900-116-EV-1025	LANDFILL FINAL TOP OF CAP PLAN
M5N-GOL-DWG-900-116-EV-1026	NOT USED
M5N-GOL-DWG-900-116-EV-1027	WASTE MOUND LEACHATE COLLECTION SYSTEM
M5N-GOL-DWG-900-116-EV-1028	WASTE MOUND SEEPAGE AND GAS COLLECTION SYSTEM
M5N-GOL-DWG-900-116-EV-1029	WASTE MOUND TYPICAL CROSS SECTIONS
M5N-GOL-DWG-900-116-EV-1030	LANDFILL TYPICAL PENETRATION DETAILS
M5N-GOL-DWG-900-116-EV-1031	LANDFILL TYPICAL CAPPING PROFILES
M5N-GOL-DWG-900-116-EV-1032	LANDFILL TYPICAL EDGE DETAILS
M5N-GOL-DWG-900-116-EV-1033	LANDFILL TYPICAL TRANSITION DETAILS

MATERIAL LIST

- UNIT 1 - TOPSOIL
- UNIT 2 - SUBSOIL
- UNIT 3 - CONSTRUCTION FILL
- UNIT 4 - BEARING LAYER MATERIAL
- UNIT 5 - CLAY RICH MATERIAL
- UNIT 6 - CLAY LINER MATERIAL
- UNIT 7 - GEOSYNTHETIC CLAY LINER
- UNIT 8A - SEPARATION GEOTEXTILE
- UNIT 8B - CUSHION GEOTEXTILE
- UNIT 9 - FILTER GEOTEXTILE
- UNIT 10 - LLDPE GEOMEMBRANE
- UNIT 11 - DRAINAGE AGGREGATE
- UNIT 12A - SUBSOIL DRAIN
- S — UNIT 12B - SUBSOIL PERIMETER DRAIN
- G — UNIT 13A - FEEDER DRAINS AND GAS COLLECTION PIPE A
- G — UNIT 13B - FEEDER DRAIN AND GAS COLLECTION PIPE B
- L — UNIT 14 - COLLECTOR DRAIN PIPE ABOVE LINER
- UNIT 14 - COLLECTOR DRAIN PIPE BELOW LINER
- LC — UNIT 15 - LEACHATE FEEDER DRAIN ABOVE LINER
- UNIT 15 - LEACHATE FEEDER DRAIN BELOW LINER
- UNIT 16 - CONCRETE PIT
- UNIT 17 - GAS VENT
- UNIT 18 - BARRIER WALL MATERIAL
- UNIT 19 - BENTONITE PELLET
- M — UNIT 20 - MARKER LAYER MATERIAL

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0 5 10 15 20 25 30 35 40 45 50mm ON A3 SIZE ORIGINAL

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DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING	REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
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PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5
CPB CONTRACTORS | DRAGADOS | SAMSUNG C&T | aJJV AURECON JACOBS NEW M5 JOINT VENTURE | Golder Associates | HASSELL

PLOT DATE / TIME: 8/06/2016 12:38:03 PM
PLOT BY: DTremelling

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DRG CHECK	RH	08.06.16
DESIGN	RH	08.06.16
DESIGN CHECK	GRS	08.06.16
DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

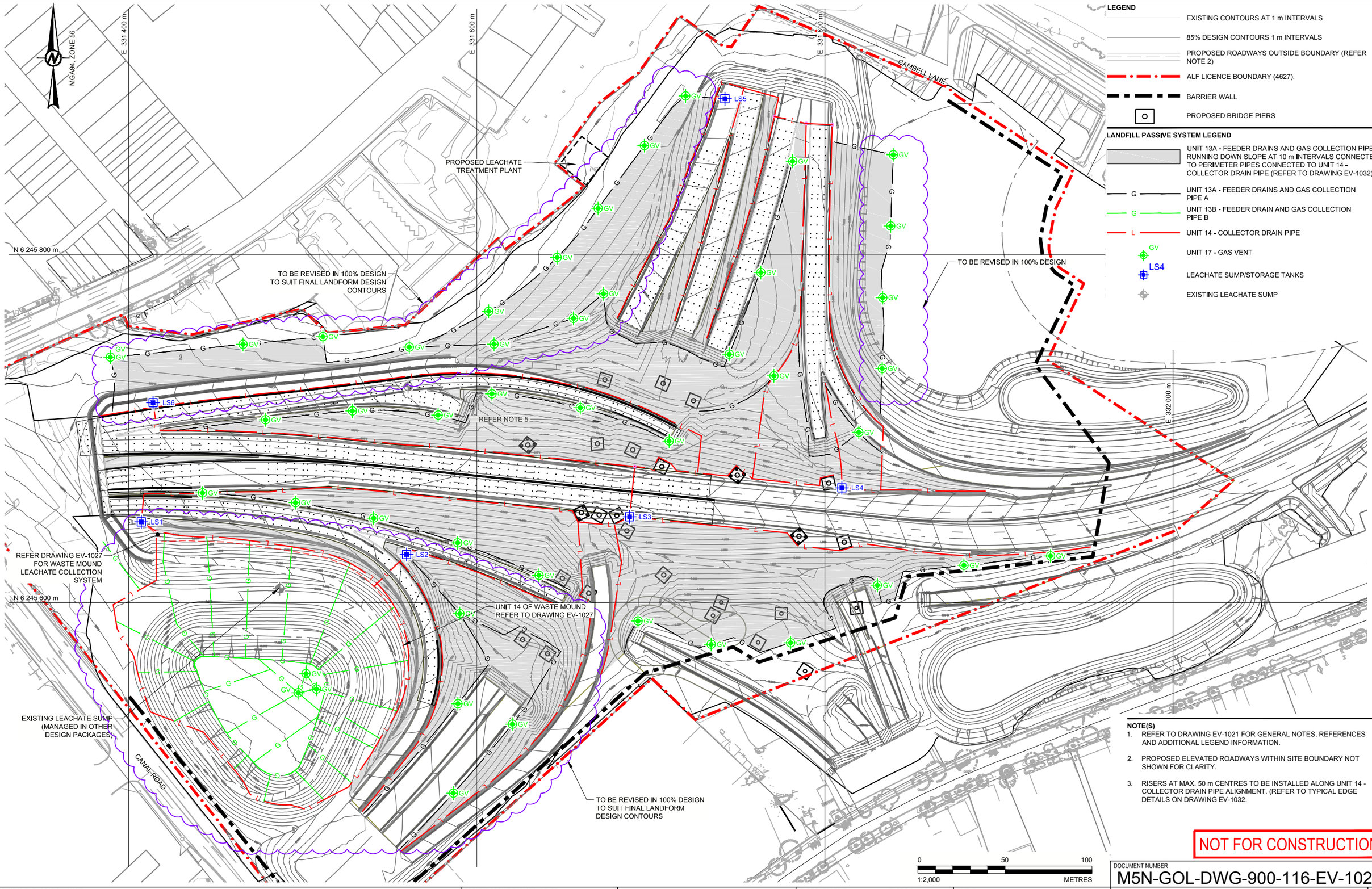
CLIENT: Sydney Motorway Corporation | WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1021

WESTCONNEX NEW M5 — A3
LANDFILL
COVER SHEET
SHEET 1 OF 12

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1021	A



LEGEND

- EXISTING CONTOURS AT 1 m INTERVALS
- 85% DESIGN CONTOURS 1 m INTERVALS
- PROPOSED ROADWAYS OUTSIDE BOUNDARY (REFER NOTE 2)
- ALF LICENCE BOUNDARY (4627).
- BARRIER WALL
- PROPOSED BRIDGE PIERS

LANDFILL PASSIVE SYSTEM LEGEND

- UNIT 13A - FEEDER DRAINS AND GAS COLLECTION PIPE A RUNNING DOWN SLOPE AT 10 m INTERVALS CONNECTED TO PERIMETER PIPES CONNECTED TO UNIT 14 - COLLECTOR DRAIN PIPE (REFER TO DRAWING EV-1032)
- G — UNIT 13A - FEEDER DRAINS AND GAS COLLECTION PIPE A
- G — UNIT 13B - FEEDER DRAIN AND GAS COLLECTION PIPE B
- L — UNIT 14 - COLLECTOR DRAIN PIPE
- GV — UNIT 17 - GAS VENT
- LS4 — LEACHATE SUMP/STORAGE TANKS
- EXISTING LEACHATE SUMP

NOTE(S)

1. REFER TO DRAWING EV-1021 FOR GENERAL NOTES, REFERENCES AND ADDITIONAL LEGEND INFORMATION.
2. PROPOSED ELEVATED ROADWAYS WITHIN SITE BOUNDARY NOT SHOWN FOR CLARITY.
3. RISERS AT MAX. 50 m CENTRES TO BE INSTALLED ALONG UNIT 14 - COLLECTOR DRAIN PIPE ALIGNMENT. (REFER TO TYPICAL EDGE DETAILS ON DRAWING EV-1032.

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	A	08.06.2016	ISSUED FOR LCMP	GRS

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5

CPB CONTRACTORS · DRAGADOS · SAMSUNG C&T · Golder Associates · aJJV AURECON JACOBS NEW M5 JOINT VENTURE · HASSELL

PLOT DATE / TIME	PLOT BY
8/06/2016 12:50:01 PM	DTremelling

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DRG CHECK	RH	08.06.16
DESIGN	RH	08.06.16
DESIGN CHECK	GRS	08.06.16
DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

CLIENT: Sydney Motorway Corporation · WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1022

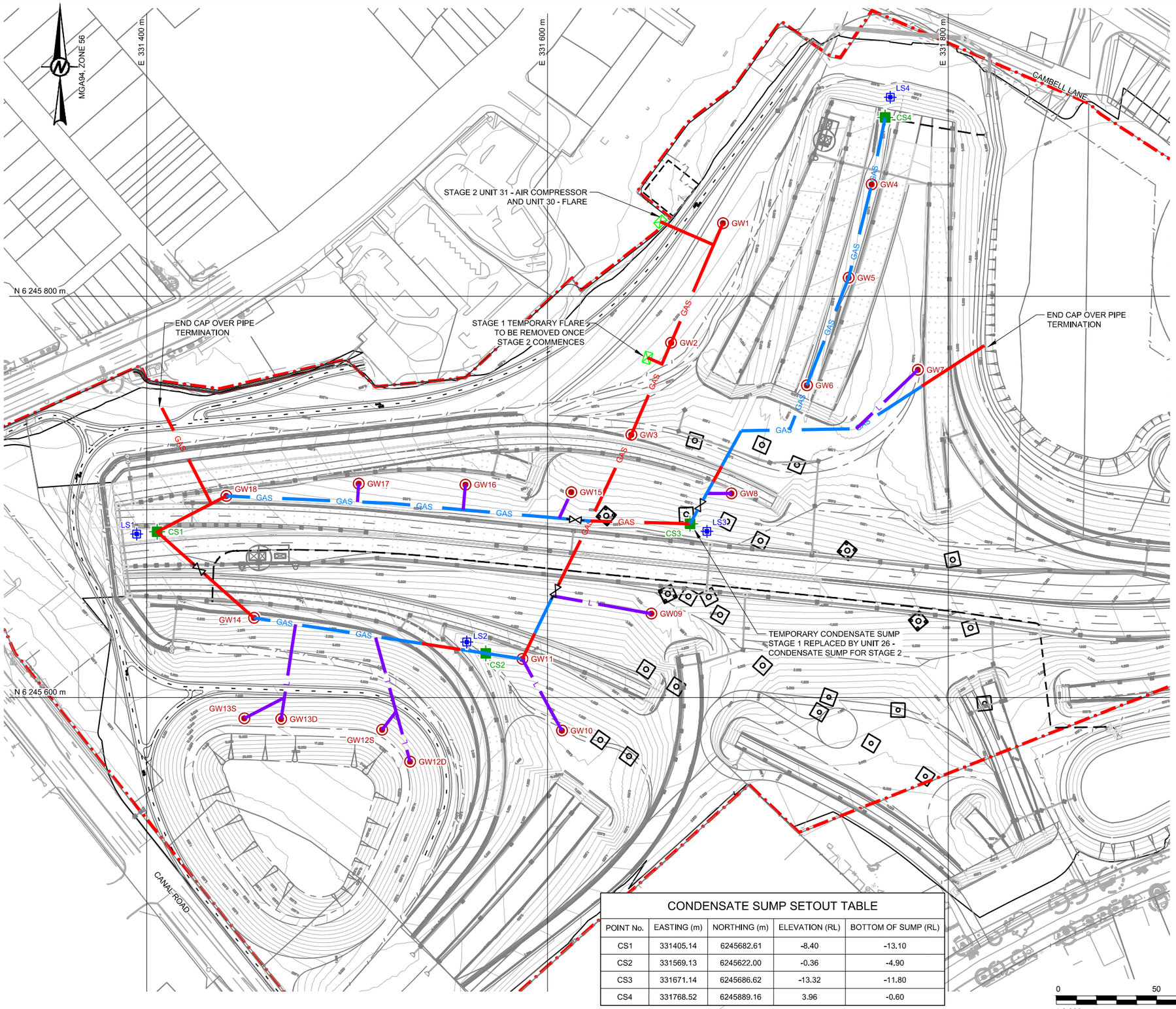
WESTCONNEX NEW M5 — A3

LANDFILL
SEEPAGE AND PASSIVE GAS COLLECTION SYSTEM

SHEET 2 OF 12

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1022	A



LEGEND

- EXISTING CONTOURS AT 1 m INTERVALS
- 85% FINAL CONTOURS 1 m INTERVALS
- PROPOSED ROADWAYS OUTSIDE BOUNDARY
- ALF LICENCE BOUNDARY (4627).
- PROPOSED BORED PIERS

ACTIVE SYSTEM LEGEND

- GAS — REFER NOTE 6 — STAGE 1 - UNIT 23A - GAS HEADER CONVEYANCE PIPE WITH UNIT 24 - AIR PRESSURE AND FORCEMAIN CONDENSATE PIPE AND FITTINGS
- GAS — REFER NOTE 6 — STAGE 2 - UNIT 23A - GAS HEADER CONVEYANCE PIPE WITH UNIT 24 - AIR PRESSURE AND FORCEMAIN CONDENSATE PIPE AND FITTINGS
- L — REFER NOTE 6 — STAGE 2 UNIT 23B - LATERAL GAS CONVEYANCE PIPE WITH UNIT 24 - AIR PRESSURE AND FORCEMAIN CONDENSATE PIPE AND FITTINGS
- GAS WELL
- GAS FLARE
- LEACHATE SUMP/STORAGE TANKS
- UNIT 26 - CONDENSATE SUMP REFER NOTE 6
- UNIT 28 - MANUAL BUTTERFLY VALVE

NOTE(S)

1. REFER TO DRAWING EV-1021 FOR GENERAL NOTES, REFERENCES AND ADDITIONAL LEGEND INFORMATION.
2. CONDENSATE COLLECTED IN UNIT 26 - CONDENSATE SUMP TO BE PIPED INTO ADJACENT LEACHATE SUMPS THROUGH UNIT 24 -FORCEMAIN PIPEWORK EXCEPT IN WASTE MOUND AREA.
3. ALL WELLS TO BE CONNECTED TO UNIT 23A - HEADERS VIA MINIMUM 3 m UNIT 23B - LATERAL LINE CONNECTIONS. NOT ALL CONNECTIONS ARE SHOWN FOR CLARITY.
4. UNIT 24 - AIR PRESSURE AND FORCEMAIN CONDENSATE PIPE AND FITTINGS NOT SHOWN FOR CLARITY. BOTH SHOULD BE INSTALLED ADJACENT TO ALL UNIT 23A - HEADER AND UNIT 23B - LATERAL PIPES. UNIT 24 - FORCEMAINS TO BE CONNECTED TO NEAREST DOWNSLOPE LEACHATE RISER, SUMP OR PIT.
5. PIPEWORK UNDER ROADS TO BE CONSTRUCTED AND CAPPED AS PART OF STAGE 1 CONSTRUCTION READY FOR STAGE 2 EXPANSION.
6. GAS PIPEWORK AND CONDENSATE SUMP LOCATIONS MAY BE ADJUSTED FOR FINAL DESIGN.

GAS WELL SETOUT TABLE - REFER NOTE 6

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)	WELL DEPTH (m)	SCREEN LENGTH (m)
GW1	331687.52	6245836.46	10.95	28	20
GW2	331661.66	6245776.82	12.77	30	20
GW3	331641.77	6245730.95	6.17	24	18
GW4	331761.74	6245855.81	5.10	21	15
GW5	331750.26	6245809.25	6.58	24	18
GW6	331729.42	6245755.61	9.14	28	20
GW7	331784.80	6245763.36	4.77	20	14
GW8	331691.76	6245701.71	0.58	20	15
GW9	331651.83	6245641.81	-7.10	15	10
GW10	331607.14	6245583.47	6.43	24	18
GW11	331587.43	6245619.21	0.72	19	14
* GW12D	331531.40	6245567.98	10.41	28	20
* GW13D	331467.03	6245589.23	10.51	28	20
GW14	331453.53	6245639.66	-5.30	15	10
GW15	331611.83	6245702.37	-2.75	17	11
GW16	331559.02	6245706.09	-2.00	14	9
GW17	331505.74	6245706.57	-4.00	11	7
GW18	331439.66	6245700.46	-7.19	9	6
* GW12S	331517.45	6245583.92	10.43	15	10
* GW13S	331448.66	6245589.61	10.54	12	8

* FINAL WELL DEPTH AND SCREEN LENGTH TO BE CONFIRMED AFTER WASTE MOUND DESIGN

CONDENSATE SUMP SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (RL)	BOTTOM OF SUMP (RL)
CS1	331405.14	6245682.61	-8.40	-13.10
CS2	331569.13	6245622.00	-0.36	-4.90
CS3	331671.14	6245686.62	-13.32	-11.80
CS4	331768.52	6245889.16	3.96	-0.60

0 50 100
1:2,000 METRES

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PROJECT BREAKDOWN STRUCTURE

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING	REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
	A	08.06.2016	ISSUED FOR LCMP	GRS

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5

CPB CONTRACTORS | DRAGADOS | SAMSUNG C&T | Golder Associates | AJJV AURECON JACOBS NEW M5 JOINT VENTURE | HASSELL

PLOT DATE / TIME	PLOT BY
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PROJECT MNGR	PD	08.06.16

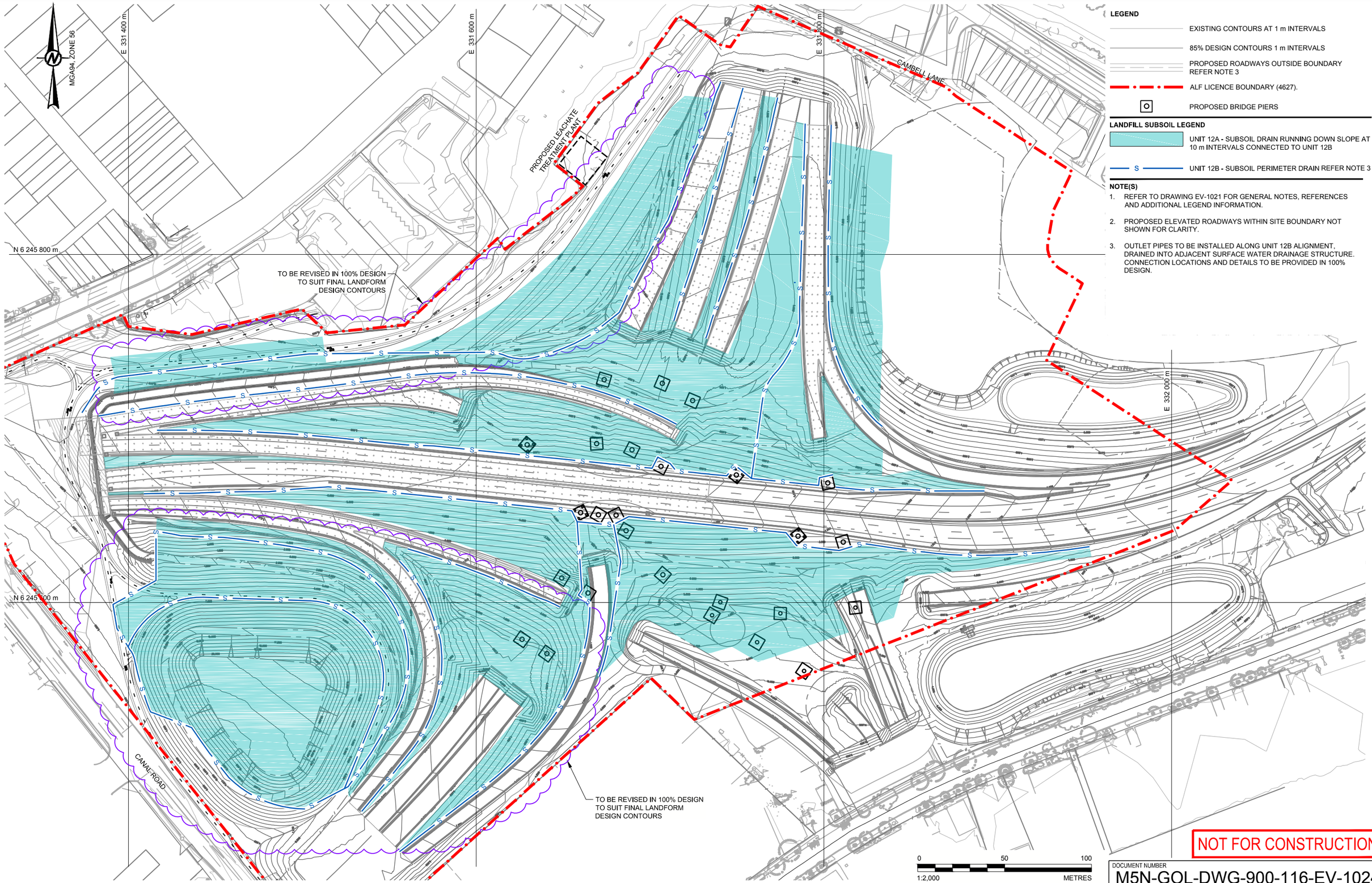
CLIENT: Sydney Motorway Corporation | WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1023

WESTCONNEX NEW M5 — A3
LANDFILL
ACTIVE GAS COLLECTION SYSTEM
SHEET 3 OF 12

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1023	A



LEGEND

- EXISTING CONTOURS AT 1 m INTERVALS
- 85% DESIGN CONTOURS 1 m INTERVALS
- PROPOSED ROADWAYS OUTSIDE BOUNDARY REFER NOTE 3
- ALF LICENCE BOUNDARY (4627).
- PROPOSED BRIDGE PIERS

LANDFILL SUBSOIL LEGEND

- UNIT 12A - SUBSOIL DRAIN RUNNING DOWN SLOPE AT 10 m INTERVALS CONNECTED TO UNIT 12B
- S — UNIT 12B - SUBSOIL PERIMETER DRAIN REFER NOTE 3

NOTE(S)

1. REFER TO DRAWING EV-1021 FOR GENERAL NOTES, REFERENCES AND ADDITIONAL LEGEND INFORMATION.
2. PROPOSED ELEVATED ROADWAYS WITHIN SITE BOUNDARY NOT SHOWN FOR CLARITY.
3. OUTLET PIPES TO BE INSTALLED ALONG UNIT 12B ALIGNMENT, DRAINED INTO ADJACENT SURFACE WATER DRAINAGE STRUCTURE. CONNECTION LOCATIONS AND DETAILS TO BE PROVIDED IN 100% DESIGN.

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REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
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PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5

AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME: 8/06/2016 2:06:54 PM
PLOT BY: DTremelling

TITLE	NAME	DATE
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DESIGN	RH	08.06.16
DESIGN CHECK	GRS	08.06.16
DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

CLIENT: Sydney Motorway Corporation / WestConnex

DOCUMENT NUMBER: M5N-GOL-DWG-900-116-EV-1024

WESTCONNEX NEW M5

A3

LANDFILL
SUBSOIL DRAINAGE LAYOUT

SHEET 4 OF 12

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1024	A

MGA94, ZONE 56

E 331 400 m

E 331 600 m

E 331 800 m

N 6 245 800 m

N 6 245 600 m

PROPOSED LEACHATE TREATMENT PLANT

CAMBELL LANE

BRADSHAW MOUNTAIN SITE

POND LINER ON HOLD

E 332 000 m

ALEXANDRIA LANDFILL SITE

CANAL ROAD

CANAL ROAD SITE

LEGEND

- EXISTING CONTOURS AT 1 m INTERVALS
- 85% DESIGN CONTOURS AT 1 m INTERVALS
- ALF LICENCE BOUNDARY (4627).
- TYPICAL CAP PROFILE TYPE 1 REFER TO DRAWING EV-1031
- TYPICAL CAP PROFILE TYPE 1A REFER TO DRAWING EV-1031
- TYPICAL CAP PROFILE TYPE 2 OR 2A REFER TO DRAWING EV-1031 (REFER NOTE 2)
- TYPICAL CAP PROFILE TYPE 3 REFER TO DRAWING EV-1031
- ROADWAY FORMS CAPPING SYSTEM.
- PROPOSED BRIDGE PIERS

NOTE(S)

1. REFER TO DRAWING EV-1021 FOR GENERAL NOTES, REFERENCES AND ADDITIONAL LEGEND INFORMATION.
2. CAP TYPE 2 TO BE USED FOR 10 m x 10 m PAD UNDER BRIDGE PIERS.

0 50 100

1:2,000 METRES

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REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
A	08.06.2016	ISSUED FOR LCMP	GRS

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56

HEIGHT DATUM: AHD

WestConnex New M5

CPB CONTRACTORS | DRAGADOS | SAMSUNG C&T | Golder Associates | HASSELL

AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME: 8/06/2016 2:09:19 PM PLOT BY: DTremelling

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DESIGN	RH	08.06.16
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DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

CLIENT: Sydney Motorway Corporation | WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1025

WESTCONNEX NEW M5

LANDFILL
FINAL TOP OF CAP PLAN

A3

SHEET 5 OF 12

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
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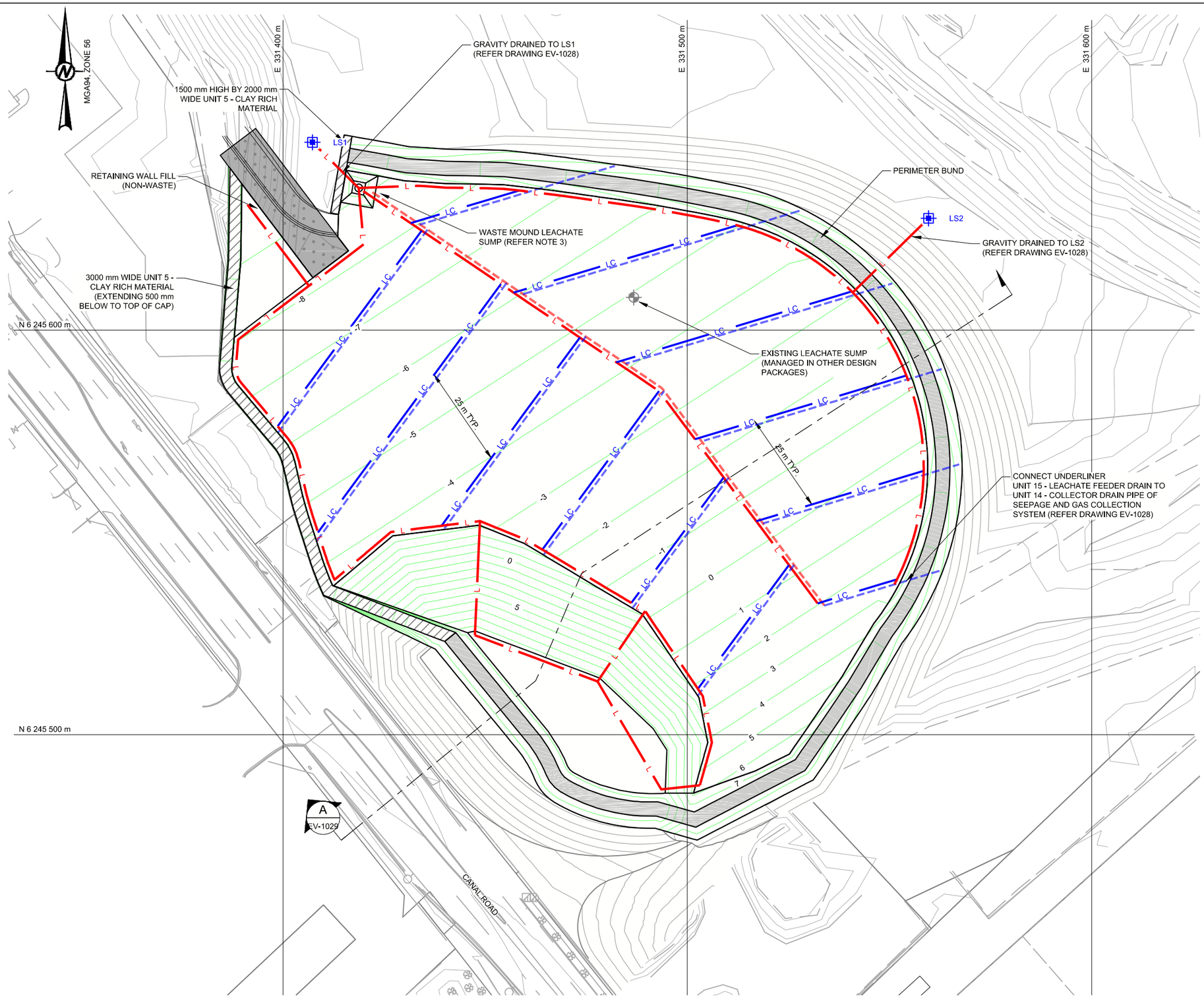

LEGEND

- EXISTING CONTOURS AT 1 m INTERVALS
- 85% WASTE MOUND LINER AND PERIMETER BUND CONTOURS AT 1 m INTERVALS
- EXISTING LEACHATE RISER/SUMP

WASTE MOUND PASSIVE SYSTEM LEGEND

- L — UNIT 14 - COLLECTOR DRAIN PIPE ABOVE LINER
- UNIT 14 - COLLECTOR DRAIN PIPE BELOW LINER
- LC — UNIT 15 - LEACHATE FEEDER DRAIN ABOVE LINER
- UNIT 15 - LEACHATE FEEDER DRAIN BELOW LINER
- LEACHATE SUMP

NOTE(S)

1. REFER TO DRAWING EV-1021 FOR GENERAL NOTES, REFERENCES AND ADDITIONAL LEGEND INFORMATION.
2. REFER TO DRAWING EV-1029 FOR WASTE MOUND BASE LINER DETAILS.

0 25 50
1:1,000 METRES

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REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
A	08.06.2016	ISSUED FOR LCMP	GRS

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5

CPB CONTRACTORS | DRAGADOS | SAMSUNG C&T | Golder Associates | HASSELL
AUJV — AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME	PLOT BY
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DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

CLIENT: Sydney Motorway Corporation | WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1027

WESTCONNEX NEW M5 — A3
WASTE MOUND
LEACHATE COLLECTION SYSTEM
SHEET 6 OF 12

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
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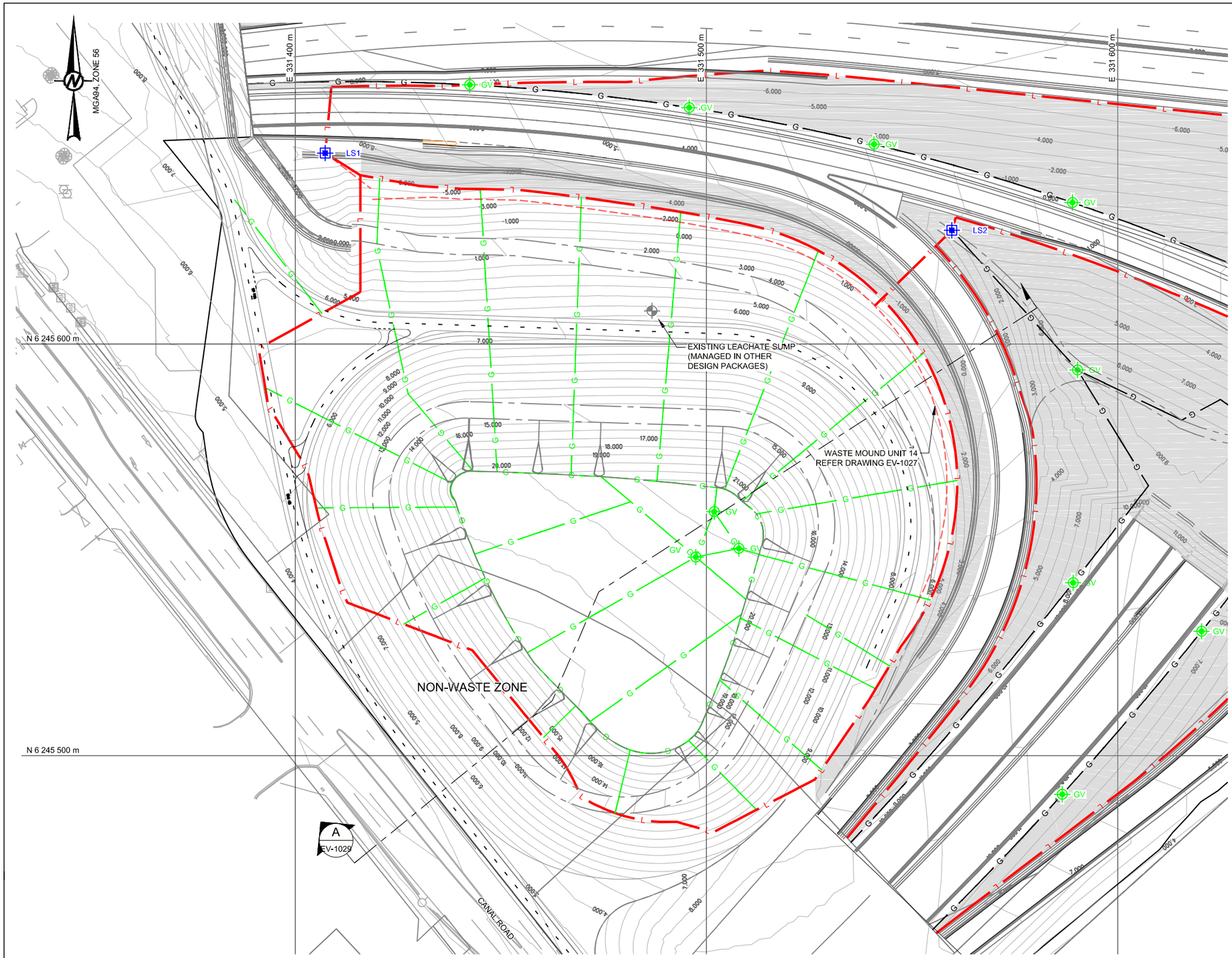

LEGEND

- EXISTING CONTOURS AT 1 m INTERVALS
- 85% DESIGN CONTOURS 1 m INTERVALS

LANDFILL PASSIVE SYSTEM LEGEND

- UNIT 13A - FEEDER DRAINS AND GAS COLLECTION PIPE A RUNNING DOWN SLOPE AT 10 m INTERVALS CONNECTED TO PERIMETER PIPES CONNECTED TO UNIT 14 - COLLECTOR DRAIN PIPE (REFER TO DRAWING EV-1032)
- G — UNIT 13A - FEEDER DRAINS AND GAS COLLECTION PIPE A
- G — UNIT 13B - FEEDER DRAIN AND GAS COLLECTION PIPE B
- L — UNIT 14 - COLLECTOR DRAIN PIPE
- GV — UNIT 17 - GAS VENT
- LS4 — LEACHATE SUMP/STORAGE TANKS

NOTE(S)

1. REFER TO DRAWING EV-1021 FOR GENERAL NOTES, REFERENCES AND ADDITIONAL LEGEND INFORMATION.

0 25 50
1:1,000 METRES

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REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
A	08.06.2016	ISSUED FOR LCMP	GRS

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5

AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME	PLOT BY
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M5N-GOL-DWG-900-116-EV-1028

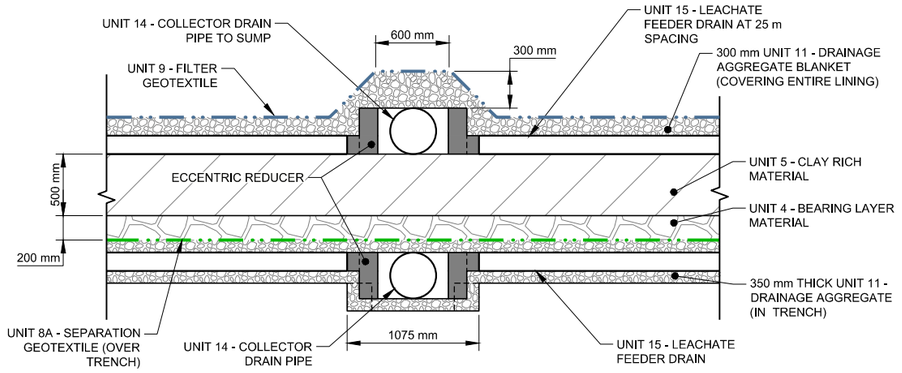
WESTCONNEX NEW M5 — A3

WASTE MOUND
SEEPAGE AND GAS COLLECTION SYSTEM

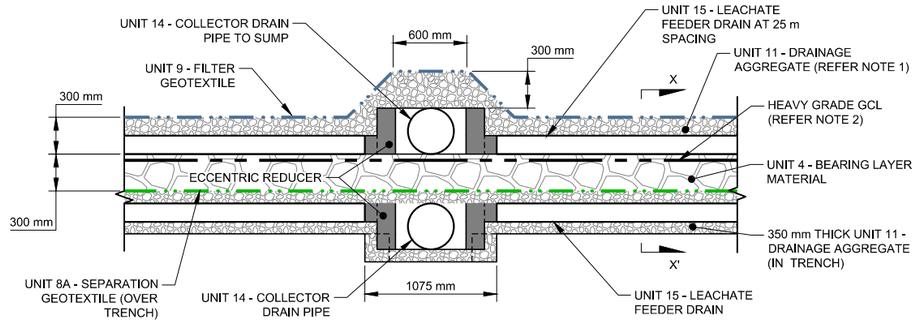
SHEET 7 OF 12

RMS REGISTRATION No.

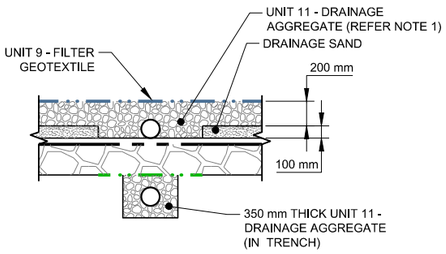
ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1028	A



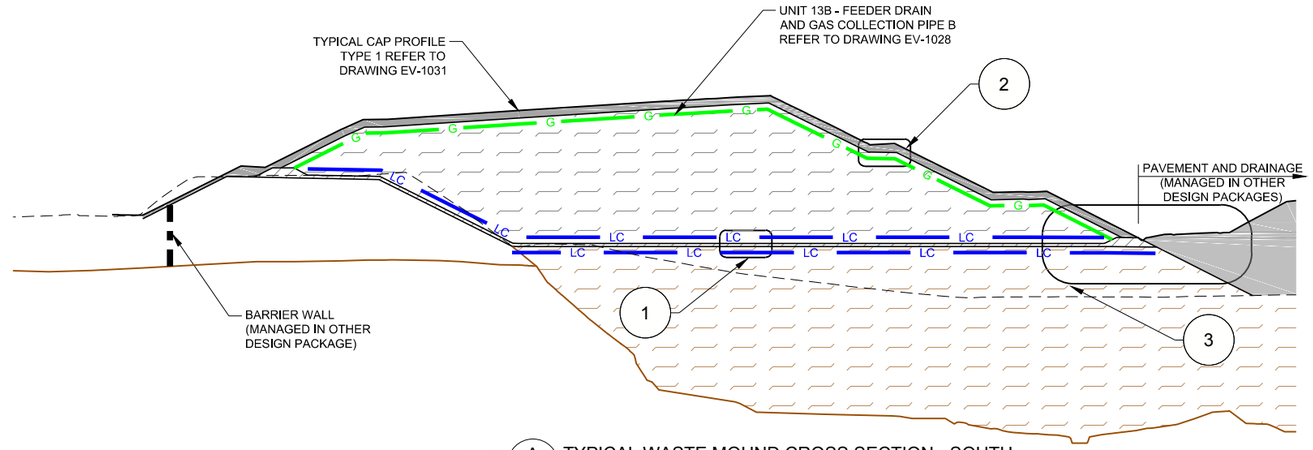
SCALE 1:50 (1) TYPICAL BASE LINER DETAIL



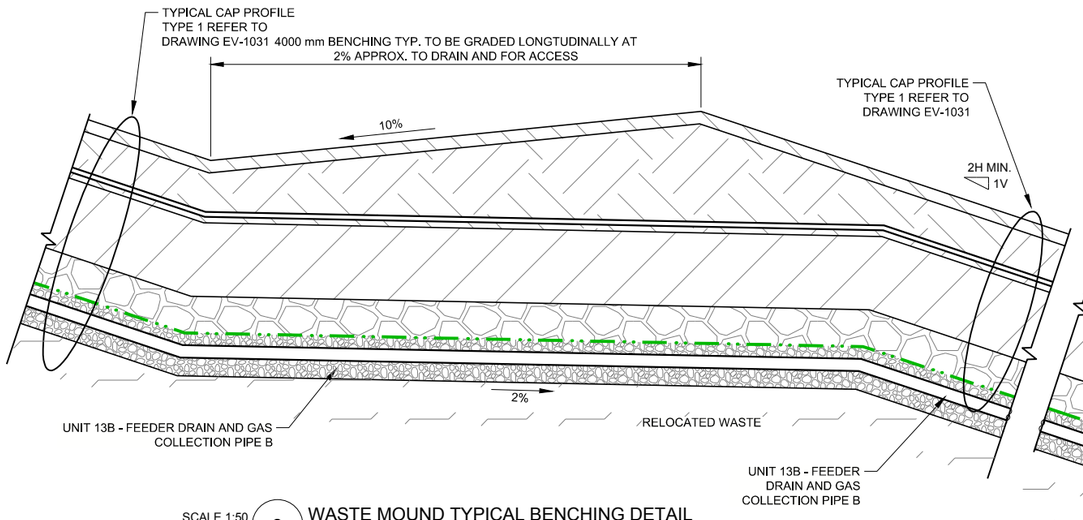
SCALE 1:50 (1) ALTERNATIVE BASE LINER DETAIL



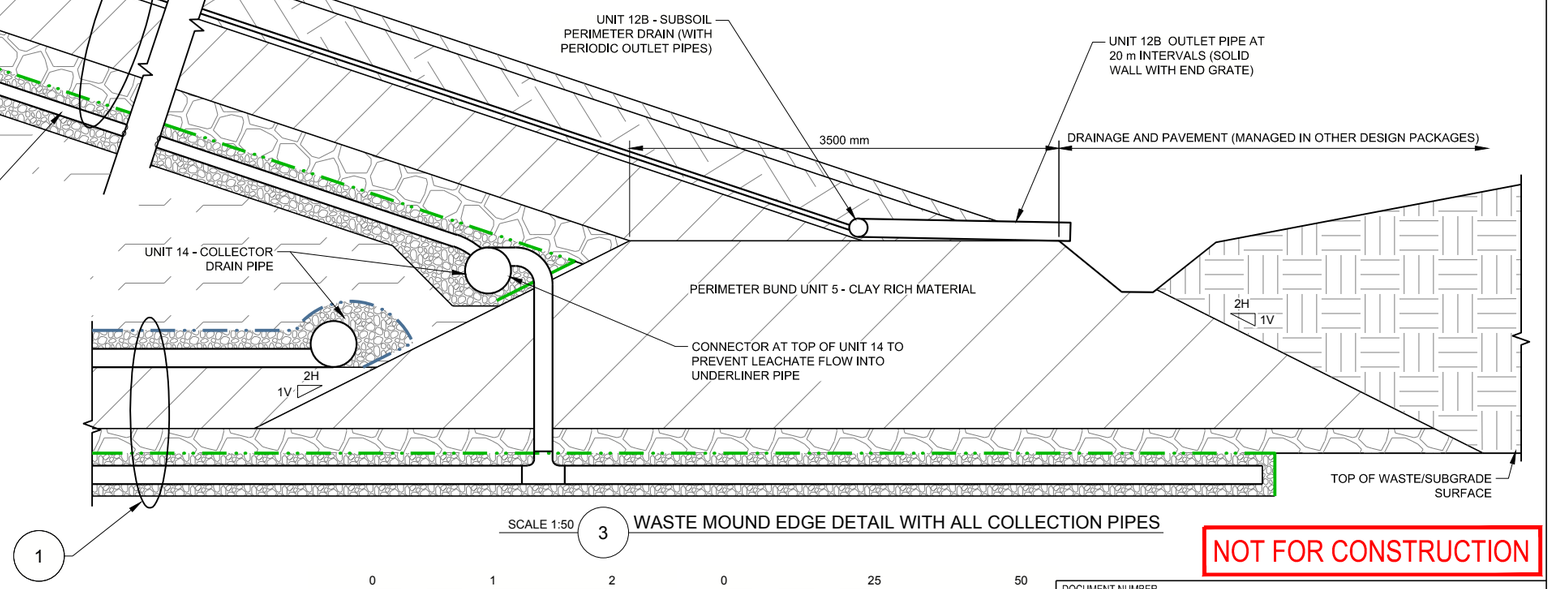
SECTION X-X'
SCALE 1:50



1:1,000 (A) EV-1027 EV-1028 TYPICAL WASTE MOUND CROSS SECTION - SOUTH



SCALE 1:50 (2) WASTE MOUND TYPICAL BENCHING DETAIL



SCALE 1:50 (3) WASTE MOUND EDGE DETAIL WITH ALL COLLECTION PIPES

NOTE(S)

1. UNIT 11 - DRAINAGE AGGREGATE TO SURROUND THE PIPES, MINIMUM 300 mm COVER EACH SIDE FOR AREAS OUTSIDE THE PIPE ALIGNMENT.
   200 mm THICK UNIT 11 - DRAINAGE AGGREGATE TO BE PLACED OVER 100 mm DRAINAGE SAND, COVERING ENTIRE GCL SURFACE.
2. DOUBLE GCL LAYER TO BE PLACED ALONG THE PIPE ALIGNMENT, UNDERLYING UNIT 11 - DRAINAGE AGGREGATE AND EXTENDING AT LEAST 100 mm UNDER THE DRAINAGE SAND LAYER

1:50 0 1 2 METRES

1:1,000 0 25 50 METRES

NOT FOR CONSTRUCTION

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED
150mm ON A3 SIZE ORIGINAL

DRAWING FILE LOCATION \ NAME					
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DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING	REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL	
	A	08.06.2016	ISSUED FOR LCMP	GRS	

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56 | HEIGHT DATUM: AHD

WestConnex New M5

CPB CONTRACTORS | DRAGADOS | SAMSUNG C&T | Golder Associates | AJJV AURECON JACOBS NEW M5 JOINT VENTURE | HASSELL

PLOT DATE / TIME	PLOT BY
8/06/2016 2:19:22 PM	DTremelling

TITLE	NAME	DATE
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DRG CHECK	RH	08.06.16
DESIGN	RH	08.06.16
DESIGN CHECK	GRS	08.06.16
DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

CLIENT: Sydney Motorway Corporation | WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1029

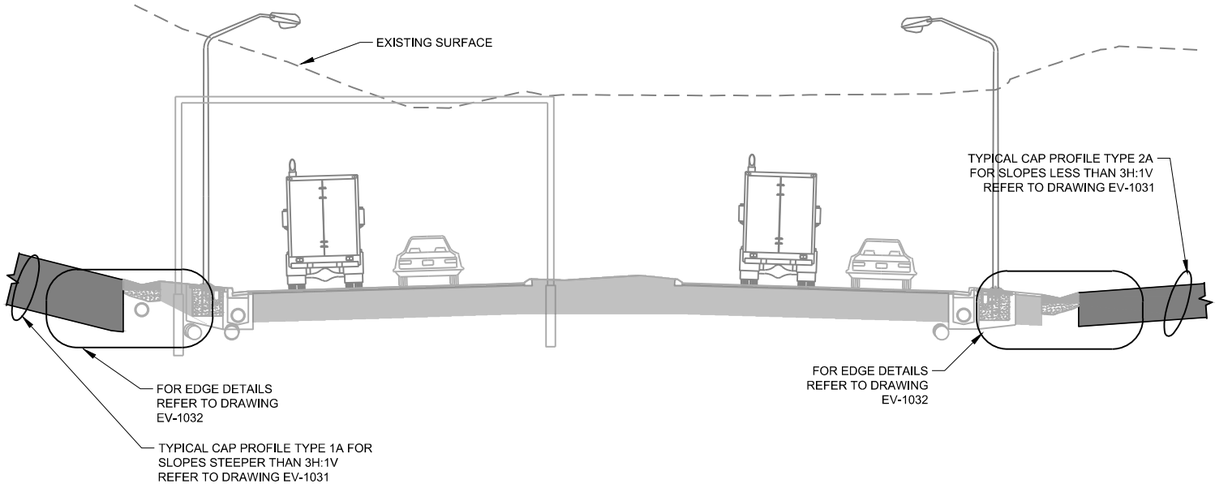
WESTCONNEX NEW M5 — A3

WASTE MOUND
TYPICAL CROSS SECTIONS

SHEET 8 OF 12

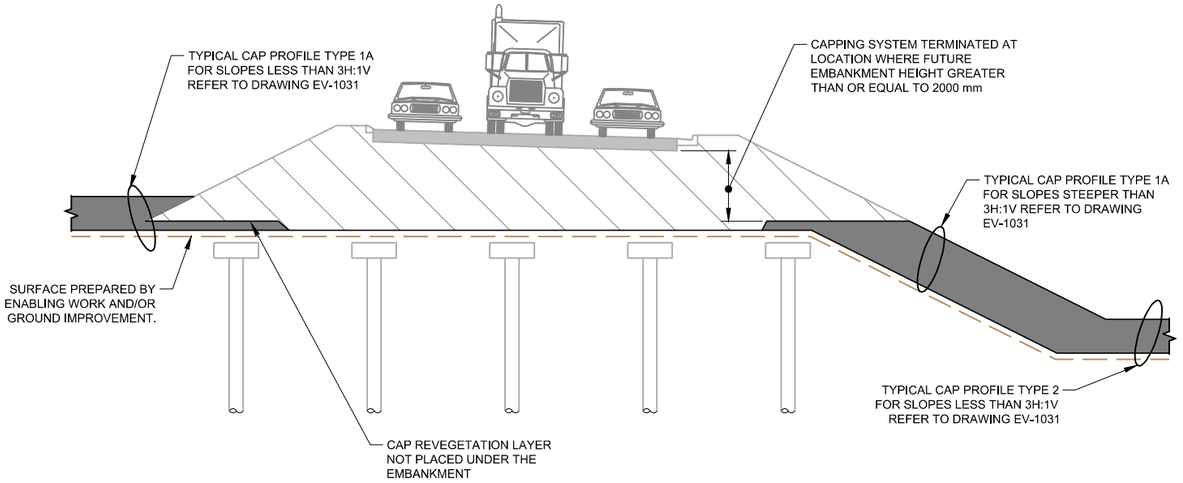
RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1029	A



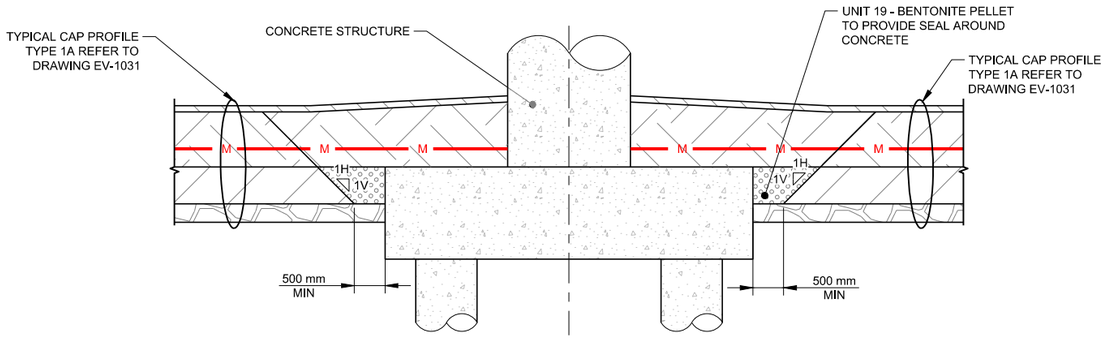
TYPICAL ROAD CROSS SECTION WITH CUT BATTERS

SCALE 1:200



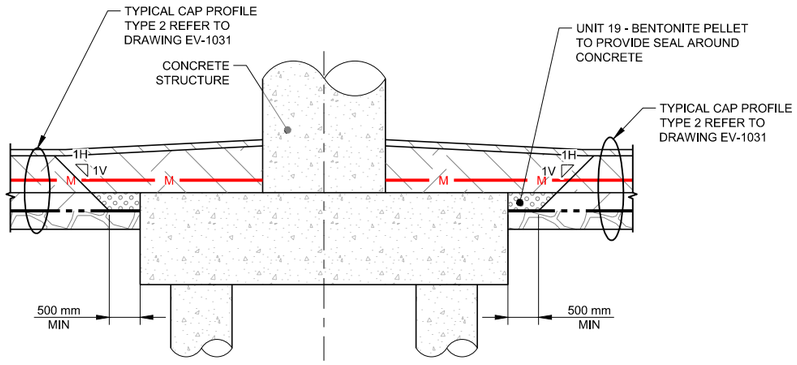
TYPICAL CROSS SECTION OF ROAD EMBANKMENT

SCALE 1:200



TYPICAL TERMINATION AROUND CONCRETE STRUCTURES (CAP TYPE 1A)

SCALE 1:100



TYPICAL TERMINATION AROUND CONCRETE STRUCTURES (CAP TYPE 2)

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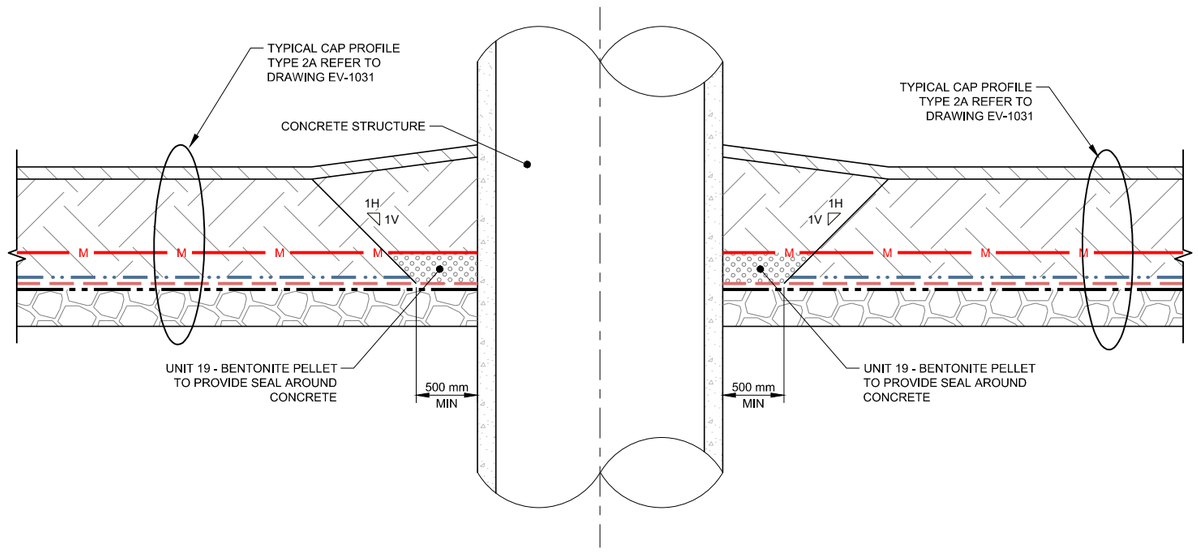

TYPICAL TERMINATION AROUND CONCRETE STRUCTURES (CAP TYPE 2A)

SCALE 1:50

0 1 2
1:50 METRES

0 2.5 5
1:100 METRES

0 5 10
1:200 METRES

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DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1030

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PROJECT BREAKDOWN STRUCTURE

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING	REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
	A	08.06.2016	ISSUED FOR LCMP	GRS

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5
CPB CONTRACTORS | DRAGADOS | SAMSUNG | SAMSUNG C&T | Golder Associates | HASSELL
AUJV AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME: 8/06/2016 12:51:49 PM
PLOT BY: DTremelling

TITLE	NAME	DATE
DRAWN	DAT	08.06.16
DRG CHECK	RH	08.06.16
DESIGN	RH	08.06.16
DESIGN CHECK	GRS	08.06.16
DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

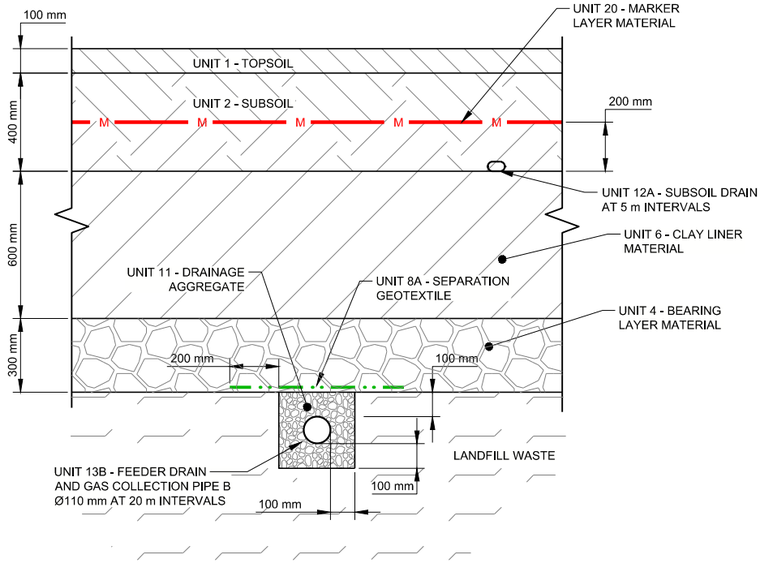
CLIENT
Sydney Motorway Corporation | WestConnex

WESTCONNEX NEW M5 — A3
LANDFILL
TYPICAL PENETRATION DETAILS

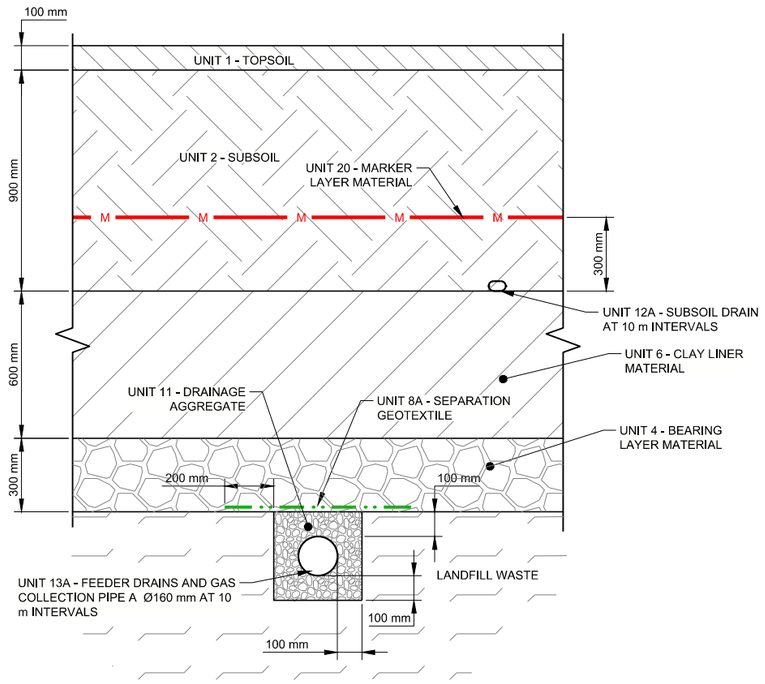
SHEET 9 OF 12

RMS REGISTRATION No.

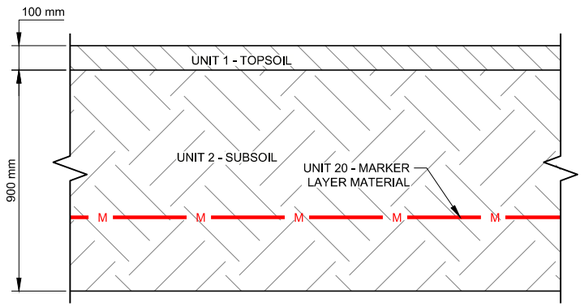
ISSUE STATUS: PRELIMINARY
EDMS No.:
SHEET No.: EV-1030
REV: A



TYPICAL CAP PROFILE TYPE 1
SCALE 1:25



TYPICAL CAP PROFILE TYPE 1A
SCALE 1:25



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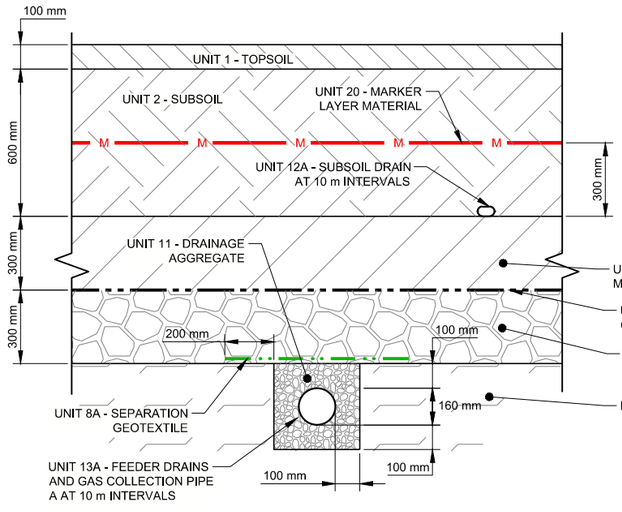
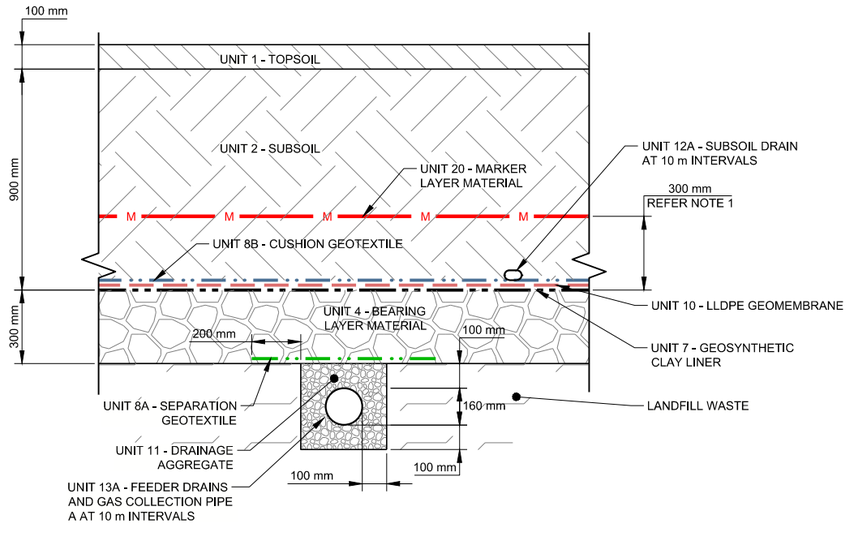
SCALE 1:25



TYPICAL CAP PROFILE TYPE 2
SCALE 1:25



TYPICAL CAP PROFILE TYPE 2A
SCALE 1:25

NOTE(S)

1. MINIMUM 300 mm THICK UNIT 2 - SUBSOIL MATERIAL TO BE PLACED WITHIN A REQUIRED TIMEFRAME AFTER INSTALLATION OF GEOSYNTHETICS LAYERS (REFER TO THE TECHNICAL SPECIFICATION)

0 0.5 1
1:25 METRES

NOT FOR CONSTRUCTION

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0 5 10 15 20 25 30 35 40 45 50mm ON A3 SIZE ORIGINAL

DRAWING FILE LOCATION \ NAME
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	A	08.06.2016	ISSUED FOR LCMP	GRS

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5

CPB CONTRACTORS | DRAGADOS | SAMSUNG C&T | Golder Associates | HASSELL
AJJV AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME: 8/06/2016 2:23:07 PM
PLOT BY: DTremelling

TITLE	NAME	DATE
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DRG CHECK	RH	08.06.16
DESIGN	RH	08.06.16
DESIGN CHECK	GRS	08.06.16
DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

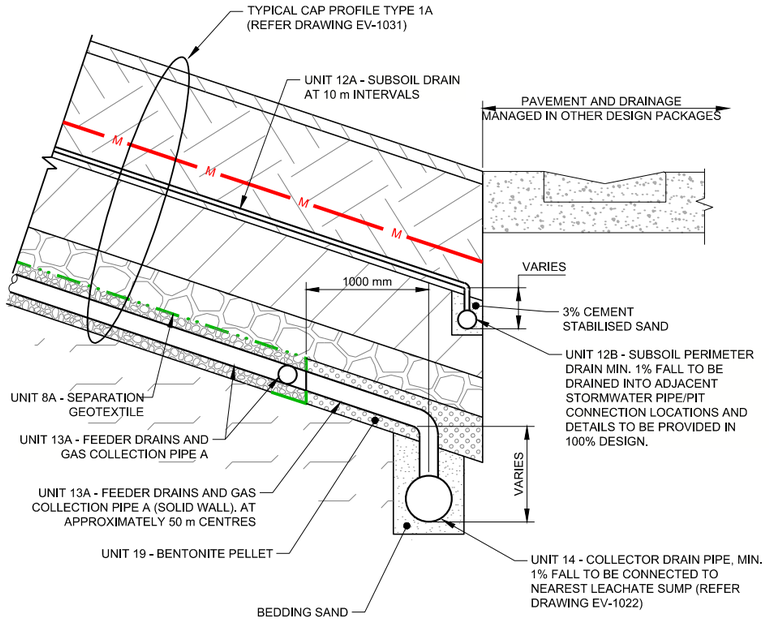
CLIENT: Sydney Motorway Corporation | WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1031

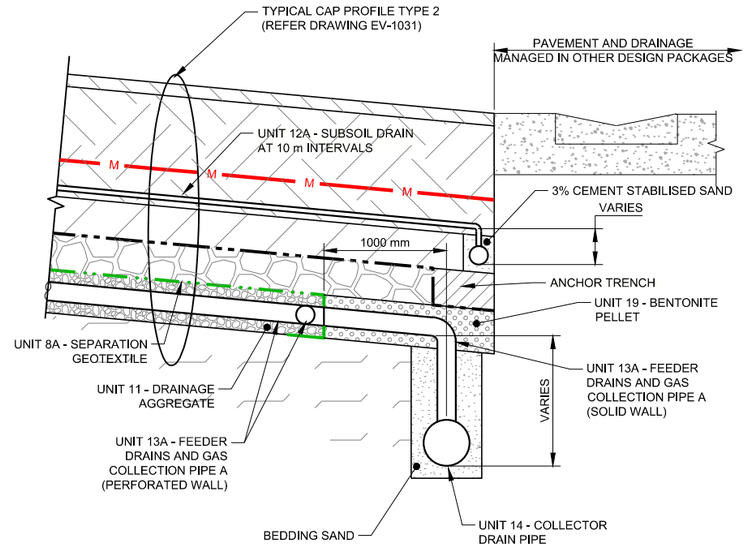
WESTCONNEX NEW M5 — A3
LANDFILL
TYPICAL CAPPING PROFILES
SHEET 10OF 12

RMS REGISTRATION No.

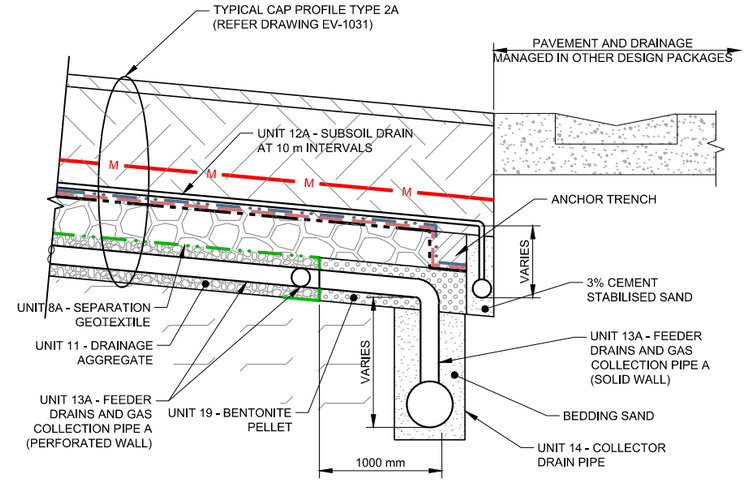
ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1031	A



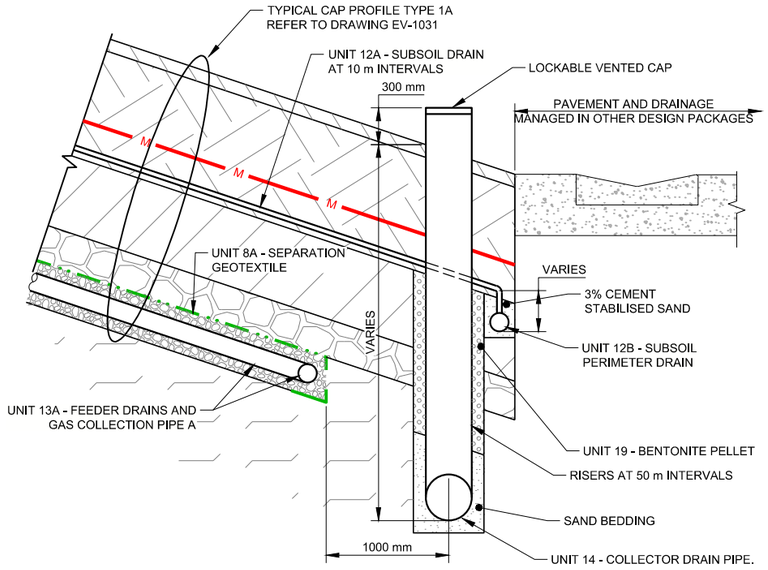
EDGE DETAIL 1 - CAP TYPE 1A TO PAVEMENT AT CONNECTION TO UNIT 14 PIPE
SCALE 1:50



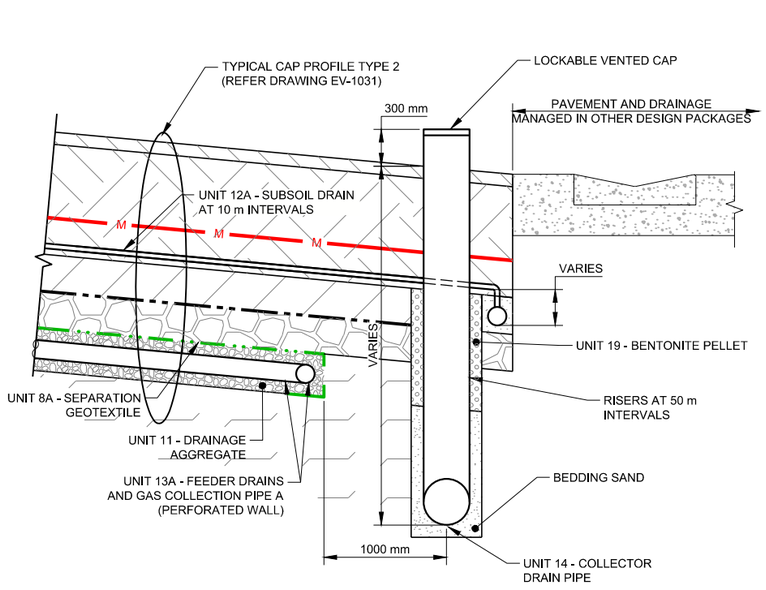
EDGE DETAIL 3 - CAP TYPE 2 TO PAVEMENT AT CONNECTION TO UNIT 14 PIPE
SCALE 1:50



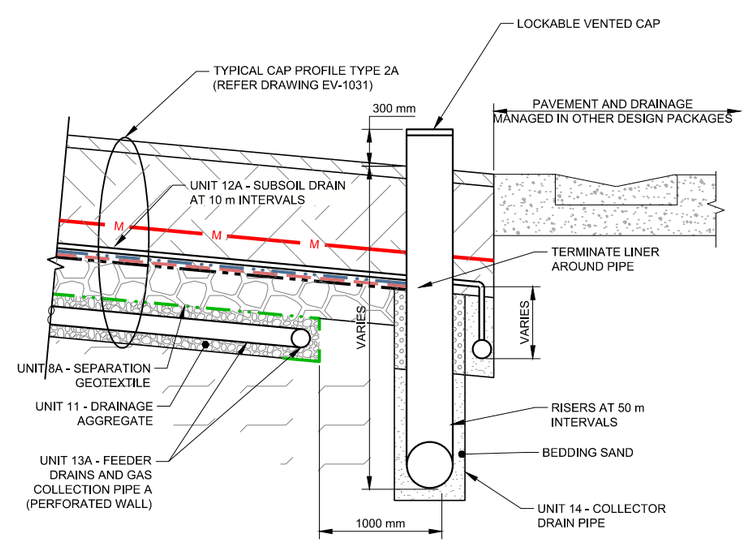
EDGE DETAIL 5 - CAP TYPE 2A TO PAVEMENT AT CONNECTION TO UNIT 14 PIPE
SCALE 1:50



EDGE DETAIL 2 - CAP TYPE 1A TO PAVEMENT AT UNIT 14 RISER
SCALE 1:50



EDGE DETAIL 4 - CAP TYPE 2 TO PAVEMENT AT UNIT 14 RISER
SCALE 1:50



EDGE DETAIL 6 - CAP TYPE 2A TO PAVEMENT AT UNIT 14 RISER
SCALE 1:50

NOT FOR CONSTRUCTION

0 1 2
1:50 METRES

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	A	08.06.2016	ISSUED FOR LCMP	GRS

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5

AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME	PLOT BY
8/06/2016 2:24:34 PM	DTremelling

TITLE	NAME	DATE
DRAWN	DAT	08.06.16
DRG CHECK	RH	08.06.16
DESIGN	RH	08.06.16
DESIGN CHECK	GRS	08.06.16
DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

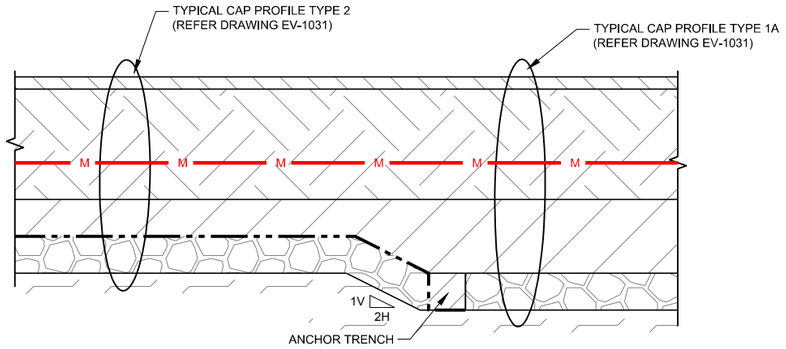
CLIENT
Sydney Motorway Corporation
WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1032

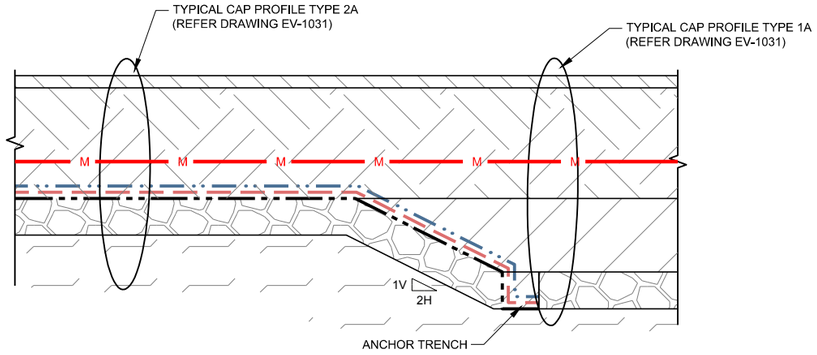
WESTCONNEX NEW M5 A3
LANDFILL
TYPICAL EDGE DETAILS
SHEET 11OF 12

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1032	A

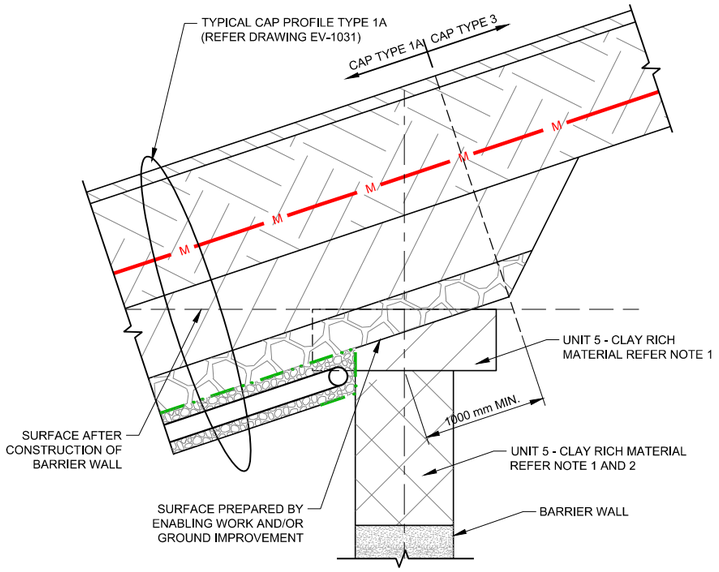


TRANSITION DETAIL BETWEEN CAP TYPE 1A AND CAP TYPE 2
SCALE 1:50

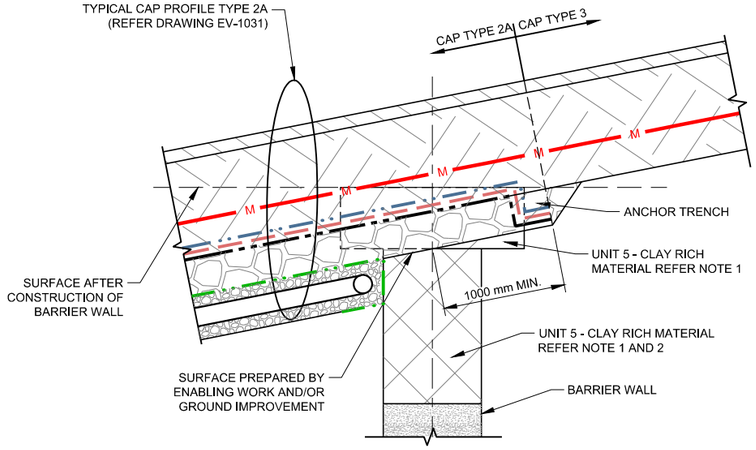


TRANSITION DETAIL BETWEEN CAP TYPE 1A AND CAP TYPE 2A
SCALE 1:50

TRANSITION DETAIL BETWEEN CAP TYPE 2 AND CAP TYPE 2A
SCALE 1:50



TYPICAL CAP DETAIL AT BARRIER WALL
CONNECTION OF CAP TYPE 1A AND 3
SCALE 1:50



TYPICAL CAP DETAIL AT BARRIER WALL
CONNECTION OF CAP TYPE 2A AND 3
SCALE 1:50

NOTE(S)

1. UNIT 5 NOT PRESENT IN ALL AREAS ALONG THE BARRIER WALL ALIGNMENT.
2. UNIT 5 TO BE PLACED DURING CONSTRUCTION OF BARRIER WALL, OR CAPPING SYSTEM.

0 1 2
1:50 METRES

NOT FOR CONSTRUCTION

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0 5 10 15 20 25 30 35 40 45 50mm ON A3 SIZE ORIGINAL

DRAWING FILE LOCATION \ NAME
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REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
A	08.06.2016	ISSUED FOR LCMP	GRS

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5

AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME	PLOT BY
8/06/2016 2:25:24 PM	DTremelling

TITLE	NAME	DATE
DRAWN	DAT	08.06.16
DRG CHECK	RH	08.06.16
DESIGN	RH	08.06.16
DESIGN CHECK	GRS	08.06.16
DESIGN MNGR	DD	08.06.16
PROJECT MNGR	PD	08.06.16

CLIENT: Sydney Motorway Corporation / WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-116-EV-1033

WESTCONNEX NEW M5 — A3
LANDFILL
TYPICAL TRANSITION DETAILS
SHEET 12OF 12

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-1033	A

Annexure B – Project Verifier Comments and Responses

DESIGN REVIEW RECORD (DRR)

Unless noted otherwise any reference to the IC is also deemed to be the D&C IC

WestConnex Stage 2 M5

DESIGN PACKAGE NUMBER

M5N-GOL-MNP-900-300-WT-9400-B

DESIGN PACKAGE TITLE

SPI - Landfill Closure Management Plan (LCMP)

Design Report: M5N-GOL-MNP-900-300-WT-9400

Drawing List: None

SUBMISSION	NO. OF DWGS	TIME ISSUED	DATE ISSUED
Substantial Detailed Design	0	9:13 AM	Sunday, 14 February 2016

<======= TO BE COMPLETED BY IC

TO BE COMPLETED BY IC======>

COMPLIANCE STATUS
O Observation / Comment
D From info currently provided not able to determine whether design / proposal is compliant.
N Non-Compliant
M Minor non-compliance for immediate action but subsequently documented in next version.

RESPONSE STATUS
O Open
C Closed
CA Closed against this package but subject to action in another package
CS Closed SUBJECT TO additional action / information

FOR IC USE ONLY
L Certification Limitation
H Drawings or part thereof on HOLD

IC Use Only	DRR TEAMBINDER REF:	WCXSTAG2-LDSJV-ARCADIS-TX-000027	
DRR REV	**DRR STATUS**	**DATE**	**BY**
Rev 01	Comments on Rev B from IC, RMS & SMC	9/03/2016	TS

No.	Stage	PACKAGE	Rev	Reviewer	Initial Comment Date	Discipline	Organisation	Document Reference	Reviewer Initial Comment	Project Deed ref	Compliance Status	Contractor Response	Initial Response Date	Response Status	Reviewer Comment on Response	Date Comment Closed	IC Use Only: Incorporation Status / Date
1	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.4 SWTCs	SWTC 1.22 a) (i) requires that Project Co as a minimum "incorporate comments of the NSW EPA accredited Site Auditor……..in the LCMP prior to submitting the plan to be certified". It is not clear how this requirement has been or will be addressed by the LCMP.	SWTC	D	The LCMP will be reviewed by a NSW EPA accredited Site Auditor. Wording has been added to Section 1.2.	18-Mar-2016				
2	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.4 SWTCs	SWTC requirements G to Q are not included in the compliance table presented in Section 1.4. These are prescribed as requirements for inclusion in the Landfill Closure Management Plan and supporting documentation. It is not clear how these requirements have been addressed by the LCMP.	SWTC	D	The relevant requirements and a reference to where they have been addressed has been provided.	18-Mar-2016				
3	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.5 Tender Conditions	Terminology included in this table around the Landfill Environmental Management Plan (LEMP) is confusing given the document is titled Landfill Closure Management Plan (LCMP). Suggest the "where addressed" column is updated to reflect this. Where requirements are being addressed by the LEMP as opposed to LCMP then Annexure G should be referenced.	Project Deed Schedule 31	O	Amended reference to LEMP.	18-Mar-2016				
4	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.5 Tender Conditions	Tender Condition 57 requires all waste materials removed from the site to be directed to a waste management facility lawfully permitted to accept materials. It is understood during the landfill closure process some waste materials exhumed may require transfer off site. Should this condition also be included in the compliance table?	Project Deed Schedule 31	O	TC57. "All waste materials removed from the site shall only be directed to a waste management facility or premises lawfully permitted to accept the materials." has been addressed in the CEMP.	18-Mar-2016				
5	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.5 Tender Conditions	For tender conditions TC15I and TC15J please provide more specific cross references to sections of the LCMP that address mitigation of offensive odours caused by leachate and landfill gas.	Project Deed Schedule 31	O	Cross references to the relevant technical report have been provided.	18-Mar-2016				
6	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.5 Tender Conditions	For tender condition TC105A please provide more specific cross references to sections of the LCMP that specifically address requirements (a) - (f).	Project Deed Schedule 31	D	More specific cross references have been provided.	18-Mar-2016				
7	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.5 Tender Conditions	It is not clear how TC105 (a) which requires definition of objectives and criteria for rehabilitation and closure are specifically covered within the LCMP. TC 105(cl which requires details of mitigation and management measures for air, surface water, groundwater and noise to meet specified objectives and criteria for rehabilitation and closure. It is difficult to determine how this requirement is addressed by the LCMP, particularly for environmental aspects such as noise and odour generated during landfill closure works.	Project Deed Schedule 31	M	Objectives for aspects of the rehabilitaiton have been included in Section 3.2 of the report. It is noted that all aspects relating to construciton of the site are addressed in the CEMP.	18-Mar-2016				
8	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.5 Tender Conditions	An LEMP is identified in Annexure G although this has not been provided. It is expected that this document will in some cases provide supporting evidence to address tender baseline condition compliance for landfill closure aspects. Compliance status can not be assessed at the moment.	Project Deed Schedule 31	D	The LEMP has been provided as an appendix to the document.	18-Mar-2016				
9	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 4 and Section 6	Compliance with TC 105 (d) and (f) which relate to monitoring of key environmental aspects linked to landfill closure and compliance monitoring/reporting could not be assessed given the LEMP (cited in Annexure G) was not available.	Project Deed Schedule 31	D	The LEMP has been provided as an appendix to the document.	18-Mar-2016				
10	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.5 Tender Conditions	TC105A highlights then need for a design (including specifications). The specification for the closure of the landfill was not clear.	Project Deed Schedule 31	D	Specifications have been prepared for the capping system design and the gas management system design. References to these specifications have been added to the LCMP.	18-Mar-2016				
11	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1	LCMP only documents compliance with scope of works technical criteria and tender baseline conditions of approval. BCoATC1 requires the LCMP to address compliance with summary Environmental Management Measures prescribed within the WCX Stg 2 EIS. Summary environmental management measures CM01 and CM02 require inclusion in Section 1.	Project Deed Schedule 31	M	CM01 and CM02 have been included in Section 1. CM02 has however been addressed in the CEMP.	18-Mar-2016				
12	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1	Summary EMM CM02 requires the LCMP to include mitigation measures for "protecting workers and off-site receptors from exposure to potential biological, chemical and physical hazards encountered during exhumation of landfill waste". No content is currently provided in the LCMP in this regard.	Project Deed Schedule 31	M	Environmental management during construction is described in the CEMP.	18-Mar-2016				
13	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 1.4 SWTCs	Reference to VB Wall Report was made but included no detail and therefore will be assed separately	Project Deed Schedule 31	D	Noted	18-Mar-2016				
14	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 3	Major components of LCMP such as Landfill Gas Management, Leachate Barrier for Waste Mound, Leachate Collection System for Waste Mound refer only to the Capping Design report. A precis of the relevant section of the report would assist in addressing all relevant matters within the LCMP.	Project Deed Schedule 31	D	More detail has been provided in the LCMP.	18-Mar-2016				
15	SDD	M5N-GOL-MNP-900-300-WT-9400	B	[redacted]	9.3.16	Environment	IC	Section 3.8	The Surface Water Drainage Management Plan is currently being prepared by AJJV. Therefore an assessment of compliance was not possible.	Project Deed Schedule 31	D	Noted	18-Mar-2016				
16	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	03-Mar-2016		RMS	All document	No comments	N/A	O	N/A	N/A	C	N/A	03-Mar-2016	
17	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	1.1	Alexandria Landfill acquired by RMS, not SMC. References to SMC throughout the should be changed to RMS (the landowner and licensee).		O	Amended	18-Mar-2016				
18	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	1.1	Relevance of last paragraph, with respect to LCMP. The LCMP relates only to ALF.		O	Amended	18-Mar-2016				
19	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	1.3	Main purpose of the LCMP is to document the requirements for landfill closure activates such as to obtain EPA approval to undertake the landfill closure works.		O	Amended	18-Mar-2016				
20	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	1.4	Reference should also be provided to the AECOM hydrogeological report.		O	It is unclear as to why the AECOM hydrogeological report should be reference in this Section. It is referenced in later sections of the report.	18-Mar-2016				
21	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.2	Include date range of the operation of landfill by Council, i.e.. 1988 to 2002.		O	This has been included in the table 'past site use'.	18-Mar-2016				
22	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.2 (Table 4)	* Update table to reflect current site conditions: - Diesel AST has been removed. - No chemicals stored at the Site. * Note that at the time when this LCMP will be submitted for approval, there will only be one licence for ALF (EPL 4627). * Details of the groundwater extraction system and dewatering licence (DPI Water) should be included in this table.		O	Noted and amended.	18-Mar-2016				
23	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.3.2	s5.2 of the Aecom Phase 2 ESA provides details of the extent of filling at ALF. This includes fill ranging in depths from 1.3 to 41 m.		O	Noted and amended.	18-Mar-2016				
24	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.3.4	References should also be made regarding the findings of the Phase 2 ESA, not just the Phase 1. Depth of fill extends to 41m, not 23m.		O	Noted and amended.	18-Mar-2016				
25	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.3.6	This section should be updated to reflect the existing infrastructure at the site.		O	Updated descriptions of existing infrastructure at the site have been added to Section 2.4 of the LCMP.	18-Mar-2016				
26	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.4.1	Replace "commencement of demolition works" with "Removal of temporary structures" & "grading of the site" with "Improvements to surface water management, including minor grading of surfaces and construction of a sediment basin in the eastern part of the Site."		O	Amended	18-Mar-2016				

DESIGN REVIEW RECORD (DRR)

Unless noted otherwise any reference to the IC is also deemed to be the D&C IC

WestConnex Stage 2 M5

DESIGN PACKAGE NUMBER

M5N-GOL-MNP-900-300-WT-9400-B

DESIGN PACKAGE TITLE

SPI - Landfill Closure Management Plan (LCMP)

Design Report: M5N-GOL-MNP-900-300-WT-9400

Drawing List: None

SUBMISSION	NO. OF DWGS	TIME ISSUED	DATE ISSUED
Substantial Detailed Design	0	9:13 AM	Sunday, 14 February 2016

<======= TO BE COMPLETED BY IC

TO BE COMPLETED BY IC======>

COMPLIANCE STATUS
O Observation / Comment
D From info currently provided not able to determine whether design / proposal is compliant.
N Non-Compliant
M Minor non-compliance for immediate action but subsequently documented in next version.

RESPONSE STATUS
O Open
C Closed
CA Closed against this package but subject to action in another package
CS Closed SUBJECT TO additional action / information

FOR IC USE ONLY
L Certification Limitation
H Drawings or part thereof on HOLD

IC Use Only	DRR TEAMBINDER REF:	WCXSTAG2-LDSJV-ARCADIS-TX-000027
DRR REV	**DRR STATUS**	**DATE**	**BY**
Rev 01	Comments on Rev B from IC, RMS & SMC	9/03/2016	TS

No.	Stage	PACKAGE	Rev	Reviewer	Initial Comment Date	Discipline	Organisation	Document Reference	Reviewer Initial Comment	Project Deed ref	Compliance Status	Contractor Response	Initial Response Date	Response Status	Reviewer Comment on Response	Date Comment Closed	IC Use Only: Incorporation Status / Date
27	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.4.3	* 2nd dot point: - The main riser is understood to be 17.28m deep with an invert at 13.28m below ground surface, refer to JPG functional specification. From this the base of the main riser is approximately -24.5mAHD - The main riser contains a single submersible pump - The 2nd paragraph is ambiguous, requires rewording with respect to points above - 3rd paragraph - currently 140m3 of leachate is treated per day through the LTP * 3rd dot point - Reference to secondary intermediate leachate riser should be changed to "Leachate Sump"		O	Generally adopted these points. Please clarify your third dot point.	18-Mar-2016				
28	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.4.5	LTP details to be updated based on the specs of the recently upgraded system (refer operations manual for details).		O	Amended	18-Mar-2016				
29	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.4.5	2nd paragraph 2nd dot point: - Currently 140 kL/day of leachate is treated per day through the LTP. - Leachate from the LTP is not discharged to stormwater even in wet weather events (as required by the EPL) - Central sump feeds the treated leachate tank and discharged under TWA due to ammonia levels greater than 0.9mg/l (ANZECC 2000). In wet weather events if field testing shows ammonia levels are <0.9mg/l then there is an opportunity to discharge to stormwater. This has occurred once since April 2015.		O	The comments have been incorporated.	18-Mar-2016				
30	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.4.7 (Table 6)	* The groundwater extraction system is operational. * The groundwater extraction is licensed by DPI Water. This temporary dewatering licence has recently been updated and transferred to RMS. * Note construction details of BS1 and BS2 are design detail only, no as builts have been sighted by RMS/SMC. * EPL groundwater monitoring locations are MW1, MW2d & MW2s, MW3 and MW4b. * Sampling of BS1 and BS2 is not an EPL requirement.	Appendix B30, 1.2.2	M	The comments have been incorporated.	18-Mar-2016				
31	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	2.4.10	Limited information is provided with details of the composition of the landfill gas or the potential landfill gas generation rates / quantity. This information is required to support the proposed landfill gas management regime.	Appendix B30, 1.2.2	D	This information has now been provided in the landfill gas design report, which has been submitted for external review.	18-Mar-2016				
32	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	3.1 (Table 7)	* Upgrade of LTP: April 15 - Jan 16. * Need to add development and EPA approval of LCMP. * Dates for completion of SPI and commencement of post closure monitoring should be 2019.		O	The comments have been incorporated.	18-Mar-2016				
33	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	3.7	* Update details of TWA, noting that current agreement allows up to 1ML/day and that the EIP has been completed. * Refer LTP operational manual for details of current system specification and configuration. * Detail is required regarding the proposed configuration of the leachate collection system, including maintenance and/or redundancy of the existing system and installation of new/or upgraded infrastructure. Refer EPA comments on draft LCMP, re contingency measures required to address potential for failure of existing infrastructure.	Appendix B30, 1.2.2	M	More detail has been provided in the LCMP.	18-Mar-2016				
34	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	3.10.	Bulk excavation, movement and management of asbestos waste is a key activity of the landfill closure works program. If the LCMP is to rely solely on the CEMP for asbestos management, the CEMP would need to include specific management procedures and controls to mitigate asbestos risk. CDS to confirm that this is covered in the CEMP.	Appendix B30, 1.2.2	D	Asbestos management is covered in the Asbestos guideline sub-plan of the CEMP (M5N-ES-GUI-PWD-0001-00- Asbestos Guideline)	18-Mar-2016				
35	SDD	M5N-GOL-MNP-900-300-WT-9400-B	A	[redacted]	25-Feb-2016	Contamination / Waste	SMC	7	* Details required to quantify stated performance criteria: - "no hazard to the environment" - "no water pollution".		O	The referenced terms have been expanded upon and reference has been made to the LEMP, where performance criteria are given in more detail.	18-Mar-2016				

Annexure C – SMC/RMS Comments and Responses

Refer Annexure B

Annexure D – Safety-in-Design Register

Not used

Annexure E – Road Safety Audit

Not used

Annexure F – EPLs and TWA

Environment Protection Licence

Licence - 4627

Licence Details	
Number:	4627
Anniversary Date:	01-December

Licensee

ROADS AND MARITIME SERVICES

LOCKED BAG 928

NORTH SYDNEY NSW 2059

Premises

NEW M5 ST PETERS INTERCHANGE

10-16 ALBERT STREET

ST PETERS NSW 2044

Scheduled Activity

Road construction

Fee Based Activity	Scale
Road construction	0-10 km of road constructed, widened or re-routed

Region

Waste & Resources - Waste Management

59-61 Goulburn Street
SYDNEY NSW 2000

Phone: (02) 9995 5000

Fax: (02) 9995 5999

PO Box A290 SYDNEY SOUTH

NSW 1232

Environment Protection Licence

Licence - 4627

Environment Protection Licence

Licence - 4627

Environment Protection Licence

Licence - 4627

Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

Environment Protection Licence

The EPA publication “A Guide to Licensing” contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

ROADS AND MARITIME SERVICES
LOCKED BAG 928
NORTH SYDNEY NSW 2059

subject to the conditions which follow.

Environment Protection Licence

Licence - 4627

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Road construction	Road construction	0 - 10 km of road constructed, widened or re-routed

A1.2 This licence authorises the carrying out of site establishment and surface works associated with the project, as per the Licence variation application for licence number 4627 dated 1 April 2016.

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
NEW M5 ST PETERS INTERCHANGE
10-16 ALBERT STREET
ST PETERS
NSW 2044
LOT SP DP 35749, LOT 1 DP 88087, LOT A DP 335583, LOT B DP 376645, LOT A DP 391775, LOT B DP 394647, LOT X DP 421363, LOT 14 DP 606737, LOT 2 DP 1168612

A2.2 In relation to Condition A2.1, the premise is defined by the most recent premise maps held on EPA Electronic File EF16/3654 and approved in writing by the EPA.

A2.3 Premises maps must be available for public access on the project website(s) no more than 3 business days after approval by the EPA.

A3 Information supplied to the EPA

A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and

b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

A3.2 The following documents (and any future amendments to them) are not to be taken as part of the documentation in A3.1, other than those parts specifically referenced in this licence:
a) The licence operates subject to the Infrastructure approval under section 115ZB of the Environmental Planning & Assessment Act 1979, application no. SSI6788, dated 20 April 2016.
b) Monitoring Plan - Alexandria Landfill, dated 3 March 2016 and prepared by Sydney Motorway Corporation Pty Ltd.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
2	Groundwater Quality Monitoring		Groundwater monitoring point labelled as "MW1" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.
3	Groundwater Quality Monitoring		Groundwater monitoring point labelled as "MW2s" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.
4	Groundwater Quality Monitoring		Groundwater monitoring point labelled as "MW2d" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.
5	Groundwater Quality Monitoring		Groundwater monitoring point labelled as "MW3" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.

6	Groundwater Quality Monitoring		Groundwater monitoring point labelled as "MW4b" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.
7	Leachate Quality Monitoring		Leachate monitoring point labelled as "LP1" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.
14	Surface Water Discharge	Surface Water Discharge	The outlet of sediment basins capturing surface water only, referred to in condition P1.5
15	Construction Water Treatment Discharge	Construction Water Treatment Discharge	The discharge of construction water associated with tunnelling works during construction at the St Peters Interchange site.

P1.3 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air

EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
9	Dust Monitoring		Air quality/dust monitoring point labelled as "DG1" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.
10	Dust Monitoring		Air quality/dust monitoring point labelled as "DG2" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.
11	Dust Monitoring		Air quality/dust monitoring point labelled as "DG3" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.
12	Dust Monitoring		Air quality/dust monitoring point labelled as "DG4" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise

EPA identification no.	Type of monitoring point	Location description

13	Meteorological Station	Latitude: -33.91697826705867 Longitude: 151.17819995546793

P1.5 The discharge points 14 and 15 referred to in condition P1.2 are active water discharge points from sediment basins and Construction Water Treatment Plants identified in the spreadsheet titled *Temporary Sediment Basin and Construction Water Treatment Plants Discharge Point Schedule* and maintained on electronic file SF16/21394

P1.6 The licensee must notify the EPA in writing, at least 48 hours prior to a basin or water treatment plant discharge point becoming active or inactive. The notification must include an updated *Temporary Sediment Basin and Construction Water Treatment Plant Discharge Point Schedule*.
(Sediment basins are only considered active whilst accepting water directly from active construction areas).

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

L2.4 Water and/or Land Concentration Limits

POINT 14

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	Visible				Not visible
pH	pH				6.5-8.5

TSS	milligrams per litre				50

POINT 15

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
pH	pH				6.5-8.5
TSS	milligrams per litre				50

L2.5 Exceeding the limits specified in the previous condition of this licence for pH and total suspended solids (TSS) for discharges from the sediment basins, referred to as EPA identification no. 14, identified by Conditions P1.1 and P1.2 is only permitted when the discharge occurs solely as a result of rainfall measured at the premises. The rainfall must exceed rainfall depth value for the corresponding discharge point as described in condition P1.2

L2.6 If the licensee uses turbidity (NTU) in place of TSS to determine compliance with Condition L2.4, the licensee must develop a statistical correlation which identifies the relationship between NTU and TSS for water quality in the sediment basin/s in order to determine the NTU equivalent of 50 mg/L TSS before its use.

L2.7 The EPA may make a written request for a copy of the statistical correlation assessment and methodology to determine compliance with condition L2.4 if required.

L3 Noise limits

L3.1 All works and activities must be undertaken in a manner that will minimise noise and vibration impacts on sensitive receivers.

L3.2 The licensee must ensure that all feasible and reasonable noise and vibration mitigation and management measures are implemented during construction work authorised by this licence in accordance with the *Interim Construction Noise Guideline, Department of Environment and Climate Change* (DECC) 2009.

L4 Hours of operation

L4.1 Unless otherwise specified by any other condition of this licence, construction work is:
(a) restricted to between the hours of 7:00 am and 6:00 pm Monday to Friday;
(b) restricted to between the hours of 8:00 am and 1:00 pm Saturday; and
(c) not to be undertaken on Sundays or Public Holidays.

L4.2 **Work generating high noise impact**
Unless otherwise specified by any other condition of this licence, high noise impact works must only be undertaken:

a) between the hours of 8:00am and 6:00pm Monday to Friday;
b) between the hours of 8:00am and 1:00pm Saturday; and
c) in continuous blocks of no more than 3 hours, with at least a 1 hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers;
except as expressly permitted by another condition of this licence.
For the purposes of this Condition 'continuous' includes any period during which there is less than a 1 hour respite between ceasing and recommencing any of the work the subject of this Condition.

L4.3 **Notification of works approved outside of standard construction hours**

a) The licensee must notify potentially affected noise sensitive receivers of works approved outside of standard construction hours not less than 5 days and not more than 14 days before those works are to be undertaken.

b) The notification must be:
• by letterbox drop or email;and
• be detailed on the project website.

c) The notification required by paragraphs (a) and (b) of this condition must:
• clearly outline the reason that the work is required to be undertaken outside the hours specified in Condition L4.1;
• include a diagram that clearly identifies the location of the proposed works in relation to nearby cross streets and local landmarks;
• include details of relevant time restrictions that apply to the proposed works;
• clearly outline, in plain English, the location, nature, scope and duration of the proposed works;
• detail the expected noise impact of the works on noise sensitive receivers;
• clearly state how complaints may be made and additional information obtained; and
• include the number of the telephone complaints line required by Condition M7.1, an after hours contact phone number specific to the works undertaken outside the hours specified in Condition L4.1, and the project website address.

Note: For the avoidance of doubt condition L4.3 does not apply to works undertaken pursuant to condition L4.6 a) or b) or condition L4.10

L4.4 The licensee may undertake works outside of standard construction hours if agreement between the licensee and a substantial majority of potentially affected sensitive receivers has been reached

L4.5 Any agreement(s) between the licensee and the potentially affected noise sensitive receivers referred to in Condition L4.4 must be recorded in writing and a copy of the agreement(s) kept on the premises by the licensee for the duration of this licence.

L4.6 The licensee may undertake construction work out of hours if that work does not cause;

a) LAeq(15 minute) noise levels no more than 5 dB(A) above rating background level at any residence in

accordance with the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009); and
b) LAeq(15 minute) noise levels no more than the noise management levels specified in Table 3 of the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009) at other sensitive receivers; and
(c) continuous or impulsive vibration values, measured at the most affected residence, greater than those for human exposure to vibration, set out for residences in Table 2.2 to the technical guideline 'Environmental Noise Management Assessing Vibration' published by the Department of Environment and Conservation in February 2006, and
(d) intermittent vibration values, measured at the most affected residence, greater than those for human exposure to vibration, set out for residences in Table 2.4 to the technical guideline 'Environmental Noise Management Assessing Vibration' published by the Department of Environment and Conservation in February 2006.

L4.7 **Works Approved Outside of Standard Construction Hours**

Activities and works may be undertaken outside of standard construction hours specified in L4.1 but only if one or more of the following applies:
(i) carrying on those works and activities during the hours specified in Condition L4.1 would cause unacceptable risks to one or more of the following:
(1) construction personnel safety;
(2) road user and public safety;
(3) road network operational performance as may be notified from time to time by the Roads and Maritime Services; and/or
(4) essential utility services; and/or
(ii) the TfNSW Transport Management Centre (or other road authority) refuse to issue a road occupancy licence for the works or activities during the hours specified in Condition L4.1.
(iii) Sydney Trains require a Rail Possession (involving week night and/or weekend rail shutdown) for the works or activities to be performed.

L4.8 In undertaking any works or activities under Condition L4.7 the licensee must:
(i) comply with the requirements of the 'Manage Environmental Noise Issues Procedure', document number M5N-ES-PRS-PWD-0043, revision date 29 April 2016; and
(ii) implement noise and vibration mitigation detailed in the Interim Construction Noise Guidelines (DECC 2009).

L4.9 A copy of the 'Out of Hours Work Procedure' must be available for public access on the project website.

L4.10 The licensee may undertakeworks outside of standard construction hours if:

(i) the delivery of oversized plant or structures has been determined by the police or otherauthorised authorities to require special arrangements to transport along public roads; or

(ii) emergency work is required to avoid the loss of lives or property, or to prevent environmental harm.

L5 Potentially offensive odour

L5.1 No condition of this licence identifies a potentially offensive odour for the purposes of section 129 of the Protection of the Environment Operations Act 1997.

Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.
This includes:
a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
a) must be maintained in a proper and efficient condition; and
b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading.

O3.2 The licensee must ensure that no material, including sediment or oil, is tracked from the premises.

O3.3 The licensee must ensure that construction work is carried on by such practicable means as may be necessary to minimise dust emissions on the premises, and implement all feasible and reasonable mitigation measures to minimise the release of dust from the premises.

O4 Emergency response

O4.1 The licensee must prepare, maintain and implement as necessary, a current Pollution Incident Response Management Plan (PIRMP) for the premises.

Note: NOTE: The licensee must develop their PIRMP in accordance with the requirements in Part 5.7A of the Protection of the Environment Operations Act 1997 (the POEO Act) and the Protection of the Environment Operations (Waste) Regulation 2014.

O4.2 The licensee must have adequate fire prevention measures in place, and ensure that facility personnel are able to access fire-fighting equipment and manage fire outbreaks at any part of the premises.

O4.3 The licensee must extinguish fires at the premises as soon as possible.

O5 Processes and management

O5.1 The licensee must take all practicable steps to control entry to the premises.

O5.2 The premises must be maintained in a condition which prevents the pollutants entering the stormwater system.

O5.3 Erosion and sediment controls must be designed (stability, location, type and size), constructed, operated and maintained in accordance with the guideline "Managing Urban Stormwater – Soils and Construction, Volume 2D, Main road construction" DECC 2008, to be read and used in conjunction with volume 1 "Managing urban stormwater: soils and construction" Landcom 2004.

O5.4 The licensee must ensure the design storage capacity of any sediment basin installed on the premises is reinstated within 5 days of the cessation of a rainfall event that causes runoff to occur on or from the premises.

O5.5 The licensee must ensure that sampling point(s) for water discharged from the sediment basin(s) are provided and maintained in an appropriate condition to permit:
a) a the clear identification of each sediment basin and discharge point;
b) the collection of representative samples of the water discharged from the sediment basin(s); and
c) access to the sampling point(s) at all times by an authorised officer of the EPA.

O5.6 The licensee must endeavour to maximise the reuse of captured stormwater on the premises.

O5.7 Where sediment basins are necessary, all sediment basins and associated drainage must be installed and commissioned prior to the commencement of any clearing or grubbing works within the catchment area of the sediment basin that may cause sediment to leave the site.
Note: This condition does not apply to those works associated with the actual installation of sediment basins or associated drainage.

O5.8 The licensee must inspect the operation of all erosion and sediment controls installed on the premises and undertake any works required to repair and/or maintain these controls:
a) at least weekly during normal construction hours outlined in condition L4.1;
b) daily during periods of rainfall that causes runoff to occur ; and
c) prior to any site closure of greater than 24 hours.

O5.9 The licensee must record all such inspections, including observations and works undertaken to repair and/or maintain soil and water management works.

O5.10 **Community Engagement**

a) The licensee must provide a Community Information Centre within the main Site Office at 25-29 Burrows Road, St Peters, that will be available to the community during business hours. The Community Information Centre must provide images and relevant information on the project and be staffed by a Community Liaison Team member to provide answers to any community concerns/enquiries.

b) The community information display must include details of upcoming construction activities (including out of hours activities), nature and timing of such activities and relevant contact details. The information must include at a minimum, details of up and coming activities that are to occur over the next month.

c) The licensee must convene and hold community meetings or open forums in relation to the project, including (but not limited to) key construction activities and/or key project milestones, at least once every three months.

d) The licensee must keep minutes of any community meeting held in accordance with this condition and must submit a copy of the relevant minutes to the EPA when requested by an EPA officer.

O6 Waste management

O6.1 There must be no incineration or burning of any waste at the premises.

O6.2 The "Waste Covering Management Plan" referenced M5N-ES-PLN-PWD-0030 dated 30 March 2016 must be implemented in areas where waste is uncovered and or exhumed.

O6.3 Leachate must only be disposed of by pumping to sewer, or removed from the premises by tanker and disposed of lawfully off-site.

O6.4 All water contained within any areas where waste is uncovered or exhumed must be managed as leachate.

O6.5 Leachate must not be used in the truck wash facility at the premises.

O6.6 Leachate must not be irrigated and/or used for dust control at the premises.

O6.7 Definition:

“Leachate” is water which has come into contact with:
a) waste (other than inert waste); and/or
b) the area where waste is exhumed or exhumed waste is stored; and/or
c) the greenwaste processing/storage areas.

“Leachate” is also liquid removed from the leachate collection system

“Leachate” is a reference to treated or untreated leachate.

“Treated leachate” is leachate that has been treated in the leachate pre-treatment facility required under the Sydney Water Trade Waste Agreement.

All other leachate on the premises is untreated leachate.

Landfill Closure

O6.8 The former landfill must be closed substantially in accordance with the document "Technical Report: St Peters Interchange – Landfill Closure Management Plan LCMP, Golders Associates, 11 May 16, Document: M5N-MNP-900-300-WT-9400-DE (the LCMP) and Annexures." This includes capping layers comprising from bottom to top a :

a. 300 mm thick seal bearing layer

b. 600mm thick clay layer with a maximum permeability of 10-9 meters per second or a geosynthetic clay liner and a 200 mm thick clay layer with a maximum permeability of 10-9 meters per second,

c. 400mm thick subsoil layer, and

d. 100 mm thick topsoil layer.

O6.9 A floor liner and leachate collection system must be installed below the waste mound. The system must be substantially in accordance with 3.8.3 of the LCMP and comprise leachate feeder drains, a 200mm thick bearing layer, a 500 mm thick layer of clay rich material, leachate drainage aggregate and leachate collection drains.

O6.10 The licensee must install the vertical barrier wall substantially in accordance with the document "St Peters Interchange – Barrier Wall Final Design (100%) Golders Associates, March 16, Document: M5N-GOL-DPK 900-302-WT-9420-E and Annexures."

O6.11 Leachate management must be substantially in accordance with section 3.8 of the LCMP. Leachate must be collected and conveyed to the leachate treatment plant and discharged to sewer.

O6.12 Any subsequent detailed leachate management design reports must be submitted to the EPA.

O6.13 Landfill gas management comprising passive, shallow gas collection and venting, and active gas extraction via deep wells and flaring must be installed substantially in accordance with section 3.7 of the LCMP.

O6.14 The licensee must install approximately 40 gas monitoring wells as proposed in section 3.7.4 of the LCMP.

O6.15 The licensee must install approximately eleven groundwater monitoring wells and the leachate collection sump/s proposed in 5.4.1.3 of the LCMP.

O6.16 Within three (3) months of practical completion of the closure works the licensee must submit the following reports to the EPA:

1. a Construction Quality Assurance Report in accordance with section 3.10 of the LCMP and section 11.2 NSW Environmental Guidelines Solid Waste Landfills second edition 2016, and

2. plans at a suitable scale of the installed barrier wall, leachate collection and conveyance systems, landfill gas management systems, and groundwater and gas monitoring wells including bore logs.

5 Monitoring and Recording Conditions

Environment Protection Licence

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:
a) in a legible form, or in a form that can readily be reduced to a legible form;
b) kept for at least 4 years after the monitoring or event to which they relate took place; and
c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
a) the date(s) on which the sample was taken;
b) the time(s) at which the sample was collected;
c) the point at which the sample was taken; and
d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 9,10,11,12

Pollutant	Units of measure	Frequency	Sampling Method
Total suspended particles	grams per square metre per month	Quarterly	Australian Standard 3580.10.1-2003

M2.3 Water and/ or Land Monitoring Requirements

POINT 2,3,4,5,6

Pollutant	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	milligrams per litre	Quarterly	Grab sample
Aluminium	milligrams per litre	Yearly	Grab sample
Arsenic	milligrams per litre	Yearly	Grab sample
Barium	milligrams per litre	Yearly	Grab sample
Benzene	milligrams per litre	Yearly	Grab sample
Bicarbonate	milligrams per litre	Quarterly	Grab sample

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Cadmium	milligrams per litre	Yearly	Grab sample
Calcium	milligrams per litre	Quarterly	Grab sample
Chloride	milligrams per litre	Quarterly	Grab sample
Chromium (hexavalent)	milligrams per litre	Yearly	Grab sample
Chromium (total)	milligrams per litre	Yearly	Grab sample
Cobalt	milligrams per litre	Yearly	Grab sample
Copper	milligrams per litre	Yearly	Grab sample
Ethyl benzene	milligrams per litre	Yearly	Grab sample
Fluoride	milligrams per litre	Yearly	Grab sample
Lead	milligrams per litre	Yearly	Grab sample
Magnesium	milligrams per litre	Quarterly	Grab sample
Manganese	milligrams per litre	Yearly	Grab sample
Mercury	milligrams per litre	Yearly	Grab sample
Nitrate	milligrams per litre	Yearly	Grab sample
Nitrite	milligrams per litre	Yearly	Grab sample
Nitrogen (ammonia)	milligrams per litre	Quarterly	Grab sample
Organochlorine pesticides	milligrams per litre	Yearly	Grab sample
Organophosphate pesticides	milligrams per litre	Yearly	Grab sample
pH	pH	Quarterly	Probe
Polycyclic aromatic hydrocarbons	milligrams per litre	Yearly	Grab sample
Potassium	milligrams per litre	Quarterly	Grab sample
Sodium	milligrams per litre	Quarterly	Grab sample
Standing Water Level	metres	Quarterly	In situ
Sulfate	milligrams per litre	Quarterly	Grab sample
Toluene	milligrams per litre	Yearly	Grab sample
Total dissolved solids	milligrams per litre	Quarterly	Grab sample
Total organic carbon	milligrams per litre	Yearly	Grab sample
Total petroleum hydrocarbons	milligrams per litre	Yearly	Grab sample
Total Phenolics	milligrams per litre	Yearly	Grab sample
Xylene	milligrams per litre	Yearly	Grab sample
Zinc	milligrams per litre	Yearly	Grab sample

POINT 7

Pollutant	Units of measure	Frequency	Sampling Method
Alkalinity (as calcium carbonate)	milligrams per litre	Quarterly	Grab sample
Aluminium	milligrams per litre	Quarterly	Grab sample
Arsenic	milligrams per litre	Quarterly	Grab sample
Barium	milligrams per litre	Quarterly	Grab sample
Benzene	milligrams per litre	Quarterly	Grab sample

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Bicarbonate	milligrams per litre	Quarterly	Grab sample
Cadmium	milligrams per litre	Quarterly	Grab sample
Calcium	milligrams per litre	Quarterly	Grab sample
Chloride	milligrams per litre	Quarterly	Grab sample
Chromium (hexavalent)	milligrams per litre	Quarterly	Grab sample
Chromium (total)	milligrams per litre	Quarterly	Grab sample
Cobalt	milligrams per litre	Quarterly	Grab sample
Copper	milligrams per litre	Quarterly	Grab sample
Ethyl benzene	milligrams per litre	Quarterly	Grab sample
Fluoride	milligrams per litre	Quarterly	Grab sample
Lead	milligrams per litre	Quarterly	Grab sample
Magnesium	milligrams per litre	Quarterly	Grab sample
Manganese	milligrams per litre	Quarterly	Grab sample
Mercury	milligrams per litre	Quarterly	Grab sample
Nitrate	milligrams per litre	Quarterly	Grab sample
Nitrite	milligrams per litre	Quarterly	Grab sample
Nitrogen (ammonia)	milligrams per litre	Quarterly	Grab sample
Organochlorine pesticides	milligrams per litre	Quarterly	Grab sample
Organophosphate pesticides	milligrams per litre	Quarterly	Grab sample
pH	pH	Quarterly	Probe
Polycyclic aromatic hydrocarbons	milligrams per litre	Quarterly	Grab sample
Potassium	milligrams per litre	Quarterly	Grab sample
Sodium	milligrams per litre	Quarterly	Grab sample
Standing Water Level	metres	Quarterly	In situ
Sulfate	milligrams per litre	Quarterly	Grab sample
Toluene	milligrams per litre	Quarterly	Grab sample
Total dissolved solids	milligrams per litre	Quarterly	Grab sample
Total organic carbon	milligrams per litre	Quarterly	Grab sample
Total petroleum hydrocarbons	milligrams per litre	Quarterly	Grab sample
Total Phenolics	milligrams per litre	Quarterly	Grab sample
Xylene	milligrams per litre	Quarterly	Grab sample
Zinc	milligrams per litre	Quarterly	Grab sample

POINT 14

Pollutant	Units of measure	Frequency	Sampling Method
Oil and Grease	Visible	Special Frequency 1	Visual Inspection
pH	pH	Special Frequency 1	Probe
TSS	milligrams per litre	Special Frequency 1	Grab sample

POINT 15

Pollutant	Units of measure	Frequency	Sampling Method
pH	pH	Daily during any discharge	Probe
TSS	milligrams per litre	Daily during any discharge	Grab sample

M2.4 For the purposes of condition M2.3 and the Table there to 'Special Frequency 1' means:
(a) less than 24 hours prior to a controlled discharge and daily for any continued controlled discharge; and
(b) when rainfall causes a discharge from a basin which has not been emptied within 5 days of the cessation of a rainfall event.

M3 Testing methods - concentration limits

M3.1 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M3.2 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:
a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

M4 Environmental monitoring

M4.1 Noise monitoring must be carried out in accordance with Australian Standard AS 2659.1 – 1998: Guide to the use of sound measuring equipment – Portable sound level meters, and the compliance monitoring guidance provided in the NSW Industrial Noise Policy.

M4.2 Vibration monitoring must be carried out in accordance with the guidance provided in the Environmental Noise Management Assessing Vibration: A Technical Guideline, published by the Department of Environment and Conservation, February 2006.

M4.3 The licensee must undertake noise and vibration monitoring as directed by an authorised officer of the EPA.

M5 Weather monitoring

M5.1 At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively.

POINT 13

Parameter	Sampling method	Units of measure	Averaging period	Frequency
Rainfall	AM-4	millimetres	-	Daily
Wind speed	AM-2 & AM-4	metres per second	1.5 hours	Continuous
Wind Direction at 10 metres	AM-2 & AM-4	-	1.5 hours	Continuous
Temperature at 10 metres	AM-4	degrees Celsius	1.5 hours	Continuous

M5.2 Rainfall at the premises must be measured and recorded in millimetres per 24 hour period at the same time each day from the time that the site office associated with the activities permitted by this licence is established.

M6 Recording of pollution complaints

M6.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M6.2 The record must include details of the following:
a) the date and time of the complaint;
b) the method by which the complaint was made;
c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
d) the nature of the complaint;
e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
f) if no action was taken by the licensee, the reasons why no action was taken.

M6.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M6.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M7 Telephone complaints line

M7.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or

by the vehicle or mobile plant, unless otherwise specified in the licence.

M7.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M7.3 The preceding two conditions do not apply until 3 months after: the date of the issue of this licence.

M7.4 **Noise and Vibration Complaints**

a) The licensee must investigate noise and vibration complaints received via the telephone complaints line from the occupants of dwellings or the management of noise sensitive receivers other than dwellings:

(i) within two hours of the complaint being made; or

(ii) in accordance with any prior complaint management agreement the licensee may have made with the complainant.

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
1. a Statement of Compliance,
2. a Monitoring and Complaints Summary,
3. a Statement of Compliance - Licence Conditions,
4. a Statement of Compliance - Load based Fee,
5. a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan,
6. a Statement of Compliance - Requirement to Publish Pollution Monitoring Data,
7. a Statement of Compliance - Environmental Management Systems and Practices; and
8. a Statement of Compliance - Environmental Improvement Works.

At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

R1.3 Where this licence is transferred from the licensee to a new licensee:
a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is

given; or
b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
a) the licence holder; or
b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R2 Notification of environmental harm

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
a) where this licence applies to premises, an event has occurred at the premises; or
b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
a) the cause, time and duration of the event;
b) the type, volume and concentration of every pollutant discharged as a result of the event;
c) the name, address and business hours telephone number of employees or agents of the licensee, or a

specified class of them, who witnessed the event;
d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Other reporting conditions

R4.1 **Noise and Vibration Reports**

a) Upon request of an authorised officer of the EPA, the licensee must submit a Preliminary Investigation Report to the EPA in respect of any noise or vibration monitoring undertaken in accordance with the requirements of Condition M7.4.

b) The Preliminary Investigation Report must be submitted to the EPA by 4.30 pm of the afternoon of the next working day following any noise or vibration monitoring.

c) The Preliminary Investigation Report must:

(i) include numerical and/or graphical representation of the noise and vibration monitoring results; and

(ii) highlight any detected exceedance of noise goals or limits specified in:

(1) this licence;

(2) relevant noise guidelines; and

(3) relevant noise modelling.

d) In the event of any exceedance of the noise goals or limits referred to in Condition R4.2 c)(ii), the licensee must:

(i) modify work practices and methods and implement all practicable and reasonable measures to prevent a recurrence of the exceedance; and

(ii) submit a Follow-up Investigation Report to the EPA within 5 working days of any noise or vibration monitoring having been undertaken (unless otherwise approved by the EPA).

e) the Follow-up Investigation Report must include:

(i) confirmation of whether noise monitoring has been undertaken in accordance with AS2659 and the

compliance monitoring guidance provided in the INP;

(ii) confirmation of whether vibration monitoring has been undertaken in accordance with the guidance provided in the Assessing vibration: a technical guideline (DEC, 2006);

(iii) details of the prevailing meteorological conditions during the period when the noise or vibration monitoring was undertaken;

(iv) a map of each noise and vibration monitoring location in relation to the noise source, including relevant distances;

(v) numerical and graphical representation of the noise and vibration monitoring results;

(vi) an analysis of the noise and vibration monitoring results;

(vii) details of any remedial action taken in relation to the matter; and

(viii) in cases not the subject of remedial action, detailed justification of the decision not to undertake remedial action.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Contact number for incidents and responsible employees

G2.1 The licensee must provide the EPA with up to date contact details to enable the EPA:

(a) to contact either the licensee or a representative of the licensee who can respond at all times to incidents relating to the premises, and

(b) to contact the licensee's senior employees or agents authorised at all times to:

(i) speak on behalf of the licensee, and

(ii) provide any information or document required under licence.

G2.2 The contact details required by Condition G2.1 above must include:

a) the full name and title of the authorised representatives and the scope of their respective authorisations; and

b) the direct telephone number, mobile number, pager number, fax number, email address and postal address for contacting each authorised representative.

8 Special Conditions

E1 Definitions

E1.1 Special Dictionary

Term	Meaning
High Noise Impact Works	grinding metal, concrete or masonary, rock drilling, line drilling, smooth drum vibratory rolling, bitumen milling and profilling, jackhammering, rock hammering or rock breaking, impact piling and other work occurring on surfaces that generates noise with impulsive, intermittent, tonal or low frequency characteristics
Project Website	means a website that is under the control of the licensee and which is easily available for viewing by the community
Background Noise Level	means the overall single figure background noise level for each assessment period.Determination of the rating background level is by the method described in the NSW Industrial Noise Policy (EPA 2000)
Rating Background Level	means the overall single figure background noise level for each assessment period.Determination of the rating background level is by the method described in the NSW Industrial Noise Policy (EPA 2000)
Potentially affected noise sensitive receivers	means identifying residences or sensitive land users that may be affected by noise from the construction project under this licence
Noise Catchment Area	means groups of sensitive receivers that are similarly affected by noise from the construction works

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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder described at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 mo nths. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.

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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non - putrescible), special waste or hazardous waste

Mr Bernie Weir

Environment Protection Authority

(By Delegation)

Date of this edition: 15-January-2001

Environment Protection Licence

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End Notes

1	Licence transferred through application 140516, approved on 18-Jun-2001, which came into effect on 01-Dec-2000.
2	Licence varied by change to Common Name field, issued on 16-Jan-2002, which came into effect on 16-Jan-2002.
3	Licence transferred through application 140976, approved on 25-Jan-2002, which came into effect on 23-Jan-2002.
4	Licence varied by correction of File Number , issued on 04-Apr-2002, which came into effect on 04-Apr-2002.
5	Licence varied by notice 1024148, issued on 07-Jan-2003, which came into effect on 07-Jan-2003.
6	Licence varied by notice 1028703, issued on 04-Jul-2003, which came into effect on 29-Jul-2003.
7	Licence varied by notice 1040317, issued on 02-Sep-2004, which came into effect on 27-Sep-2004.
8	Licence varied by notice 1041133, issued on 29-Sep-2004, which came into effect on 24-Oct-2004.
9	Licence varied by notice 1042998, issued on 30-Sep-2005, which came into effect on 04-Oct-2005.
10	Licence varied by notice 1057971, issued on 31-Mar-2006, which came into effect on 25-Apr-2006.
11	Licence varied by notice 1061862, issued on 02-Nov-2006, which came into effect on 02-Nov-2006.
12	Licence varied by notice 1067504, issued on 04-Dec-2006, which came into effect on 04-Dec-2006.
13	Licence varied by notice 1068196, issued on 21-Jun-2007, which came into effect on 21-Jun-2007.
14	Licence varied by notice 1093194, issued on 31-Oct-2008, which came into effect on 31-Oct-2008.
15	Condition A1.3 Not applicable varied by notice issued on <issue date> which came into effect on <effective date>
16	Licence varied by notice 1099148, issued on 30-Mar-2009, which came into effect on 30-Mar-2009.
17	Licence varied by Correction to EPA Region data record., issued on 25-Jun-2010, which came into effect on 25-Jun-2010.
18	Licence varied by correction to DECCW Region data record, issued on 07-Jul-2010, which came into effect on 07-Jul-2010.

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19	Licence varied by notice 1507165 issued on 03-Aug-2012
20	Licence transferred through application 1529361 approved on 23-Mar-2015 , which came into effect on 23-Mar-2015
21	Licence transferred through application 1535067 approved on 27-Oct-2015 , which came into effect on 14-Oct-2015
22	Licence varied by notice 1535597 issued on 27-Apr-2016
23	Licence varied by notice 1540748 issued on 20-May-2016

Consent to Discharge Industrial Trade Wastewater

SYDNEY WATER CORPORATION

and

WESTCONNEX DELIVERY AUTHORITY
Trading as

WESTCONNEX DELIVERY AUTHORITY

A.B.N. 33 855 314 176

ACTIVITY: GARBAGE TIP (GE06)

RISK INDEX: 04

CONSENT NO: 29304

CONNECTION NO: 2

PROPERTY NUMBER: 4059264

This **CONSENT** is made on day: 21 month: June year: 2015

Executed for and on behalf of
Sydney Water Corporation

By

[redacted]

.....
(Signature)

Manager Business Customer Delivery

In the presence of:

Witness

[redacted]

Executed for and on behalf of
the Customer:

By

.....
(Print name and position of person signing)
who warrants s/he has sufficient authority to execute this consent.

In the presence of:

Witness

[redacted]

(Print name of witness)

This consent must be executed by the Customer prior to execution by Sydney Water and submitted by the Customer to Sydney Water for its consideration. Submission of a consent executed by the Customer under no circumstances obliges Sydney Water to enter into or complete the consent. Submission of an executed consent by the Customer constitutes an application for a consent which Sydney Water may in its reasonable discretion reject, or with the consent of the Customer modify any of the proposed terms thereto.

SCHEDULE 1
(SUBJECT TO PUBLIC DISCLOSURE)

TRADE WASTEWATER WHICH MAY BE DISCHARGED

1. Trade wastewater substances

(a) The Customer may discharge trade wastewater into the Sewer in a manner whereby the substance characteristics of the trade wastewater are of a type and discharged at a rate, level or concentration equal to or less than that described in this schedule.

(b) The Customer must not discharge trade wastewater into the Sewer in a manner whereby the trade wastewater discharged;

(i) contains, possesses or produces a substance characteristic not provided in, or which may be determined as being contrary to that described in this schedule.

(ii) is at or of a rate, level, or concentration not provided in, or which may be determined as being contrary to, that described in this schedule.

SUBSTANCE	LTADM (kg/day)	MDM (kg/day)	Standard (mg/L)
AMMONIA (AS N)	25.00000	90.00000	100.000
SUSPENDED SOLIDS	22.00000	180.00000	600.000
TOTAL DISSOLVED SOLIDS	950.00000	1200.00000	10000.000
BARIUM	0.50000	2.00000	5.000
IRON	1.40000	9.00000	50.000

RECONCILIATION PROCEDURES:

LONG TERM AVERAGE DAILY MASS:

The Long Term Average Daily Mass is a twelve month arithmetic average of ALL daily mass discharges as calculated for each composite sample. The Daily Mass discharged is to be calculated for each of the above substances, and checked against the above Long Term Average Daily Mass (kg/day) on the basis of average concentrations of substances discharged (mg/L) over any 24 hour period as determined from composite samples, obtained by either the Customer (in accordance with Schedule 2) or Sydney Water, or a combination of sample results by both.

This average concentration (mg/L) is to be multiplied by the total discharge (kL) as recorded by the Customer's discharge flow meter over the 24 hour period in order to calculate the Daily Mass of substances discharged (kg). Exceeding the Long Term Average Daily Mass does not constitute a Breach.

ACCEPTANCE STANDARD:

The Composite Sample Concentration is to be determined for each of the above substances, and checked against the above Acceptance Standard (mg/L) for each sample obtained. Exceeding the Acceptance Standard constitutes a Breach and will also incur an increased Quality Charge as detailed in Schedule 3.

The Discrete Sample Concentration is to be determined for each of the substances identified at Schedule 2, 2 (b) and checked against the above Acceptance Standard (mg/L) for each sample obtained. Exceeding the Acceptance Standard constitutes a Breach.

MAXIMUM DAILY MASS:

The Daily Mass discharged is to be calculated for each of the above substances, and checked against the above Maximum Daily Mass (kg/day) on the basis of average concentrations of substances discharged (mg/L) over any 24 hour period as determined from composite samples, obtained by either the Customer (in accordance with Schedule 2) or Sydney Water, or a combination of sample results by both.

This average concentration (mg/L) is to be multiplied by the total discharge (kL) as recorded by the Customer's discharge flow meter over the 24hour period in order to calculate the Daily Mass of substances discharged (kg). Exceeding the Maximum Daily Mass constitutes a Breach.

2. The trade wastewater discharged must at all times have the following properties:

Temperature	-	Not to exceed 38 degrees Celsius.
Colour	-	Determined on a system specific basis
pH	-	Within the range 7.0 to 10.0.
Fibrous material	-	None which could cause an obstruction to Sydney Water's sewerage system.
Gross solids (other than faecal)	-	A maximum linear dimension of less than 20 mm, a maximum cross section dimension of 6 mm, and a quiescent settling velocity of less than 3 m/h.
Flammability	-	Where flammable and/or explosive substances may be present, the Customer must demonstrate to the satisfaction of Sydney Water that there is no possibility of explosions or fires occurring in the sewerage system. The flammability of the discharge must never exceed 5% of the Lower Explosive Limit (LEL) at 25° Celsius.

3. Rate of discharge of waste to sewer:

(a) Instantaneous maximum rate of gravitated discharge 15.00 litres per second

(b) Maximum daily discharge 1000.0 kilolitres

(c) Average daily discharge 500.0 kilolitres

RECONCILIATION PROCEDURE:

The data obtained from applying these procedures is to be checked by the interface of a chart recorder to the Customer's flow metering equipment, or by the installation of flow metering equipment by Sydney Water, for a minimum of 7 days.

SCHEDULE 2
(SUBJECT TO PUBLIC DISCLOSURE)

SAMPLING, ANALYSIS, FLOW RATES AND VOLUME DETERMINATION

1. The Customer must provide and make available for the purpose of sampling and analysis;
   (a) Sampling point located at pretreat.discharge excl. domestic sewage prior to the point of connection to the Sewer.
   (b) Equipment necessary to allow collection of composite automatic samples on either a flow proportional or a time basis.
2. The Customer is to undertake collection and analysis of samples in accordance with the schedule detailed below:
   (a) Composite samples are to be obtained:
      (i) over one full production day by combining equal volumes taken at 5 kilolitre intervals. The volumes are to be such that at least 5,000 millilitres are obtained over the full day. The reading of the Flowmeter meter is to be obtained at the commencement and conclusion of the sampling day.
      (ii) on 8 June 2015 and every 8 days thereafter. If trade wastewater is not discharged on this day, then the sample is to be taken on the next day that trade wastewater is discharged. Trade wastewater includes all non-domestic wastewater discharged to sewer from the premises, including cleaning waste.
   (b) Discrete samples are to be obtained as detailed below, and analysed according to the procedures and methods specified in Sydney Water's published analytical methods, to determine the concentrations or levels of the following substance characteristics:

pH	at the start and finish of each sample day
AMMONIA (AS N)	at the finish of each sample day

   (c) Composite samples are to be analysed according to the procedures and methods specified in Sydney Water's published analytical methods, or methods otherwise agreed to and detailed hereunder, to determine the concentrations or levels of the following substance characteristics

      AMMONIA (AS N)
      SUSPENDED SOLIDS
      TOTAL DISSOLVED SOLIDS
      BARIUM
      IRON

   (d) The Customer, or the laboratory contracted by the customer, is to submit results of analyses to Sydney Water within 21 days from the date the sample was taken. All analysis results are to be submitted on the sample analysis report provided as appendices 1 and 2 to this Consent OR in such format as may be specified from time to time by Sydney Water.
   (e) All data requested on the sample analysis report must be provided.
   (f) Sydney Water must be notified in writing within 7 days of;
      (i) any failure to obtain samples in accordance with the provisions of Schedule 2; or
      (ii) any loss of any analytical data.

      Where data is unavailable, lost or not provided, the Quality Charge, as detailed in Schedule 3, will be assessed on the basis of the highest Composite Sample concentration recorded in the 12 months prior to the date of the missing sample data.

3. The volume of wastewater discharged must be obtained from the reading of the total flow on the Customer's flowmetering system.

   The rate of waste discharged is to be obtained by the reading of the instantaneous flow rate indicator on

the Customer's flowmetering system, or from any chart recorder interfaced to the Customer's flowmetering system.

The flowmetering system is to be calibrated at least annually at the Customer's expense, by a person or company approved by Sydney Water and a copy of the calibration certificate supplied to Sydney Water within one month of such certificate being received by the Customer.

If the Customer's flowmetering system fails to record data for any period, Sydney Water is to be advised in writing by the Customer within 7 days of any such failure becoming known by the Customer. An estimate of any data not recorded is to be made as follows:

Average of the waste discharged, registered for the four weeks before and/or after the failure to record.

SCHEDULE 3

(SUBJECT TO PUBLIC DISCLOSURE)

PAYMENTS

The charges are effective from 18 December 2014 and will continue until otherwise advised by Sydney Water.

All trade waste fees and charges are subject to CPI adjustments from 1 July each year in accordance with Determination No 1, 2012 made by the Independent Pricing and Regulatory Tribunal (IPART).

1. CHARGES FOR TRADE WASTEWATER DISCHARGE

Sydney Water will conduct a reading of the Customer's discharge meter at approximately 90 day intervals. The volume of trade wastewater discharged for the period since the previous reading will be calculated.

Charges are based on the Daily Mass calculated from composite samples and corresponding meter readings for each sampling day in the billing period, and calculated in accord with (c), (d), (e), and (f) below. The charge for each sampling day is then multiplied by a flow weighting factor to give a flow weighted charge. The total charge for each substance for the billing period is equal to the sum of the flow weighted charges for the billing period.

Total Charge = the sum of the flow weighted charges for the billing period

Flow Weighted Charge = (charge for all sample days) x (flow weighting factor) and:

$$\text{Flow Weighting Factor} = \frac{\text{(total volume discharged during billing period)}}{\text{(sum of volumes discharged during all sample days during billing period)}}$$

In this formula volume discharged refers to the volume of trade wastewater discharged.

(a) Mass Discharged:

For each substance, the Mass Discharged is calculated by multiplying the Composite Sample concentration by the Trade Wastewater discharge for that sample day.

(b) Chargeable Tradewaste Mass:

(i) For the following substances, the Chargeable Tradewaste Mass is equal to the Mass Discharged:

SUBSTANCE
BARIUM
IRON

(ii) For the following substances, the Chargeable Tradewaste Mass is calculated by subtracting the Equivalent Domestic Mass from the Mass Discharged. The Equivalent Domestic Mass is defined as the Domestic Concentration multiplied by the Trade Wastewater discharge.

SUBSTANCE	DOMESTIC CONCENTRATION mg/L
AMMONIA (AS N)	35.000
SUSPENDED SOLIDS	200.000
TOTAL DISSOLVED SOLIDS	450.000

If the resulting Chargeable Tradewaste Mass is zero or negative, then no Quality charges will apply for that substance for that sample day.

(c) Quality Charge:

For the following substances, the Quality Charge is determined by multiplying the Chargeable Tradewaste Mass by the Rate for that substance:

SUBSTANCE	STANDARD MASS CHARGING RATE $ per kg
SUSPENDED SOLIDS	0.4890

(d) Concentration Breach Charge:

Where the Composite Sample concentration is greater than the Acceptance Standards specified in Schedule 1 (with the exception of sulphate), any charges calculated in (c) above will be doubled for that sampling day.

(e) Failure to collect required samples:

Where the Customer fails to collect and analyse samples in accord with this consent the above charges will be assessed on the basis of the highest composite concentrations recorded for any billing period within the previous 12 months and the average daily discharge for the current billing period.

(f) pH and Temperature charges:

Sydney Water regularly assesses its wastewater networks to determine if a system is affected by accelerated odour and corrosion. Where Sydney Water declares a wastewater system to be affected by accelerated odour and corrosion, the temperature and pH charge will only apply if the customer is not committed to or not complying with an effluent improvement program.

2. CHARGES FOR INSPECTIONS

(a) If, in the opinion of Sydney Water, it is necessary for a Customer Service Representative to exercise rights under clause 6.1, the Customer will incur no liability for payment for any such exercise unless Customer Service Representative has already exercised rights under clause 6.1 on 13 occasions within a period of one year.

(b) If it is necessary, in the opinion of Sydney Water, to carry out more than 13 occasions within a period of one year, the additional inspections will be charged at the current inspection rate.

(c) Any inspection required following up an alleged breach or a default notice will result in a fee payable even if the number of inspections nominated in paragraph 2 (a) has not been exceeded.

(d) For the purposes of 2 (a) and 2 (b), above, one year is defined as the period from 1 July to 30 June the following year.

3. CHARGES FOR ADMINISTRATION OF TRADEWASTE CONSENT

A consent fee of $887.65 per quarter is payable from 1 April 2015.

4. CHARGES FOR VARIATION OR RENEWAL OF TRADEWASTE CONSENT

Where a Variation is made to the Consent a fee of $537.41 will be payable. There will be no charge for renewal.

5. CHARGES FOR GREASE TRAPS

Wastesafe administration charge $96.00 per pit per year.

6. PAYMENT OF FEES AND CHARGES

An account will be issued for all fees and charges. Any fees or charges payable by the Customer must be paid by the Customer within 30 days of the receipt by the Customer of the account detailing those fees and charges.

SCHEDULE 4

ADDITIONAL REQUIREMENTS

1. EFFLUENT IMPROVEMENT PROGRAM

An improvement program must be submitted to Sydney Water by 30 June 2015.The improvement program should specify the steps that will be taken to ensure that the trade waste discharge will meet the standards by 30 October 2015 for the substances listed below as set out in Sydney Water's published acceptance standards for the discharge to the sewer.

AMMONIA	100 mg/L

2. WASTE MANAGEMENT PLAN

The existing pretreatment will result in the generation of 3000.0 tonne per annum of waste substances in the form of a sludge containing generally solids. The waste substances are, and will continue to be disposed of, in compliance with the requirements of The Environment Protection Authority.

3. OTHER REQUIREMENTS

3.1 Backflow Containment Device must be installed and maintained at the water meter outlet/property boundary in line with Sydney Water's Connected customer Policy.

3.2 Backflow individual/zone protection is required on any tap located within 5m of the trade waste apparatus.

4. TIPPING BUCKET RAIN GAUGE MAINTENANCE

The customer must be at least every week remove the rain gauge cover and clear any spider webs that my interfere with the operation of the tipping bucket. The customer must ensure that the collector spout and bucket area free of debris. the customer must clean any build up of pollen, slime or dust from both the buckets and the collector spout. The customer must check that the instrument is level.

The customer must at least every 12 months have the tipping bucket rain gauge calibrated by an instrument technician. The technician must provide a certificate of calibration that must list the manufacturer, the model and serial number of the tipping bucket. The certificate must confirm that the tipping bucket rain gauge and control system comforms to Sydney Water's published specifications. A copy of the certificate of calibration must be supplied to Sydney Water within 2 weeks of the calibration date.

Calibration is to be carried out to manufacturers specifications.

SCHEDULE 5

APPARATUS, PLANT AND EQUIPMENT

EXISTING: COLLECTION WELL 30 kL
1 X 100 KL biological treatment plant(batch discharge)
1 X RAINFALL SENTINEL MEA 2211
1 X ABB MAGMASTER ELECTROMAGNETIC FLOW METER

PROPOSED: N/A

SCHEDULE 6

SPECIAL CONDITIONS

1. DANGEROUS DISCHARGES

In this Schedule, the term "may pose a danger to the environment, the Sewer or workers at a sewage treatment plant";

(a) means an occurrence whereby matter is discharged to the Sewer which either alone or in conjunction with other matter discharged cannot be adequately treated or may cause corrosion or a blockage, explosion or the production of dangerous gases in the Sewer or may adversely affect the operation of a sewer or sewage treatment plant; and

(b) includes, but not so as to restrict the generality of paragraph (a), matter or substances, which is or are

(i) toxic or corrosive;
(ii) petroleum hydrocarbons;
(iii) heavy metals;
(iv) volatile solvents;
(v) phenolic compounds;
(vi) organic compounds.

2. UNINTENDED DISCHARGES

(a) For purposes of avoiding unintended discharges to the Sewer or the stormwater drainage system, all matter and substances on the Premises must be processed, handled, moved and stored in a proper and efficient manner.

(b) Any substance on the Premises which, if discharged to the Sewer, may pose a danger to the environment, the Sewer or workers at a sewage treatment plant or may harm any sewage treatment process must be handled, moved and stored in areas where leaks, spillages or overflows cannot drain by gravity or by automated or other mechanical means to the Sewer or the stormwater drainage system.

3. NOTIFICATION

In the event of a discharge of matter to the sewer that poses or may pose a danger to the environment, the Sewer or workers at a sewage treatment plant the Customer must immediately notify:

(a) MALABAR STP CONTROL ROOM TEL: (02) 9931 8319 FAX: (02) 9931 8366

(b) BUSINESS CUSTOMER SERVICES (8AM TO 5PM MON TO FRI) TEL: 1300 985 227

(c) BUSINESS CUSTOMER SERVICES EMERGENCY CONTACT (24 HOURS) TEL: (02) 8849 5029

(d) SYDNEY WATER EMERGENCY CONTACT (24 HOURS) TEL: 13 20 90

4. PROVISION OF SAFE ACCESS

The Customer shall provide safe access to Sydney Water employees visiting the site. In the event that unsafe conditions are identified the Customer must take reasonable steps to correct unsafe conditions and create safe access.

5. ELECTRONIC REPORTING OF SAMPLE ANALYSIS RESULTS

Sydney Water reserves the right to vary this consent to specify the option of reporting by electronic mail as outlined in Schedule 2, 2 (d).

SCHEDULE 7

1. **Premises for which Consent is granted**

   9 CANAL RD, ST PETERS NSW 2044

2. **Industrial or other commercial activities for which Consent granted**

   FORMER GARBAGE TIP (GE06)

3. **Discharge point for which Consent granted**

   BOUNDARY TRAP

4. **The date for purposes of clause 3.1 is** 1 July 2015

5. **The period for purposes of clause 3.2 is** 24 months

6. **The receiving Treatment Plant is** MALABAR Sewage Treatment Plant

SCHEDULE 8

NOTICES AND COMMUNICATION ADDRESSES

SYDNEY WATER MANAGER BUSINESS CUSTOMER DELIVERY
PO Box 399
PARRAMATTA 2150

TEL: 1300 985 227
A.H: (02) 8849 5029

CUSTOMER: [redacted]

SCHEDULE 9

AUTHORISED OFFICERS

SYDNEY WATER: MANAGER BUSINESS CUSTOMER DELIVERY
PO Box 399
PARRAMATTA 2150

TEL: 1300 985 227
A.H: (02) 8849 5029

Email: businesscustomers@sydneywater.com.au

CUSTOMER: [redacted]

Email:

SCHEDULE 10

NOMINATED REPRESENTATIVES

SYDNEY WATER: MANAGER BUSINESS CUSTOMER DELIVERY
PO Box 399
PARRAMATTA 2150

TEL: 1300 985 227
A.H: (02) 8849 5029

CUSTOMER: [redacted]

APPENDIX 1 (Example)
SAMPLE ANALYSIS REPORT (COMPOSITE) DISCHARGE METER

Consent Number:	29304
Company Name:	WESTCONNEX DELIVERY AUTHORITY, WESTCONNEX DELIVERY AUTHORITY
Company Address:	9 CANAL RD, ST PETERS NSW 2044

Sample Type:

☐ 6 (composite, manual time based)
☐ 7 (composite, manual flow proportional)
☐ 8 (composite, automatic time based)
☐ 9 (composite, automatic flow proportional)

Start date: ___/___/___
Finish date: ___/___/___
Start time: ____:____ am/pm
Finish time: ____:____ am/pm

grabs taken in sample period: _____
sample intervals min/kL _____
mL per grab: _____

Initial meter reading: _____kL
Final Meter reading: _____kL
Volume discharged: _____kL

Laboratory:

	Acceptance Standard	Measured Units
Substance	**Acceptance Standard (mg/L)**	**Measured Concentration(mg/L)**
AMMONIA (AS N)	100.000	
SUSPENDED SOLIDS	600.000	
TOTAL DISSOLVED SOLIDS	10000.000	
BARIUM	5.000	
IRON	50.000	

COPY OF ORIGINAL ANALYTICAL LABORATORY REPORT TO BE ATTACHED
NOTE: LABORATORY REPORT MUST CERTIFY NATA REGISTRATION FOR EACH ANALYSIS

Comments: _____

Customer Signature: _____ Date: ___/___/___

Designation: _____

OFFICE USE ONLY

TERRITORY: D4

Sample No: | | | | | |

EMAIL TO:
businesscustomers.labdata@sydneywater.com.au

APPENDIX 2
SAMPLE ANALYSIS REPORT (DISCRETE SAMPLE)

Consent Number:	29304
Company Name:	WESTCONNEX DELIVERY AUTHORITY, WESTCONNEX DELIVERY AUTHORITY
Company Address:	9 CANAL RD, ST PETERS NSW 2044

Sample Type: DISCRETE

Date

Time

Laboratory:

Substance	Acceptance Standard (units or mg/L)	Measured Units or Concentration.
pH at start	7 - 10	
pH at finish	7 - 10	
NH3	100.000	

COPY OF ORIGINAL ANALYTICAL LABORATORY REPORT TO BE ATTACHED
NOTE: LABORATORY REPORT MUST CERTIFY NATA REGISTRATION FOR EACH ANALYSIS
Comments: _____

Customer Signature: _____ Date: ___/___/___

Designation: _____

OFFICE USE ONLY

TERRITORY: D4

Sample No: | | | | | |

EMAIL TO:
businesscustomers.labdata@sydneywater.com.au

Annexure G – LEMP

Alexandria Landfill Closure – Landfill Environmental Management Plan (LEMP)

Annexure G to the Landfill Closure Management Plan

Final Design Documentation (100%)

Project:	New M5 – Design and Construct
Contract Number:	15.7105.1373
Document Number:	M5N-GOL-TER-900-300-EV-0014-B

Document Approval

Rev.	Date	Prepared by	Reviewed by	Approved by	Remarks
A	24 March 2016	[redacted]	[redacted]	[redacted]	Internal issue
B	11 April 2016	[redacted]	[redacted]	[redacted]	FD
C	08 June 2016	[redacted]	[redacted]	[redacted]	FD

Tables of Contents

1 Introduction

1.1 Description of Design Package

This LEMP for the ALF site, St Peters, NSW (the site) forms an Annexure to the LCMP design package (M5N-GOL-MNP-900-300-WT-9400) which in turn forms an Annexure to the Alexandria Landfill & Bradshaw Mountain RAP design package (M5N-GOL-MNP-900-300-WT-9401). Both the LEMP and the LCMP are also referenced by the Project CEMP (M5N-ES-PLN-PWD-0001).

The LCMP is focused on closure works while this LEMP is focused on overall environmental management and monitoring following rehabilitation of the site and will inform future licences and management plans for the site.

Prior to the commencement of closure works, the Contractor will take possession of the site. Existing and/or consolidated EPLs and regulatory responsibility will be transferred from RMS to the Contractor during construction and will be amended and transferred to the operator of the SPI, Sydney Motorway Corporation (SMC) following landfill closure.

This LEMP is a live document requiring regular revision, including upon receipt of final Project Conditions of Approval.

1.2 Background

1.2.1 Site Redevelopment Proposal

The Alexandria Landfill (ALF) site has been acquired by the New South Wales (NSW) Roads and Maritime Services (RMS) and will be the location of the St Peter Interchange (SPI) for the WestConnex New M5 (WCX M5) project (the Project). The landfill is required to be closed and remediated to accommodate the proposed road infrastructure and open space land use.

1.2.2 Site Description

The site comprises Lot 2 in Deposited Plan (DP) 1168612, and is located at 10 Albert Street, St Peters, NSW. This LEMP relates to the areas licensed under the Environmental Protection Licence (EPL) mentioned in Section 1.4.

1.2.3 Landfill Closure

Closure of the landfill and remediation/land forming works are required for future beneficial use of the land as part of the WestConnex New M5 (WCX M5) project (the Project). The SPI redevelopment has been designed to incorporate landfill closure considerations including capping, leachate and landfill gas management.

The construction of the road interchange will require the excavation and land forming of existing landfill materials, including waste, to accommodate the interchange and tunnel design.

It is proposed that excavated landfill waste materials are to be capped and contained on-site within a proposed waste mound (T2) with capping of the remaining in-situ landfill wastes. The proposed containment system also considers the installation of a Vertical Barrier wall (VB wall) along the eastern boundary of the site to restrict groundwater migration from the Botany Sands aquifer into the SPI site.

Management of these works will be addressed through the preparation of specific work method statements, noting that compliance with: the Project Construction Environmental Management Plan (CEMP); the

Alexandria Landfill & Bradshaw Mountain Remediation Action Plan (the RAP); the Landfill Closure Management Plan (the LCMP); and the EPL(s) is required.

1.3 Objectives

As noted above this LEMP describes the environmental management and monitoring procedures for the Alexandria Landfill post closure. It has been prepared to provide easily accessible procedures for environmentally sound and operationally efficient management of the closed site and supports compliance with:

- the Environmental Guidelines Solid Waste Landfills (NSW EPA, 2016);
- Conditions of the Environment Protection Licence (EPL) 4627 applying to closure;
- the site Trade Waste Agreement (TWA) 29304;
- the relevant Conditions of Approval;
- Scope of Work and Technical Criteria (SWTC) for the Project issued by WestConnex Delivery Authority (WDA) (now SMC), dated November 2015; and
- The *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA 2012) (HGG Guidelines).

Further detail is presented in Section 1.4.

The LEMP relates to the areas licensed under the abovementioned EPL.

The LEMP will serve as:

- A means of identifying and concentrating on the key environmental and rehabilitation issues;
- A commitment to a minimum standard of long-term environmental management for the site;
- A guidance document for monitoring and reporting after rehabilitation of the landfill;
- A guidance document for interaction with relevant Government authorities such as the NSW EPA.

The plan is consistent with the provisions of the Environmental Guidelines Solid Waste Landfills (NSW EPA, 2016) as required in the SWTCs, particularly with regard to the minimum requirements for landfill monitoring.

As noted above the LEMP is considered a live document and should be updated by the Contractor on a regular basis as management requirements change.

In particular this LEMP has been prepared with consideration to the Contractor's concept design for the SPI and will be subject to review following construction of the site.

As a minimum the document will be subject to review on an annual basis. Any review will be carried out in consultation with the EPA and may require EPL variation. Major reviews will be aligned with five-yearly EPL reviews.

1.4 Regulatory Instruments

The following regulatory instruments have been considered in the preparation of this Landfill Environmental Management Plan:

- *Protection of the Environment Operations (POEO) Act 1997*
- *Environment Planning and Assessment (EP&A) Act 1979;*

- *Water Act 1912; and*
- *Water Management Act 2000*.

1.4.1 ALF Scheduled Activities EPL

All licensed landfills must meet the requirements of the *POEO Act 1997* and the Regulations made under that Act. The site is licenced for "Road Construction" under EPL number 4627.

The EPL establishes the limits to the accepted waste types, quantities, waste management and operating conditions at the facility and any additional limiting conditions including pollution of waters, noise and odour limits. The EPL also specifies the air and water monitoring and recording requirements. The anniversary date for the EPL is 1 December.

1.4.2 NSW EPA (2016) Environmental Guidelines : Solid Waste Landfills

The *NSW EPA (2016) Environmental Guidelines Solid Waste Landfills* provide guidance for the environmental management of landfills in NSW by specifying a series of best practice measures called 'Minimum Standards'. They involve a mix of design and construction techniques, effective site operations, monitoring and reporting protocols, and post-closure management.

The NSW EPA will use these guidelines to assess applications for new or varied landfill licences under the *POEO Act 1997* and to administer these licences during the operational and post- closure periods of landfills.

Regardless of the planning assessment process under the EP&A Act 1979, these guidelines form the basis of the NSW EPA's requirements for the content of the LCMP for the site, including the attached LEMP.

1.4.3 NSW EPA (2012) Guidelines for Assessment and Management of Sites Impacted by Hazardous Ground Gases

As this document requires review under the *Contaminated Land Management Act* 1997 (*CLM Act)* as well as the *POEO Act*, the EPA's *Guidelines for Assessment and Management of Sites Impacted by Hazardous Ground Gases* (EPA 2012) have also been considered. This document provides guidance on recognising and appropriately managing risks due to hazardous ground gases during the assessment and remediation of potentially contaminated land or during the development of land adjacent to sites impacted by hazardous ground gases.

1.4.4 ALF Trade Waste Agreement

RMS holds Consent Number 29304 with Sydney Water Corporation to discharge industrial trade wastewater. This TWA is for the discharge of treated leachate to a sewer discharge point in Albert Street and is dated 2 June 2015.

1.4.5 Planning Approvals

The Project is declared to be State significant infrastructure under section 115U (2) of the EP&A Act 1979 by reason of the operation of clauses 1 and 14 of Schedule 3 of the State Environmental Planning Policy (State and Regional Development) 2011. Accordingly, the project is subject to Part 5.1 of the EP&A Act 1979 and requires the approval of the Minister for Planning.

Conditions of Approval (COA) issued with the Infrastructure Approval dated 20 April 2016 that specifically address landfill environmental monitoring post closure are identified in the following table:

Table 1 Relevant Conditions of Approval

No.	Condition	Addressed where
B32	The Proponent must submit a copy of the final Landfill Closure Management Plan to the Secretary prior to the commencement of any closure or construction works at Lot 2 DP 1168612, 10-16 Albert Street, St Peters (the Alexandria Landfill), the. The Plan must be accompanied by a statement which sets out where the following have been addressed in the Landfill Closure Management Plan:	
	(a) the environmental and monitoring framework to be implemented following the cessation of waste disposal and material recycling activities at the Alexandria Landfill and associated waste recycling and transfer facility;	LEMP (this document)
	(b) existing operational consents and approvals for use of the site as a waste storage and recycling facility;	LCMP Section 1.5
	© the proposed future use of the site;	LCMP Section 3.3
	(d) the closure and stabilisation of the site including details of final capping designs and future landform;	LCMP Section 3.4 and Section 3.6
	(e) a groundwater monitoring bore network, to monitor the movement of groundwater within and immediately outside the cut-off wall;	LEMP Section 5.4
	(f) material tracking;	LCMP Section 3.11
	(g) occupational health and safety requirements;	LCMP Section 3.12
	(h) community engagement processes;	LCMP Section 3.13
	(i) specific measures for the management, monitoring and reporting of;	
	(i) dust and odour;	LEMP Section 7 CEMP
	(ii) asbestos;	LCMP Section 3.15
	(iii) leachate and gases;	LCMP Section 3.8 and 3.7 CEMP LEMP Sections 5 and 6 M5N-GOL-DPK-900-302-WT-9410 SPI (Gas Design)
	(iv) stormwater; and	LCMP Section 3.9
	(j) any outstanding clean-up notices.	LCMP Section 3.14
	(k) evidence that the EPA has reviewed the Landfill Closure Management Plan and has no outstanding concerns.	LCMP Section 1.7

No.	Condition	Addressed where
	Where any of the above details have not been included in the final Landfill Closure Management Plan, then the Proponent must provide the details in the statement accompanying the plan required by this condition.	N/A

Several local council planning consents and Land and Environment Court (LEC) orders cover the ALF site. These are listed as follows:

- City of Sydney (CoS), Determination of a Development Application No. 44785/1259, 23 February 1987 (CoS 1987);
- Municipality of Marrickville, Determination of a Development Application No. 10797, 20 March 1987 (MoM 1987);
- Land and Environment Court NSW, Order No. 10079 of 2005, 28 September 2006 (LEC 2006a) – superseded by CoS (2013);
- Land and Environment Court NSW, Order No. 11646 of 2004, 28 September 2006 (LEC 2006b);
- Land and Environment Court NSW, Case Number 45/10489, 7 November 2012 (LEC 2012); and
- City of Sydney, Section 96 Modification Approval for 9 Canal Road, St Peters, No: DU/2003/356/C, 2 April 2013 (CoS 2013).

Local planning consents have been considered in the preparation of the LEMP, but are not necessarily referenced throughout the document as their intent is largely covered by the EPLs, the CoA and the SWTCs (refer Section 1.5).

1.5 Contractual Obligations

This LEMP has been developed to satisfy the project's SWTCs. The relevant conditions outlined in the SWTC, impacted by this report are summarised in the LCMP. Key SWTCs relevant to the LEMP are:

- 1.2.2 a) ii): The Project Company must undertake the Landfill Closure Works. The Landfill Closure Works includes the design, construction and commissioning of the following landfill infrastructure elements as a minimum:
  - I. new landfill monitoring systems;
  - J. upgrades to the existing landfill monitoring system if required;
- 1.2.2 a) v): The Project Company must undertake the Landfill Closure Works. The Landfill Closure Works includes operation and maintenance of the Alexandria Landfill Site from the relevant Date for Access up to and including the Date of Completion;
- 1.2.2 a) viii): The Project Company must undertake the Landfill Closure Works. The Landfill Closure Works includes preparation and finalisation of a comprehensive LEMP in accordance with the requirements of section 5 of SWTC, Appendix C.2 (Project Company Documentation Schedule), for Post Closure Works to the satisfaction of RMS by no later than six months prior to the Date of Completion;

Table 2: SWTCs

Condition	Description	Addressed
1.2.2 a) ii)	The Project Company must undertake the Landfill Closure Works. The Landfill Closure Works includes the design, construction and commissioning of the following landfill infrastructure elements as a minimum:	

I.	new landfill monitoring systems;	Sections 5.4, 5.5 and 6.3
J.	upgrades to the existing landfill monitoring system if required;	Sections 5.4, 5.5 and 6.3
1.2.2 a) v)	The Project Company must undertake the Landfill Closure Works. The Landfill Closure Works includes operation and maintenance of the Alexandria Landfill Site from the relevant Date for Access up to and including the Date of Completion;	CEMP, this LEMP
1.2.2 a) viii)	The Project Company must undertake the Landfill Closure Works. The Landfill Closure Works includes preparation and finalisation of a comprehensive LEMP in accordance with the requirements of section 5 of SWTC, Appendix C.2 (Project Company Documentation Schedule), for Post Closure Works to the satisfaction of RMS by no later than six months prior to the Date of Completion	This LEMP

1.6 Plan Structure

The LEMP has been structured to encourage its use on a day to day basis and to outline procedures required to manage key environmental factors regarding the closure and post closure of the landfill site.

As noted above, minimum requirements of NSW EPA (2015) are addressed and the document structure is summarised below:

Section 1 – Introduction

Presents an introduction and background to the site and establishes the objectives of the LEMP. This section will require substantial up-date following completion of landfill closure activities and post Completion of the SPI construction.

Section 2 – Site Overview

This section currently cross references the LCMP. Following completion of landfill closure activities and post Completion of the SPI construction the LEMP becomes a stand-alone document and will be updated to summarise the final site landform and infrastructure.

Section 3 – Operations Overview

This section references current site operations as detailed in the LCMP. As noted above, following completion of landfill closure activities and post Completion of the SPI construction the LEMP will be updated to summarise the final site operations and maintenance activities, including interface with the final site development.

Section 4 – Structure and Responsibilities

This section outlines the roles and responsibilities following construction of the SPI and closure and rehabilitation of the landfill.

Section 5 – Water Quality Management

This section presents details on proposed approaches to leachate, groundwater and surface water management.

Section 6 – Air Quality Management

This section presents details on current and proposed approaches to air quality (in particular odour, dust and landfill gas) management.

Section 7 –Amenity Issues

This section presents details on key aspects to be considered regarding site hazards and amenity issues.

Section 8 – Reporting

This section presents reporting requirements for the Site

Section 9 – References

This section presents the References list.

1.7 Definitions, Abbreviations and Project Document Citations

The key technical terms and abbreviations used through this report are defined in Tables 1.2 and 1.3 respectively.

The key technical terms and abbreviations used through this LEMP are defined in Table 2 and Table 3.

Table 3: Definitions

Term	Description
The Contractor	CPB Dragados Samsung Joint Venture (CDS).
Project Company	WCX M5 Pty Limited

*Table 4 **A**bbreviations*

Abbreviation	Description
AG	Asbestos Guide (for WCX M5)
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Conservation Council
ALF	Alexandria Landfill
ARI	Average Recurrence Interval
BoM	Bureau of Meteorology
CDS	CPB Dragados Samsung Joint Venture
CEMP	Construction Environmental Management Plan
CLM Act	*Contaminated Land Management Act* 1997
CoA	Conditions of Approval
CoS	City of Sydney
CIRIA	Construction Industry Research and Information Association
CQA	Construction Quality Assurance
DECC	Department of Environment and Climate Change
DP	Deposited Plan
EIS	Environmental Impact Statement

Abbreviation	Description
EPA	Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPL	Environment Protection Licence
ESA	Environmental Site Assessment
FDD	Final Design Documentation
HGG	Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (EPA 2012) (also referred to as the HGG Guidelines)
IFC	Issued for construction
km/h	Kilometres per hour
LCMP	Landfill Closure Management Plan
LEL	Lower Explosive Limit
LEMP	Landfill Environmental Management Plan
LTP	Leachate Treatment Plant
NMOC	Non Methane Organic Compounds
NSW	New South Wales
OEH	Office of Environment and Heritage
POEO Act	*Protection of the Environment Operations Act* 1997
Project	WestConnex New M5
PVC	Polyvinyl Chloride
RMS	Roads and Maritime Services
SBR	Sequential Biological Reactor
SMC	Sydney Motorway Corporation
SPI	St Peters Interchange
SWC	Sydney Water Corporation
SWTC	Scope of Work and Technical Criteria
T2	Waste mound for landfill waste material – to be constructed
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TWA	Trade Waste Agreement
VB Wall	Vertical Barrier Wall comprising slurry vertical barrier wall at SPI
v/v	Volume / volume
WAMC	Waste Assets Management Corporation

Abbreviation	Description
WCX M5	WestConnex New M5
WDA	WestConnex Delivery Authority (now the Sydney Motorway Corporation)
WHS	Work Health and Safety

1.8 Project Design Reports, Procedures and Plans Cited

The Project design reports, procedures and plans are cited in this LEMP are listed in Table 4.

Table 5: Project Reports, Procedures and Plans cited in this LEMP

Document	Reference Number
Asbestos Guide	M5N-ES-GUI-PWD-0001 (CDS, 2016)
SPI Capping Concept Design Report	M5N-GOL-DPK-900-302-WT-9415-B (Golder, 2016)
Construction Environmental Management Plan (CEMP)	M5N-ES-PLN-PWD-0001 (CDS, 2016)
ALF & BM Remediation Action Plan (RAP)	M5N-GOL-MNP-900-300-WT-9401-C (Golder, 2016)
Landfill Closure Management Plan (LCMP)	M5N-GOL-MNP-900-300-WT-9400-C (Golder, 2016)
Vertical Barrier Wall Design Report	M5N-GOL-DPK-900-302-WT-9420-D (Golder, 2016)
Leachate Design (Water Balance)	M5N-GOL-DPK-900-302-WT-9405-B (Golder, 2016)
Landfill Gas Modelling / Report	M5N-GOL-DPK-900-302-WT-9410-B (Golder, 2016)
Pavement Drainage Design	M5N-AJV-TER-900-300-DR-1405 (AJJV 2016)

2 Site Overview

An overview of the site conditions is contained in the LCMP. Following completion of landfill closure activities and post Completion of the SPI construction the LEMP becomes a stand-alone document and will be updated to summarise the final site landform and infrastructure.

3 Operations Overview

The site operations are described in detail in the LCMP. Following completion of landfill closure activities and post Completion of the SPI construction the LEMP becomes a stand-alone document and will be updated to summarise the operations overview.

4 Structure and Responsibilities

4.1 Roles and Responsibilities

This section outlines the roles and responsibilities following construction of the SPI and rehabilitation of the landfill and focusses on likely responsibilities following closure. During construction, the site will be operated under EPL4627.

The operational roles and responsibilities for the site following closure are summarised in Table 6. It is noted that the required operational items and associated responsibilities may change during the post closure phase of monitoring. The operational responsibilities section would be updated regularly to reflect changing compliance requirements.

Table 6: Operational Roles

Entity	Operational Roles
Site operator (licensee)	• Entity responsible for site management: SMC post-construction • Appointment and management of Site Manager
Site manager (site representative of the site operator)	• A nominated Site Manager who must be available to visit the site on short notice • Implementation of all aspects of the LEMP and the site operational management plan • Appointment and management of subcontractors and subconsultants • Liaison with authorities (EPA, Sydney Water, Department of Primary Industries - Water) • Key point of contact for the site • Management of complaints
Environmental consultant	• Environmental monitoring • Reporting of results • Liaison with authorities (EPA,) as instructed by the Site Manager
Other specialist sub-consultants and sub-contractors	• Roles as defined by the Site Operator

Contact details for key personnel operating the site are summarised in Table 7. This table should be updated once the details become available.

Table 7: Contact Details

Entity and name	Telephone	Address	Email
Site operator (licensee)*: Sydney Motorway Corporation			
Site manager: To be appointed			
Environmental consultant: To be appointed			
Other specialist sub-consultants and sub-contractors			

*This document assumes that the site operator and licensee will be identical. Should the site operator and licensee be different entities, this should be reflected in future iterations of this LEMP.

4.2 Complaints Management

4.2.1 Objectives

The purpose of maintaining a Complaints Register is to record and monitor the number of complaints received to improve site operations.

4.2.2 Requirements

Section 6.1 and 10.1 of NSW EPA (2016) outline requirements for complaints management.

4.2.3 Management Strategy, Task and Actions

A complaints register will be maintained to log public complaints regarding odours, vermin, dust, noise and any other issues received at the Site. The following information is recorded:

- date,
- time,
- weather conditions,
- name and contact details of the complainant
- nature of any complaint and
- the subsequent actions taken to help minimise or eliminate the concerns will be logged.

All of the site operator's communication, including communication relating to complaints are maintained in the site operator's record keeping system.

All staff will be trained in the requirement to notify and record any public complaints.

The site operator will provide a customer service number which will be advertised and calls to this number are promptly allocated to the responsible officer. The telephone number for the Site will also be publically listed and displayed prominently at the site.

4.2.4 Performance Indicators

- Number of complaints recorded

4.2.5 Responsible Person

- Licensee

4.2.6 Reporting

- Annual Report (refer Section 8)

4.2.7 Corrective Actions

- If complaints are not being recorded, staff may need further training in this area.

4.3 Staffing and Training Requirements

4.3.1 Objectives

The objectives of adequate Site staffing and training will promote the environmentally responsible and safe management of the Site.

4.3.2 Requirements

The landfill guidelines (NSW EPA, 2016) recommend the Site be adequately staffed and that those staff have adequate training.

4.3.3 Management Strategy, Task and Actions

General Induction Training

All staff employed by the operator undergo a formal induction program relating to their position. The training program comprises:

- Work Health and Safety (WHS) Training
- Code of Conduct Training
- Risk assessment training
- First aid training where applicable

Site Specific Induction Training

Site induction and training of Site staff and contractors will be undertaken inclusive of training in all applicable

Ongoing Training

Ongoing training requirements will be reviewed on an annual or as-needs basis depending on staffing at the Site and triggers for ongoing training such as equipment upgrades, review of procedures or change in regulatory requirements.

Some staff may be required to obtain tickets or licenses to operate plant or conduct certain tasks. A register of tickets and licenses for each staff member is maintained by the operator.

4.3.4 Performance Indicators

- Staff are competent and knowledgeable in relation to their daily requirements
- The number of errors in data recording and reporting
- Level of operational and administrative efficiency
- Sampling and monitoring is conducted to approved EPA standards
- Training records are maintained and reviewed accordingly

4.3.5 Responsible Person

Licensee

4.3.6 Corrective Actions

- If annual reviews detect a failing, then measures will be put in place to increase the training requirements

5 Water Quality Management

5.1 Goals

The environmental goals for water pollution management are:

- Preventing water pollution by leachate and sediments
- Detecting water pollution; and
- Remediating water pollution.

5.2 Prevention of Pollution by Leachate

The following management techniques will be used to prevent and detect pollution of water by leachate:

- Leachate barrier system for T2 waste mound
- Leachate collection and treatment system
- Leachate monitoring
- Ground water and surface water monitoring.

5.2.1 Leachate Barrier System

5.2.1.1 Objectives

The objective of a leachate barrier system is to provide a physical barrier to leachate migration to protect groundwater, surface water and soils from pollution.

5.2.1.2 Requirements

The guidelines (EPA, 20156), Section 1.10, makes requirements for lining systems for new landfilling on existing landfill areas, referred to as ‘piggy-backing’ , and require that pollution of water from leachate be prevented. This requirement is considered generally applicable to the T2 waste mound. A suitable leachate

barrier system is required to be designed in order to contain leachate over the time that waste poses an environmental risk which reduces the potential for environmental impacts caused by the landfill.

5.2.1.3 Management Strategy, Task and Actions

Current Situation

The site was constructed without a leachate barrier layer. Leachate is and will be managed using a collection, extraction and treatment system and surface water controls identified in the following sections.

Future Situation

Lining systems have been proposed to address the following situations (refer to the LCMP for more detail):

For the T2 waste mound: The waste mound is proposed on site for placement of waste excavated on other areas in the site. The proposed mound will be located mainly on the existing landfill area, except a small area on the south western of the site will sit on the natural ground surface. The waste mound base will be lined and the base liner surface will be graded with greater than typical slopes to accommodate future settlement under the landform and allow long-term functioning of the overlying leachate collection layer.

5.2.2 Leachate Collection

The proposed leachate collection system is described in the LCMP and comprises:

- A new shallow leachate collection system incorporated in the capping system;
- Existing deep leachate collection system reporting to the existing main leachate riser;
- A new leachate collection system at the base of the waste mound;
- A system to store and transfer collected leachate to the LTP;
- A leachate treatment plant (LTP); and
- Leachate collected in the deep, shallow and waste mound systems will drain by gravity to collection sumps and then will be pumped to a leachate treatment plant (refer below).

The leachate collection system also collects gas condensate from the active landfill gas extraction system (refer Section 6.2.2).

5.3 Leachate Storage, Treatment and Disposal System

5.3.1 Objectives

The objective for leachate storage is to provide adequate storage capacity for leachate on the site. The objective of leachate treatment and disposal is to provide adequate leachate treatment capacity and an environmentally suitable mechanism for leachate disposal.

5.3.2 Requirements

Requirements for leachate storage, treatment and disposal are outlined in the landfill guidelines (EPA, 2016), Section 2.1 ‘Leachate storage’, 2.2 ‘Leachate treatment and disposal’ and 2.3 ‘Conducting a water balance’. The SWTCs, conditions 1.2.2 a) ii) A., B., C., outline general requirements for leachate management at the site.

5.3.3 Management Strategy, Task and Actions

The existing LTP comprises a Sequential Biological Reactor (SBR) system and a 30 000 L storage tank, which was recently upgraded by RMS. It is understood that as of January 2016, the plant is undergoing

commissioning. The primary function of the treatment system is to remove ammonia from incoming leachate. A process flow diagram showing the LTP is indicated in Figure 1. It is assumed this plant will be used during construction and will be replaced with a new plant following construction.

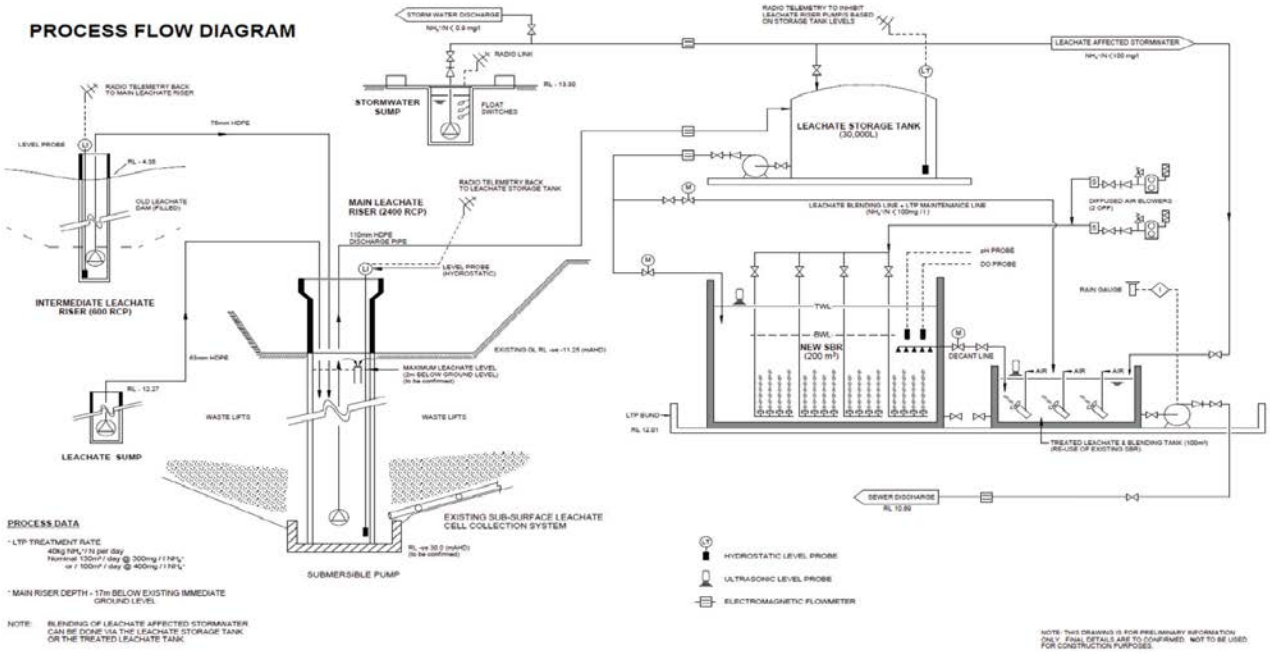

Figure 1: LTP Process Flow Diagram

Treated leachate is pumped from the LTP to a sewer discharge point in Albert Street under Trade Waste Agreement (TWA) 29304 with Sydney Water Corporation (SWC). Refer to Section 5.5 for a detailed description of the requirements of the TWA.

Treated leachate will continue to be discharged into the local sewer system under a Sydney Water TWA following treatment in a LTP.

5.3.4 Performance Indicators

- Results of ongoing monitoring of groundwater, surface water and leachate
- Monitoring of leachate levels within landfill and hydraulic gradient, as derived from those levels
- Operation of the new LTP and compliance with the TWA.

5.3.5 Responsible Person

- Site operator / Licensee

5.3.6 Inspection, Monitoring and Maintenance Schedule

Refer to Section 5.4 for the frequency and timing of groundwater, surface water and leachate monitoring.

5.3.7 Reporting

- Annual report (refer Section 8)

5.3.8 Corrective Actions

- If the leachate collection and treatment system is found not to be functioning, repairs and maintenance will be conducted where possible

- Should the leachate collection system not be repairable, a contingency area for installation of leachate extraction wells has been indicated in the LCMP. These extraction wells would then replace or supplement the extraction sump.
- Section 5.4 identifies actions to be undertaken if the monitoring results indicate that conditions have changed and leachate has a potential to cause environmental degradation of the groundwater or surface waters.

5.3.9 Surface Water and Sediment Controls

5.3.9.1 Objectives

The objectives of surface water and sediment controls include the following:

- Prevent unacceptable sediment loads in receiving waters;
- Prevent surface water mixing with waste;
- Prevent erosion of cover material and/or waste; and
- This plan assumes that the site has been revegetated or covered with pavement / hardstand and that no areas of exposed soil remain.

5.3.9.2 Requirements

The landfill guidelines require that pollution of water from leachate be prevented – refer Section 3 in NSW EPA (2015). DECC guidelines for surface water, erosion and sediment control at waste landfills also apply (DECC, 2008).

5.3.9.3 Management Strategy, Task and Actions

Proposed Surface Water and Sediment Controls

To manage surface water, the construction and installation of two storm water pump stations, inclusive of a gross pollutant and hydrocarbon collection facility is proposed. This design is subject to development by AJJV Design Package M5N-AJV-TER-900-300-DR-1405 and as per the 15% design comprise the following components:

- Two drainage pump sumps will receive surface water for pumping to the water quality basins;
- Collected water is directed to a two water quality control basins (WQ1 and WQ2) prior to being discharged to Alexandra Canal;
- All water quality control basins will be able to contain a 1 year ARI rainfall event first flush;
- Since the landfill is closed, surface water should not come into contact with waste. Therefore this water is not considered to be leachate;
- Should leachate seeps be identified in the landfill surface, these will be repaired and any leachate will be captured and treated in the leachate management system;
- Surface water runoff from the landscaped T2 waste mound is directed towards an existing drain at Canal Road;
- Leachate generated by waste is collected and managed in accordance with Section 5.3; and
- Maintain, upgrade, improvements and/or renewal of the stormwater drainage line approved by Marrickville Council Determination No. 199901506.

5.3.9.4 Performance Indicators

- Quantity of sediment in sediment control structures
- Level of maintenance required for the sediment control structures
- Records of visual inspection of the surface water management systems
- Surface water monitoring results
- Number of complaints or observations regarding sediment discharge from the site

- Detection of leachate in surface water.

5.3.9.5 Inspection, Monitoring and Maintenance Schedule

Table 8: Surface water inspection schedule

Action Item	Frequency	Frequency
Inspection of surface water detention / energy dissipation / water quality control basin	Quarterly and after rainfall events	Quarterly
Inspection of stormwater diversion drains	Quarterly and after rainfall events	Quarterly
Surface, groundwater and leachate monitoring	Refer Section 5.4	

5.3.9.6 Responsible Person

Licensee / site operator

5.3.9.7 Reporting

Annual Report

5.3.9.8 Corrective Actions

Maintain and repair sediment control structures when required, including removal of silt from surface drains and the surface water detention / energy dissipation / water quality control basin.

Maintain and repair the stormwater drain age line crossing the site.

5.4 Detecting Water Pollution

The landfill guidelines (EPA, 2015) require measures to be implemented to detect water pollution – refer Benchmark Technique Number 4. The following management techniques will be applied for early detection of surface water and groundwater pollution.

- Groundwater monitoring network
- Groundwater monitoring program
- Surface water monitoring program

5.4.1 Groundwater and Leachate Monitoring

5.4.1.1 Objectives

A groundwater monitoring network is necessary to demonstrate that there is limited potential for migration of hazardous constituents from the landfill to the surrounding groundwater or soil during the active life and post closure period. It is therefore important that wells comprising the monitoring network are:

- Strategically located to maximise the opportunity for intercepting groundwater flow onto the site and discharge from the landfill
- located so as to allow adequate definition of the direction and magnitude of the hydraulic gradient
- Constructed appropriately to ensure sample representativeness.

5.4.1.2 Requirements

EPL 12594 and 4627, specify monitoring of groundwater water. The landfill guidelines (EPA, 2016) provide technical guidance regarding groundwater monitoring, well construction, sampling and development of a

landfill groundwater monitoring network. The requirements for groundwater monitoring are outlined in Section 4,4 of NSW EPA (2015).

The existing monitoring system is proposed to be amended to reflect the site rehabilitation measures to be implemented. The proposed groundwater monitoring network is outlined in the following sections. The EPLs will require amendment to reflect the revised groundwater monitoring program.

5.4.1.3 Monitoring Program

A network of eleven groundwater monitoring wells and the leachate collection sump is proposed. The groundwater extraction sump forms part of the monitoring network. The proposed monitoring network is shown on Drawing M5N-GOL-DWG-900-300-EV-0004 Annexure A, while the program is outlined in Table 9 and Table 10.

The monitoring network has been designed based on the outcomes of the hydrogeological model for the site (refer to the Leachate Design – Water Balance, M5N-GOL-DPK-900-302-WT-9405-B). Its primary purpose is to identify that an inward hydraulic gradient exists at the site. As discussed in the LCMP and discussed in previous management plans for the site (IGGC 2011b, AECOM 2015a, 2015b) and historic assessments of the hydrogeology of the brick pits in the area (McNally and Branagan 1998), the inward hydraulic gradient is the primary mechanism by which migration of leachate from the site can be prevented.

Table 9: Groundwater monitoring program

Monitoring location	Frequency
Leachate sump (LP1) (EPL Point) [1]	• Continuous water level data logging and volume extraction [2] • Chemical analysis as per Table 10 • Leachate quality monitoring in accordance with the TWA. Refer Section 5.5 • Continuous leachate extraction volume
Monitoring wells assessing off site migration and water levels (proposed new EPL points): : **WCX-BH-157, MW1, MW4c (upgradient)** **LDS-BH-3081, LDS-BH-3087, LDS-BH-3088 (within the landfill footprint)** **MW3, LDS-BH-3059, LDS-BH-3082, LDS-BH-3083, MW309 (along the landfill boundary)**	• Continuous water level data logging (three continuous weeks of data logging following cap and barrier wall construction at time periods to be determined) • Continuous water level data logging at wells LDS-BH-3059 and MW4c • Standing water level (quarterly) • Chemical analysis as per Table 10

1. An alternative well yet to be installed may be sampled instead of LP1 obtain representative leachate samples.

2. From flow meters or pumping records of the amount of leachate transferred from the landfill

Table 10: Groundwater monitoring analytical program

Analytical parameter	Unit of Measure	Frequency of measure	Sampling method
pH, redox potential, temperature, electrical conductivity	• -	• Quarterly	• Field analysis
Standing water level	• mAHD	• Quarterly	• In situ
Total dissolved solids	• mg/L	• Quarterly	• Low flow purge or hydro sleeves

Analytical parameter	Unit of Measure	Frequency of measure	Sampling method
Major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulfate)	• mg/L	• Quarterly	• Low flow purge or hydro sleeves
Alkalinity (bicarbonate and carbonate)	• mg/L	• Quarterly	• Low flow purge or hydro sleeves
Total organic carbon	• mg/L	• Quarterly	• Low flow purge or hydro sleeves
Ammonia and nutrients (nitrate, nitrite, and phosphorus)	• mg/L	• Quarterly	• Low flow purge or hydro sleeves
Metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, zinc)	• mg/L	• Annually	• Low flow purge or hydro sleeves
Organic contaminants: • **phenols** • **petroleum hydrocarbons** • **monoaromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene)** • **organochlorine and organophosphate pesticides** • **polycyclic aromatic hydrocarbons**	• mg/L	• Annually	• Low flow purge or hydro sleeves

With respect to sampling, analyses and QA/QC, the groundwater sampling program will be conducted in general accordance with requirements of EPA (2015).

5.4.1.4 Performance Indicators

Groundwater monitoring results.

5.4.2 Groundwater Assessment Program

5.4.2.1 Objectives

The objective of the groundwater assessment program is to provide a methodology to regularly assess trends in groundwater quality and identify impacts on groundwater quality.

5.4.2.2 Requirements

The landfill guidelines (EPA, 2016), Section 4.4, require a regular groundwater assessment program at an interval of at least every three years.

5.4.2.3 Management Strategy, Task and Actions

A groundwater assessment report will be prepared at a yearly interval. This frequency could be reduced in the future based on an assessment by an independent environmental consultant. The Groundwater assessment report will comprise:

- Description of groundwater monitoring network
- Background groundwater quality as established for the site

- Hydrogeology
- Receptors
- Quality control
- Assessment criteria

If a significant change in concentration for any of the groundwater analytical parameters is detected over two consecutive monitoring periods, then the affected groundwater monitoring bores will be resampled as soon as possible. Statistical comparisons of key indicator parameters may be required to identify statistically significant evidence of contamination between key indicator parameters.

If the anomaly is verified by resampling, the EPA will be notified by telephone and in writing within 14 days of the verification of the increase in the groundwater indicator contaminants (or as specified in the EPL).

Should the data indicate groundwater contamination above acceptable levels, a groundwater contingency plan will be developed. Should the data indicate improving trends or indicate a low likelihood of an impact of the site receptors over a period of 12 months, the monitoring frequency may be reduced in consultation with the NSW EPA or as part of an EPA licence review.

5.4.2.4 Groundwater Contingency Plans

The need to develop a groundwater contingency plan will flow from the groundwater assessment program. The assessment program will define the nature and general extent of the migration of leachate.

A groundwater contingency plan will utilise the information obtained in the assessment program. There will need to be a formal determination if sufficient information was obtained in that assessment. Should a groundwater specialist determine that there are data gaps, it will be necessary to fill these before developing the plan.

An appropriate response will be developed in consultation with the EPA following an assessment of the nature of the migration and the human health and environmental risks posed.

5.4.3 Surface Water Monitoring Program

5.4.3.1 Objectives

The objective of surface water monitoring is to effectively monitor and report surface water character, and ensure early detection and reporting of possible pollution of surface water.

5.4.3.2 Requirements

The landfill guidelines (EPA, 2016) require a program of surface water monitoring to detect pollution of off-site surface water bodies by leachate or by stormwater runoff from the landfill. Refer Section 4.3 of the guidelines.

5.4.3.3 Management Strategy, Task and Actions

- As all surface water runoff is captured within the pit, surface water monitoring is only required at the point where stormwater is discharged to the surrounding environment.
- The nearest surface water body is Alexandra Canal, approximately 160 m to the southwest of the site. As groundwater at the site boundary is monitored and stormwater discharged from the site is monitored at the discharge point, no monitoring at Alexandra Canal is proposed.

5.4.3.4 Monitoring Plan

The following monitoring program is proposed at the main Water Quality control basins WQ1 and WQ2, and if flowing, at the drain leaving the T2 waste mound towards Canal Rd. The monitoring program has been devised to identify indicator parameters of potential leachate contamination.

Table 11: Surface water monitoring program

Analytical parameter	Unit of Measure	Frequency of measure*	Sampling method
pH, dissolved oxygen, electrical conductivity, temperature	• -	• Quarterly	• Field analysis
Total suspended solids	• mg/L	• Quarterly	• Grab sample
Total dissolved solids	• mg/L	• Quarterly	• Grab sample
Potassium	• mg/L	• Quarterly	• Grab sample
Alkalinity (bicarbonate and carbonate)	• mg/L	• Quarterly	• Grab sample
Total organic carbon	• mg/L	• Quarterly	• Grab sample
Nitrogen (ammonia)	• mg/L	• Quarterly	• Grab sample
Nitrogen (nitrate and nitrite)	• mg/L	• Quarterly	• Grab sample

*additional event-based monitoring is required following heavy rainfall events with more than 100 mm of rain within 24 hours. This rainfall represents approximately an ARI of 1 year as assessed using BoM (2016) data.

5.4.3.5 Surface Water Contingency Plan

Surface water monitoring or visual observations may indicate the need to control surface water discharges to the environment. If monitoring results indicate that the limit concentrations have been breached, it will be necessary to establish the cause for that violation.

Determining the source will require the development of a plan. This plan may require sampling and testing from the point of the violation and moving upstream until a source can be located. Once the source has been identified, the site operator will be able to isolate the source and develop plans to control the discharge. The discharge may be contained by mechanical means or by restricting the flow off-site.

Once the action has been taken to contain the pollution, the site operator will prepare a report for EPA detailing the nature and source of contamination and the actions put in place to prevent recurrence.

5.4.4 Water Quality Performance Indicators

- Groundwater, surface water and leachate monitoring analytical results
- EPL criteria
- Groundwater levels and assessed gradient
- Performance indicators for contingency plans would be the amount of time following determination that successful control actions are established. The time will be a function of the severity of the incident and the nature of the controls. Successful control can be assessed from the results of ongoing monitoring.

5.5 Trade Waste Agreement

5.5.1 Objectives

The objective of the TWA is to ensure that the consent holder discharges leachate from the Site within the daily masses and volumes allowed by Sydney Water.

5.5.2 Requirements

TWA 29304 specifies substances and daily masses as well as maximum daily volumes that the site operator is allowed to discharge to sewer, in particular discharges from the leachate treatment plant at the Site. The TWA also specifies sampling and reporting requirements. Prior to the commencement of construction of the SPI and landfill closure works, transfer of this consent to the contractor, CDS is anticipated. Following construction, the consent will be transferred back to SMC.

The key requirements of the TWA are summarised in Table 11. Should the requirements of the TWA change in the future, this LEMP would need to be updated accordingly.

Table 12: Key requirements stipulated in TWA 29304, June 2015

Item	TWA Requirements
General	• The Customer may discharge trade wastewater into the Sewer in a manner whereby the substance characteristics of the trade wastewater are of a type and discharged at a rate, level or concentration equal to or less than that described in this schedule •
Analytes Limits	• Ammonia as N: Long Term Average Daily Mass (LTADM) 25 kg/day, Maximum Daily Mass (MDM) 90 kg/day, Standard 100 mg/L • Suspended Solids: LTADM 22 kg/day, MDM 180 kg/day, Standard 600 mg/L Total • Dissolved Solids: LTADM 950 kg/day, MDM 1200 kg/day, Standard 10,000 mg/L • Barium: LTADM 0.5 kg/day, MDM 2 kg/day, Standard 5 mg/L • Iron: LTADM 1.4 kg/day, MDM 9 kg/day, Standard 50 mg/L
Property Limits	• Temperature: Not to exceed 38 degrees Celsius • Colour: Determined on a system specific basis • pH: Within the range 7.0 to 10.0 • Fibrous material: None which could cause obstruction to Sydney Water's sewerage system • Gross solids (other than faecal): A maximum linear dimension of less than 20 mm, a maximum cross section dimension of 6 mm and a quiescent setting velocity of 3m/h • Flammability: Where flammable and/or explosive substances may be present, the customer must demonstrate to the satisfaction of Sydney Water that there is no possibility of explosions or fires occurring from the sewerage system. The flammability of the discharge must never exceed 5% of the Lower Explosive Limit (LEL) at 25 degrees Celsius.
Rate of discharge	• Instantaneous maximum rate of gravitated discharge 15 L/second • Maximum daily discharge 1000 kL • Average daily discharge 500 kL

5.5.3 Management Strategy, Task and Actions

The main management tasks and actions comprise sampling and reporting in accordance with the TWA. For detailed requirements, the current TWA should be referred to. The requirements of Sydney Water's published analytical methods shall be followed for all sampling and analysis.

Some of the key management tasks and action items relating to the TWA are summarised in the sections below.

5.5.4 Performance Indicators

- Number of events where a sample has not been collected
- Number of events where the specified concentrations or load limits have been exceeded
- Number of events where the reporting requirements of the TWA were not complied with
- The charges for trade wastewater discharge paid by site operator to Sydney Water

5.5.5 Inspection, Monitoring and Maintenance Schedule

The following inspection, monitoring and maintenance is currently occurring and may be changed subject to a new TWA being issued:

- Refer to the LCMP, Section 3.8 for additional details
- Sampling will occur at a point specified by Sydney Water
- Sampling will occur over a full production day by combining equal volumes taken at 5 kilolitre intervals
- Sampling will occur on 8 June 2015 and every eight days thereafter
- Discrete samples will be collected at the start and finish of each sample day and shall be analysed for pH and ammonia (as N)
- Composite samples will be analysed for:
  - Ammonia as N
  - Suspended solids
  - Total dissolved solids
  - Barium
  - Iron
- The flow meter shall be accessible to Sydney Water for inspection

5.5.6 Responsible Person

- Licensee

5.5.7 Reporting

- Results of analytical testing must be submitted to Sydney Water within 21 days of sampling
- The results of the trade waste sampling shall be summarised in the annual report
- Sydney Water must be notified in writing within seven days of:
  - any failure to obtain samples
  - any loss of analytical data
  - any failure in the discharge flow meter

5.5.8 Corrective Actions

- If sampling and reporting requirements are not met on a regular basis, reasons for this failure will be investigated and a more revised sampling procedure will be implemented. EPA may take action in accordance with its compliance policy (EPA 2013).
- If concentrations and load limits are not achieved on a regular basis, the performance of the leachate treatment plant will be investigated

6 Air Quality (Landfill Gas) Management

6.1 Goals

The environmental goals for landfill gas management are:

- Preventing uncontrolled landfill gas emissions
- Detecting landfill gas emissions
- Remediating landfill gas emissions

6.2 Preventing Air Pollution

The management techniques used to control landfill gas emissions are:

- Landfill gas containment system
- Passive landfill gas collection system
- Potential active landfill gas extraction and flaring system (refer to LCMP and Landfill Gas Modelling Report)

6.2.1 Landfill Gas Containment System

6.2.1.1 Objectives

The objective of the landfill gas containment system is to

- minimise emissions of untreated landfill gas through the surface of the landfill or subsurface strata.
- minimise greenhouse gas emissions
- minimise emissions of offensive odour
- minimise explosive, toxic and asphyxiative risk posed by landfill gas emissions
- minimise the explosive risk to humans from gas build-up in confined spaces.

6.2.1.2 Requirements

The landfill guidelines (NSW EPA, 2016), Section 5.1 recommend that landfill gas be contained installing low permeability engineered layers on the walls and within the cap of the landfill. As the walls of the landfill are unlined and will remain so, additional landfill gas controls in the form of passive under cap drainage and active gas extraction are proposed.

6.2.1.3 Management Strategy, Task and Actions

The containment of landfill gas is managed by installation of a capping system as outlined in the LCMP. Prior to installation of the capping system, the landfill gas is allowed to vent freely through the interim capping system. Extraction of landfill gas is described in Section 6.2.2.

More detail on historical and proposed approaches to landfill gas management is contained within the LCMP.

6.2.1.4 Performance Indicators

- Results of landfill gas monitoring
- Odour complaints (refer Section 4.2)

6.2.1.5 Inspection, Monitoring and Maintenance Schedule

Table 13: Landfill Gas Containment System Inspection, Monitoring and Maintenance Schedule

Action Item	Frequency	Timing
Odour observations	• Quarterly	• Quarterly

Action Item	Frequency	Timing
Landfill gas monitoring	Refer Section 6.3 • Refer LCMP	Refer Section 6.3 • Refer LCMP

6.2.1.6 Responsible Person

Licensee

6.2.1.7 Reporting

- Odour complaint reports
- Annual report (refer Section 8)

6.2.1.8 Corrective Actions

- Section 6.4 identifies the actions to be undertaken if the monitoring results indicate the presence of landfill gas beyond trigger levels.

6.2.2 Landfill Gas Extraction and Disposal System

6.2.2.1 Objectives

The objectives of extraction and disposal of landfill gas are to:

- minimise greenhouse gas emissions
- minimise emissions of offensive odour
- minimise the explosive risk to humans from gas build-up in confined spaces
- minimise explosive, toxic and asphyxiative risk posed by landfill gas emissions
- ensure that, wherever feasible, landfill gas is sustainably utilised for energy recovery
- minimise emissions of air pollutants from the combustion of landfill gas in flaring or electricity-generating equipment.

6.2.2.2 Requirements

The landfill guidelines (NSW EPA, 2016), Section 5.1 recommend that landfill gas be contained installing low permeability engineered layers on the walls and within the cap of the landfill. As the walls of the landfill are unlined and will remain so, additional landfill gas controls in the form of passive under cap drainage and active gas extraction are proposed.

6.2.2.3 Management Strategy, Task and Actions

The landfill gas management system for the Site is described in the LCMP. Detail on this proposed system is contained within the LCMP, with key elements being:

A passive collection system, comprising:

- Subsurface gas drainage system comprising collection pipes in gravel filled trenches
- System passively vented to the atmosphere via closable vents and, if required based on monitoring data, gas treated or redirected into the active gas extraction system
- System allows for leachate collection and is connected to leachate collection system

An active landfill gas extraction system (independent of the passive collection system) is described in the landfill gas design report (M5N-GOL-REP-900-301-WT-0022-B) comprising:

- Approximately 20 vertical gas extraction wells distributed across the landfill area
- Horizontal flow pipes leading to a central gas pumping and flaring compound

The active extraction system includes gas condensate collection and drainage components to deliver collected gas condensate to the leachate collection system discussed in Section 5.2.2 above.

6.2.2.4 Performance Indicators

- Results of landfill gas monitoring

6.2.2.5 Inspection, Monitoring and Maintenance Schedule

- Landfill gas monitoring (refer Section 6.3)
- Inspection of the condition of the surface of the landfill cover

6.2.2.6 Responsible Person

- Licensee

6.2.2.7 Reporting

- Annual report (refer Section 8)

6.2.2.8 Corrective Actions

- Section 6.4 identifies actions to be undertaken if monitoring results indicate the presence of landfill gas above trigger concentrations

6.3 Detecting Air Pollution

The following management techniques will be applied for detecting air pollution:

-
- Subsurface gas monitoring program;
- Surface gas emission monitoring; and
- Gas accumulation monitoring.

6.3.1 Objectives

The objective of subsurface gas monitoring is to be capable of detecting migration of landfill gas off-site using perimeter landfill gas monitoring wells as shown in Figure M5N-GOL-DWG-900-300-EV-0004.

The objective of surface gas emission monitoring is to demonstrate that the landfill capping layer and the gas extraction system are effective in controlling the emission of landfill gas.

Monitoring the accessible portions of the surface of the landfill should locate any point sources or fissures that may be emitting landfill gas. Road surface will not be monitored for surface landfill gas emissions.

The objective of gas accumulation monitoring is to monitor gas build up in buildings adjacent to the site as shown in Figure M5N-GOL-DWG-900-300-EV-0004. Methane is both an asphyxiant and explosive and can accumulate in buildings, particularly if they were constructed over landfilled materials. In addition, monitoring for methane and carbon dioxide in buildings is also intended to protect human health. Carbon dioxide is toxic and an asphyxiant. Tunnels located adjacent to the landfill will also be monitored for landfill gas accumulation.

6.3.2 Requirements

The NSW EPA (2015) guidelines provide guidance on landfill gas monitoring in Section 5.2, 5.3 and 5.4. The design of a landfill gas monitoring system is to rely on a risk assessment based on the subsurface conditions encountered. NSW EPA (2015) refers to Table 8.1 of UK EPA (2004) for guidance of landfill gas monitoring

well spacing based on ground conditions and proximity to receptors. The NSW EPA HGG guidelines (EPA 2012) will be referenced in addition to NSW EPA (2015) for risk assessments.

6.3.3 Management Strategy, Task and Actions

Summary

The landfill gas surface and subsurface monitoring plan is summarised in Table 14.

Table 14: Landfill Gas Inspection, Monitoring and Maintenance Schedule

Action Item	Frequency
Source monitoring of landfill gas collection wells	• Six monthly, conducted as part of well field balancing
Subsurface migration monitoring of perimeter monitoring wells	• Quarterly
Surface gas monitoring on a 25 m grid in accordance with Section 5.2 of NSW EPA (2015)	• Quarterly
Walkover inspection for cracks, settlement or erosion of landfill surface (may be carried out concurrently with the surface gas monitoring outlined above)	• Quarterly
Gas accumulation monitoring of enclosed structures identified on figure M5N-GOL-DWG-900-300-EV-0004 and any enclosed structures to be built on the landfill surface.	• Quarterly
Gas extraction system (if implemented) – manifolds. NOTE: this should include landfill gas temperature to identify landfill fires.	• As per operators plan
Gas vents (passive system)	• Quarterly
Flares (if implemented)	• As per operators plan
Field balancing – monitoring and/or collection wells, manifolds and flare	• As per operators plan
Survey of cap surface	• Annual
Meteorological – Sydney Airport weather station	• Daily

The locations of the perimeter landfill gas monitoring points are presented in the attached Drawing M5N-GOL-DWG-900-300-EV-0004-A in Annexure A. Locations include 41 wells along the landfill boundary at an approximate spacing of 50 m to be installed during or following capping works. Well spacing is less than 50 m in areas with buildings present close to the landfill boundary. It is noted that buildings adjacent to the site boundary along Campbell Road and Canal Rd currently shown in the aerial photograph in Drawing M5N-GOL-DWG-900-300-EV-0004-A in Annexure A are planned to be demolished as part of local roads upgrade works.

Sub-surface gas monitoring

All monitoring bores will be installed to the top of groundwater levels as required by the NSW EPA (2015) and will be constructed in accordance with the requirements of the Victorian EPA guidelines (VIC EPA 2010), which are outlined in Table 15.

Table 15: Typical Construction Details for Landfill Gas Bore Construction

Component	Value
Drilled bore diameter (mm)	• 100 – 150

Component	Value
Pipework casing diameter outer diameter (mm)	• 50
Pipework casing size of perforations (mm)	• 3-5
Depth of top bentonite seal (m)	• 1
Length of solid casing below ground level (m)*	• 1
Perforated casing pipe work (% open space)	• 10-0
Size range of gravel backfill (mm)	• >5 mm
Gravel type	• Gravel to be rounded to subrounded, and noncalcareous (< 5%)

Sampling of each monitoring well will comprise sampling using a calibrated and appropriately maintained landfill gas monitor and the compounds tested will include methane (% v/v), carbon dioxide (% v/v), oxygen (% v/v), hydrogen sulfide (ppm) and carbon monoxide (ppm). The device used for monitoring should have a minimum accuracy for methane detection of +/- 0.5% (v/v). Shut in pressure, gas flow rate and dynamic pressure would be measured and recorded. Meteorological conditions at the nearest BoM weather station (Sydney Airport, 066037) will be recorded for the 24 hours preceding and following the monitoring event. This monitoring should be performed during periods of relatively low and stable atmospheric pressure (e.g. less than 101.3 kPa).

The threshold level for further investigation and corrective action is detection of methane at concentrations above 1.25% (v/v).

Landfill gas monitoring will be carried out on a quarterly basis as recommended by the NSW EPA (2015) Landfill Guidelines. If methane is not detected in the subsurface monitoring wells for at least 12 months, the monitoring frequency may be reduced to a bi-annual or annual frequency.

The landfill gas monitoring device should be capable of detecting methane gas in sufficiently low concentrations to ensure confidence in the results. The device should be properly zeroed and calibrated according to the manufacturer's instructions before any measurements are made. The well should be sampled before air can ingress and dilute the gas. Therefore, wells will be equipped with suitable quick-connect nipple or manual valve and nipple to allow meter connection.

6.3.4 Performance Indicators

Surface gas monitoring

The methodology for surface monitoring of landfill gas will follow the requirements of NSW EPA (2015), in particular:

- Methane would be tested in the atmosphere 5 cm above the landfill surface;
- The threshold for reporting of methane concentrations to the EPA is 500 parts per million
- Testing should be conducted in a grid pattern across the landfill surface at 25 m spacing in areas not covered with roads;
- Depressions in the cover material, or surface fissures away from the sampling grid, should also be investigated;
- The monitoring should be performed on calm days (winds below 10 km/h) when no rainfall has occurred in the previous 48 hours, and during periods of relatively low and stable atmospheric pressure (e.g. less than 101.3 kPa); and
- A flame ionisation detector or a device with a similar sensitivity to flammable gases (20 parts per

million) should be used.

Landfill gas accumulation monitoring in enclosed structures

Gas accumulation monitoring will be carried out in accordance with NSW EPA (2015), Section 5.4. in particular, it will comprise:

- Accumulation monitoring in buildings highlighted in Figure M5N-GOL-DWG-900-300-EV-0004-A
- Accumulation monitoring would involve sampling in the atmosphere 5 cm above the surface on a 25 m grid within the buildings; surface fissures or cracks away from the sampling grid should also be investigated
- Sampling in each building using a calibrated and appropriately maintained landfill gas monitor analysing methane (% v/v), carbon dioxide (% v/v), oxygen (% v/v), hydrogen sulfide (ppm) and carbon monoxide (ppm).
- The device used for monitoring should have a minimum accuracy for methane detection of +/- 0.5% (v/v).
- The threshold level for further investigation and corrective action is detection of methane at concentrations above 1.25% (v/v) and notification to the EPA shall occur as soon as the licensee becomes aware of the detection.
- The landfill gas monitoring device should be capable of detecting methane gas in sufficiently low concentrations to ensure confidence in the results. The device should be properly zeroed and calibrated according to the manufacturer's instructions before any measurements are made.
- Accumulation monitoring in adjacent road tunnels to focus on any zones or internal drainage structures within the tunnel that are unventilated. Details will be determined based on consideration of tunnel design features and to complement tunnel air monitoring.

6.4 Corrective Actions and Remediation of Uncontrolled Landfill Gas

6.4.1 Objectives

The purpose of remediating uncontrolled landfill gas emissions is to prevent further emissions from occurring.

6.4.2 Management Strategy

- Notification of the EPA is required as soon as the licensee becomes aware of values above the thresholds identified in this plan having been measured.
- Management controls to remediate uncontrolled landfill gas emissions are developed on an individual basis dependent on the nature and degree of emissions detected.

Surface Gas Emissions

Corrective actions in the event of excessive landfill gas emissions from the landfill surface may include:

- Management controls to remediate uncontrolled landfill gas emissions are developed on an individual basis dependent on the nature and degree of emissions detected and a multi-level risk assessment. The risk assessment will be carried out in accordance with NSW EPA (2012) HGG and will include measurement of flow in monitoring wells.
- Supplementing or repairing existing cover or changing the material used as cover, such as use of materials with greater cohesive properties
- Installation of additional gas extraction wells within the waste mass
- Adjusting or installing gas venting/extraction equipment

If these measures are not successful in controlling gaseous emissions, an assessment will be made as to the need to adopt other engineering solutions.

Subsurface Landfill Gas

Should the monitoring program demonstrate lateral migration of landfill gas through soil or rock, the extent of the lateral migration will be established by increased monitoring and installation of additional monitoring wells, if required. Contingency measures will be developed on a risk basis using NSW EPA (2012) HGG and may include:

- If the methane concentration exceeds 1.25% (v/v) within monitoring wells, an increase in testing frequency to monthly, weekly or daily will be required depending on the outcome of a multi-level risk assessment. The risk assessment will be carried out in accordance with NSW EPA (2012) HGG and will comprise measurement of flow in monitoring wells.
- Increased monitoring
- Further extraction bores
- Subsurface extraction drains as described in the LCMP
- Subsurface interception or cut-off walls

Building Accumulation

- If the methane concentration exceeds 1.25% (v/v) within buildings, daily testing will be undertaken until ventilation or other measures control the methane build up. The EPA will be notified as soon as the licensee is aware of the detection and a plan outlining further investigation or remediation will be submitted to the EPA.
- A multi-level risk assessment will be carried out. The risk assessment will be carried out in accordance with NSW EPA (2012) HGG and will comprise measurement of flow in monitoring wells.

6.4.3 Performance Indicators

- The results of monitoring are the key indicators for determining the effectiveness of the remediation

6.4.4 Responsible Person

- Licensee

6.4.5 Reporting

- Specific contingency plans and reporting activities are not necessary until uncontrolled release of pollutants have been identified. Review and reporting will be necessary to demonstrate that the situation is under control.
- The EPA will be notified as soon as the licensee becomes aware of landfill gas detection above the limits identified in this plan.

7 Amenity Issues: Odour, Dust, Noise and Fire Control

7.1 Objectives

Based on NSW EPA (2015), the landfill must not adversely affect amenity in the locality. In particular, the site should not:

- Emit offensive odours beyond the site boundary;
- Emit excessive nuisance dust and other particulate matter beyond the landfill boundaries;
- Emit excessive noise; and
- Be managed in such a way that is likely to cause landfill fires or be unprepared for the event of a fire.

7.2 Requirements

Requirements for management of amenity issues are outlined in NSW EPA (2015), Section 6. As this LEMP covers the period following post closure, potential amenity issues are significantly reduced when compared to an operational landfill.

7.3 Management Strategy, Task and Actions

Odour

As the landfill will be capped, potential odour emissions pathways are via passive venting of landfill gas, leachate seepage points, the leachate treatment plant and the potential active landfill gas extraction and flaring system.

The odour management strategy is as follows:

- Odour complaints will be recorded. Should excessive odour complaints in relation of passive landfill gas vents be recorded, the landfill gas management system will be reviewed
- Passive gas vents:
  - Designed to be located at a distance from footpaths and above head height;
  - To be monitored for landfill gas on a quarterly basis along with subsurface gas measurements;
- Leachate seepage points are controlled by the capping system and a seepage control system. Should leachate seepage be identified on the cap surface, the source of seepage investigated and a remediation plan be developed;
- Leachate risers, sumps and pipework will be equipped with air tight fittings;
- Pipes conveying landfill gas will be buried beneath the surface and equipped with air tight fittings; and
- A design and monitoring program in accordance with Section 5.5 NSW EPA (2015) will be developed for the landfill gas flare (if required) and documented in operational manuals to be developed.

Dust

Dust emissions should be negligible once the landfill is capped and revegetated, with the vegetation being the main mechanism to prevent dust emissions. The landfill surface and vegetation should be maintained to prevent dust emissions and maintenance should be covered in a landscape and vegetation maintenance plan.

Noise

Being a closed landfill, no noise emissions are expected from the landfill closure operation itself. The hours of operation for maintenance of the site that has the potential to disrupt the amenity of nearby residents can only be carried out between 0700 to 1800 Mon to Fri and 0730 to 1600 Sat.

Litter

Litter management is not applicable to a closed landfill.

Fire control

Landfill fire risks depend on whether a fire is surficial or deep-seated, as described below.

- Surficial fires comprise combustion of exposed solid waste materials and air (oxygen) and are generally triggered by an ignition source coming into contact with uncovered waste. Surficial fires can also be initiated by excavation and exposure to air of waste that has developed an elevated temperature due to internal decomposition. The risk of starting a surficial fire may be significant during waste excavation and capping works but is highly unlikely once the landfill is covered.
- Deep-seated fires comprise combustion of below-ground solid waste materials. These fires are generally initiated by oxygen entering the waste mass and coming into contact with waste that has developed an elevated temperature due to internal decomposition. The risk of a deep-seated fire occurring is generally related to the ingress of atmospheric oxygen into the waste through surface pathways such as gaps/defects in the capping system and poorly sealed landfill gas extraction wells or other surface structures. The risk of oxygen ingress has been mitigated in design by developing appropriate design details for the capping system and landfill gas extraction wells. Long-term mitigation will be provided through inspection and maintenance of the capping system and potential landfill gas extraction wells and appropriate operation procedures for landfill gas extraction. In particular, balancing landfill gas extraction rates with gas generation rates will reduce potential to draw air into the waste mass.

The overall likelihood of a landfill fire occurring at this site is considered low due to the lack of readily decomposable (putrescible) waste in the landfill

In the case that a deep-seated landfill fire occurs, impacts to open space and surrounding land would be mainly related to odour, smoke generation, and temporary reduction in landfill gas extraction. Potential impacts onto the road infrastructure would be mainly related to potential settlement of non-piled structures. The likelihood of early detection of a deep-seated fire will be increased through ongoing monitoring of landfill gas extraction wells for elevated gas temperatures and for the presence of oxygen or combustion products such as carbon monoxide. If signs of a fire, such as elevated landfill gas temperatures, carbon monoxide concentrations above 100 ppm and/or excessive localised settlement are detected, the following management measures could be employed:

- Landfill gas extraction system (if installed) temporary shut down (to reduce potential oxygen ingress);
- Thermal imaging to identify location of fire;
- Locate and seal surface ingress of oxygen; and
- Deep injection of nitrogen or water to control the fire.

7.4 Performance Indicators

- Number of complaints received
- Theft or vandalism reports

7.5 Inspection, Monitoring and Maintenance Schedule

- Weekly inspection of fences and gates, in particular around landfill gas and leachate treatment infrastructure
- Daily security patrols of the Site

7.6 Responsible Person

- Site operator / Licensee

7.7 Reporting

- Annual report (refer Section 8)

7.8 Corrective Actions

- Passively vented gas may be diverted to a biofilter, activated carbon system or alternative system to reduce odour emissions

8 Reporting

8.1 General Reporting Requirements

Reporting is required by the NSW EPA to produce systematic, comprehensive and informative reports on the environmental monitoring and operational activities of the landfill. Performance assessments are based on the reports and provide the basis of information to the EPA for review of the LEMP.

Reporting requirements will be outlined in the post closure and Completion EPL for the Site and will likely comprise:

- Annual reporting summarising all environmental monitoring and management data and a discussion of the results with respect of the requirements outlined in this LEMP, the landfill guidelines (NSW EPA 2016) and future EPLs and submit this report to the EPA.
  - complete and supply to the EPA an Annual Return in the approved form comprising:
  - a Statement of Compliance; and
  - a Monitoring and Complaints Summary
- notify the EPA of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident
  - Notifications must be made by telephoning the Environment Line service on 131 555 within 24 hours of the incident
  - The site operator must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred

EPA will be notified of any incident that represents a threat to the environment and which may lead to a breach of licence conditions as outlined in this LEMP.

Reporting requirements also exist under the TWA, which makes the following requirements:

- Results of analytical testing must be submitted to Sydney Water within 21 days of sampling
- The results of the trade waste sampling shall be summarised in the annual report
- Sydney Water must be notified in writing within seven days of:
  - any failure to obtain samples
  - any loss of analytical data
  - any failure in the discharge flow meter

Written Reporting

A written notice of any incidents as defined above should be made to the NSW EPA within seven days of the incident occurring.

Trade Waste Agreement

A trade waste agreement (TWA) for the leachate treatment plant of the Site has been issued by Sydney Water on 2 June 2015. The TWA (Consent No.29304) specifies load limits and concentrations for ammonia,

suspended solids (SS), Total dissolved solids (TDS), Barium and Iron for the discharge of treated leachate as well as sampling and reporting requirements.

Reporting requirements under the TWA are as follows:

- Results of analytical testing must be submitted to Sydney Water within 21 days of sampling
- The results of the trade waste sampling shall be summarised in the annual report
- Sydney Water must be notified in writing within seven days of:
- any failure to obtain samples
- any loss of analytical data
- any failure in the discharge flow meter
- In addition, the site operator will make the results of the trade waste monitoring available to the EPA in the annual report.

Responsible Party

- Site Operator / licensee

8.2 Annual Reporting and Annual Returns

The Annual Return comprises a form provided by EPA, which should be filled in by the site operator and returned to EPA. This will be provided each year in support of the annual licence renewal application (with all information up to date to within 60 days of the licence renewal date). The Annual Return will be accompanied by an Annual Report, which will include the following sections:

- **Hydrogeological Report** - this will assess the changes detected in the groundwater monitoring results over the period of operation, updated for the last 12 months. Any changes in hydraulic gradient or statistically significant variations in contaminant concentrations should be highlighted and explained
- **Leachate Collection Report** - this will identify the quantity and composition of any leachate generated over the past 12 months. Any trends should be highlighted and explained in terms of the biological activity within the landfill. The trends should generally be related to monthly rainfall and sampling results
- **Surface Water Report** - this will summarise the surface water monitoring results over the period of operation for the past 12 months. Any changes in water levels and statistically significant variations in contaminants should be highlighted and explained
- **Landfill Gas Emissions Report** - this will summarise the gas monitoring results over the period of operation for the past 12 months. Any trends should be highlighted and explained
- **Incident Report** - this will summarise any incident reported for the 12 month period
- **Complaints Report** - this will record odour, litter, noise or other complaints received by the facility in the past 12 months, including comments on their correlation with prevailing weather conditions or waste reception circumstances
- **Proposed Site Operations for the Following year** – describing the environment protection, construction works and any other works planned for the following year

9 References

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Municipality of Marrickville, Determination of a Development Application No. 10797, 20 March 1987 (MoM 1987);

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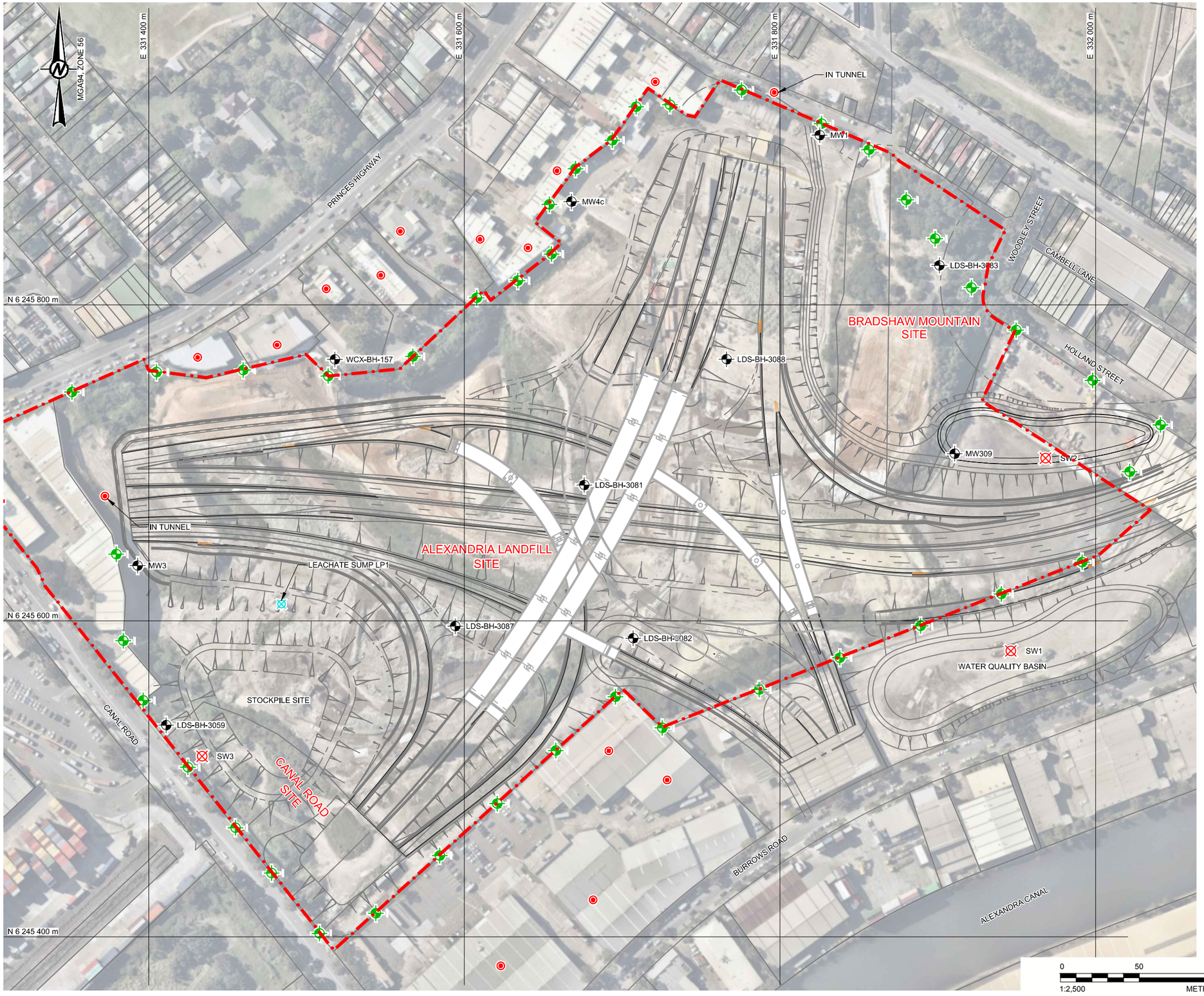
WAMC 2015. Discussion Paper for Project Manager - Alexandria Leachate, Stormwater & Groundwater Collection, Treatment and Disposal Options & Recommendations to comply with EPL/TWA conditions for the next two years (Draft), 8 May 2015

Annexure A – Figures



LEGEND

ALF LICENCE BOUNDARY (4627).

MONITORING POINT LEGEND

- PROPOSED LANDFILL GAS MONITORING POINTS
- BUILDING GAS ACCUMULATION MONITORING
- LEMP GROUND WATER MONITORING WELL
- SUFACE WATER MONITORING POINT

REFERENCE(S)

ROAD LAYOUT TO 85% DESIGN SURFACE SOURCED FROM AJJV 08 APRIL 2016
X-M5N-AJV-XRF-900-300-RD-ROAD_DESIGN_SURFACE.DWG

BRIDGE AND PIERS TO 15% DESIGN SOURCED FROM AJJV 08 APRIL 2016
X-M5N-AJV-XRF-900-400-BR-SPI_BR1_M9X0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR2_M920.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR3_M9W0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR4_M9Z0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR5_M9S0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR6_M9T0.DWG
X-M5N-AJV-XRF-900-400-BR-SPI_BR7_M930.DWG

SITE BOUNDARY SOURCED FROM AJJV RECEIVED 08 APRIL 2016
X-M5N-AJV-XRF-100-115-SU-CADASTRAL_REGIONAL.DWG

IMAGE DATED 16 OCTOBER 2015
SOURCED WITH PERMISSION FROM NEARMAP ON 17 NOVEMBER 2015
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY
www.nearmap.com.au

0 50 100
1:2,500 METRES

NOT FOR CONSTRUCTION

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED
0 5 10 15 20 25 30 35 40 45 50mm ON A3 SIZE ORIGINAL

DRAWING FILE LOCATION \ NAME
B:\Leighton\WestConnex_Stage2\99_PROJECTS\1524285 - WCX2 Landfill Rehab\DESIGN\02_PRODUCTION\DWG\M5N-GOL-DWG-900-300-EV-0004.dwg

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING

REV	DATE	AMENDMENT / REVISION DESCRIPTION	APPROVAL
A	27.01.2016	PRELIMINARY ISSUE	GRS
B	24.03.2016	PRELIMINARY RE-ISSUE	GRS
C	08.04.2016	MONITORING WELLS ADDED	GRS
D	08.06.2016	BOUNDARY REVISED	GRS

PROJECT BREAKDOWN STRUCTURE

SCALES ON A3 SIZE DRAWING

CO-ORDINATE SYSTEM: MGA ZONE 56
HEIGHT DATUM: AHD

WestConnex New M5
CPB CONTRACTORS | DRAGADOS | SAMSUNG C&T | Golder Associates | HASSELL
AURECON JACOBS NEW M5 JOINT VENTURE

PLOT DATE / TIME: 8/06/2016 12:07:22 PM
PLOT BY: DTremelling

TITLE	NAME	DATE
DRAWN	DAT	24.03.16
DRG CHECK	RH	24.03.16
DESIGN	RH	24.03.16
DESIGN CHECK	GRS	24.03.16
DESIGN MNGR	DD	24.03.16
PROJECT MNGR	NB	24.03.16

CLIENT: Sydney Motorway Corporation | WestConnex

DOCUMENT NUMBER
M5N-GOL-DWG-900-300-EV-0004

WESTCONNEX NEW M5 — A3
LANDFILL
ENVIRONMENTAL MONITORING LOCATIONS
SHEET OF

RMS REGISTRATION No.

ISSUE STATUS	EDMS No.	SHEET No.	REV
PRELIMINARY		EV-0004	D

Annexure B – Project Verifier Comments and Responses

Not used

Annexure C – SMC/RMS Comments and Responses

Not used

Annexure D – Safety-in-Design Register

Not used

Annexure E – Road Safety Audit

Not used

Annexure J – EPA Letter

Our reference: DOC16/248636-03

ROADS AND MARITIME SERVICES
Trading as RMS
Locked Bag 928
NORTH SYDNEY NSW 2059
[redacted]

BY EMAIL & STANDARD POST
26 May 2016

Dear [redacted]

Landfill Closure Management Plan - Environment Protection Licence No. 4627

I refer to CPB Dragados Samsung Joint Venture letter to the Environment Protection Authority ("EPA") dated 29 April 2016 relating to Condition B32(k) of the *Ministers Conditions of Approval for Development for the purposes of the WestConnex New M5 project* and Environment Protection Licence no. 4627 ("the Licence") for the premises located at 10-16 Albert Street, St Peters NSW 2044 ("the Premises").

EPA Endorsement of the LCMP

The EPA has reviewed document titled "Technical Report: St Peters Interchange – Landfill Closure Management Plan LCMP, Golders Associates, 11 April 2016, Document M5N-MNP-900-300-WT-9400-DE and Annexures" and has no outstanding concerns.

If you have any questions in relation to the above please contact Philip Nevill on (02) 9995 6523.

Yours sincerely

[redacted]

[redacted]
Unit Head Waste Compliance
Environment Protection Authority

PO Box A290 Sydney South NSW 1232
59-61 Goulburn St Sydney NSW 2000
Tel: (02) 9995 5000 Fax: (02) 9995 5999
TTY (02) 9211 4723
ABN 43 692 285 758
www.environment.nsw.gov.au

Annexure H – LTP Upgrade

WESTCONNEX DELIVERY AUTHORITY
ST PETERS INTERCHANGE
Alexandria Landfill Site

LEACHATE TREATMENT PLANT UPGRADE
FUNCTIONAL DESCRIPTION
(J1430: Rev 2 – 16/10/15)

Prepared for

WestConnex Delivery Authority
101 Miller Street
North Sydney NSW 2060

September 2015

JPG ENGINEERING
Industrial Water Treatment
Purpose Built Process Plant & Equipment
ABN 65 067 761 871
ACN 067 761 871

JPG Engineering

[redacted]

DOCUMENT CONTROL

Document: WESTCONNEX DELIVERY AUTHORITY
ST PETERS INTERCHANGE
Alexandria Landfill Site

LEACHATE TREATMENT PLANT UPGRADE
FUNCTIONAL DESCRIPTION

Reference: J1430

Date: September 2015

Prepared by: [redacted]
JPG Engineering – Principal Process Engineer

Reviewed by: [redacted]
WAMC – Manager, Gas and Leachate

Revision History

Revision	Revision Date	Description/Details	Authorised		Approved	
			Name/Position	Signature	Name/Position	Signature
0	15/09/15	Original Draft	[redacted]		[redacted]	
1	23/09/15	Section 7.0 revised. EDG check	[redacted]		[redacted]	
2	16/10/15	WAMC (EDG) and WestConnex (DB) Review	[redacted]		[redacted]	

CONTENTS

1.0 INTRODUCTION

1.0 INTRODUCTION

The WestConnex Delivery Authority, as part of the works associated with the construction of the St Peters Interchange, propose to upgrade the existing Alexandria Landfill Leachate Treatment System to achieve compliance with current Sydney Water sewer discharge criteria.

The upgraded system will treat leachate generated and collected from the closed Alexandria Landfill prior to offsite disposal via controlled discharge to sewer.

Compliance with the current Sydney Water Sewer Discharge Trade Waste Licence Agreement for the site requires that the leachate discharged to sewer have an ammonia concentration of less than 100 mg/l.

The current untreated leachate generated on the site has dry weather ammonia levels that range between 200 mg/l and 400 mg/l. During periods of high rainfall leachate generation is high and the ammonia concentration is low. During periods of low rainfall leachate generation is lower and the respective ammonia concentrations are generally higher.

The proposed upgrade to the Leachate Treatment Systems will reduce ammonia concentration in the leachate via biological nitrification using the sequencing batch reactor (SBR) process.

The completed Leachate Treatment Plant upgrade will produce a compliant effluent suitable for sewer discharge, allowing collected leachate to be disposed offsite during the interim 2 to 3 year Interchange construction period prior to the design and construction of the final Leachate Treatment Facility – (by others).

This document describes the operation, functionality, control systems and design basis of the upgraded Leachate Ammonia Treatment System located at WestConnex Alexandria Landfill site.

2.0 HISTORICAL LEACHATE AND STORMWATER SYSTEMS

2.0 HISTORICAL LEACHATE AND STORMWATER SYSTEMS

2.1 Leachate Systems

2.1.1 Background

The original Leachate Treatment Plant consisted of two (2) circular sequencing batch reactors (SBRs). Refer to the Process Flow Diagram – Original attached.

The original SBR1 was an 80 kL circular panel tank approximately 7 metres in diameter and 2 metres high. The tank was fitted with 7 off small aspirating aerators presumably to provide both mixing and oxygen to the reactor.

As of late 2014 (time of site handover) this reactor was not in service and appeared to require a new liner and aerator repairs before being in a condition suitable for recommissioning.

The newer SBR2 is a 2.2 metre high, 8 metre diameter concrete tank fitted with 4 off aspirating aerators. These aerators are a larger version of the aerators used in SBR 1.

SBR 2 had an operating level of approximately 1.9m giving an operating volume of approximately 96 m3.

It is assumed that these aerated tanks were intended to operate as activated sludge reactors (SBRs) to reduce the ammonia levels in the leachate via biological nitrification.

The operating SBR2 had been set up to operate with 2 x 12 hour cycles per day. Each cycle had a maximum 2 hour decant period discharging directly to sewer at just over 6.0 L/s. Operating in this manner the plant had a maximum daily treatment capacity of 90 m^3/day.

At a treatment rate of 90 m3/day and operating with a 12 hour cycle time (as was the case) the decant fraction per cycle will be 50% which made the retention of the necessary concentration of nitrifying biomass in the reactor very difficult. The reactor would not be operated in this manner unless absolutely necessary. As such, it is assumed that plant throughput had been set to match site leachate generation, ie: 90 m^3/hr.

Analysis of the leachate influent and treated leachate effluent during the four (4) month period from December 2014 through to March 2015 period showed that the system was unable to achieve the required ammonia discharge limits. Treated Leachate samples tested for nitrate and nitrite returned trace levels only, indicating that no nitrification (ammonia oxidation) was occurring at all.

SBR2 was emptied during the second week of May 2015 to allow for aerator maintenance. There was little noticeable biomass present in the reactor which was understandable given that the decant offtake level within the SBR was positioned at a level well below half the SBR top operating water level.

The hydraulic retention time (at 24 hrs) for the current system is low and the decant fraction (at 50%) is high compared with existing reliably operating leachate treatment systems, so it is no surprise that the existing plant was unable to cope with the required hydraulic and ammonia treatment load.

Contrary to the above observations and conclusions, Sydney Water's Trade Waste records showed that the Leachate Treatment Plant (LTP) was compliant with the Trade Waste Agreement discharge standards (Refer AECOM Memorandum 60327128 dated 12/12/14). The Facility's historical operating compliance was also confirmed verbally by Sydney Water's Trade Waste Officer for the site at the time of handover.

Sewer discharge volumes recorded for the period 2004 to 2012 list the average volume of leachate discharged to sewer as 32.9 kl/day.

The historical trade waste discharge volumes or recorded discharge water quality were not consistent with the leachate generation volumes or discharge water quality being observed at the time of handover.

2.1.2 Current Situation

In the 90 day period from the 23 December 14 to 23 March 2015 (i.e. post site handover) the Treatment Plant was operating automatically, and an average of 89.6m3 was treated and discharged to sewer per day. During this same period the Main Leachate Riser level remained stable. During this 90 day period 110.4mm (or 447mm annualised) of rain was recorded at the site (Sydney Airport AMO). The average rainfall for the site is around 1086mm per year, so this 90 day period was dry, with only 45% of the historical average rainfall being recorded during this time.

Considering the above, it has been assumed that the leachate treated during this period would reflect leachate generation for the site and that this generation rate could be considered to reasonably reflect the base dry weather leachate generation.

The documented historical trade waste discharge volumes for the site account for less than 50% of the observed leachate generation data for this period.

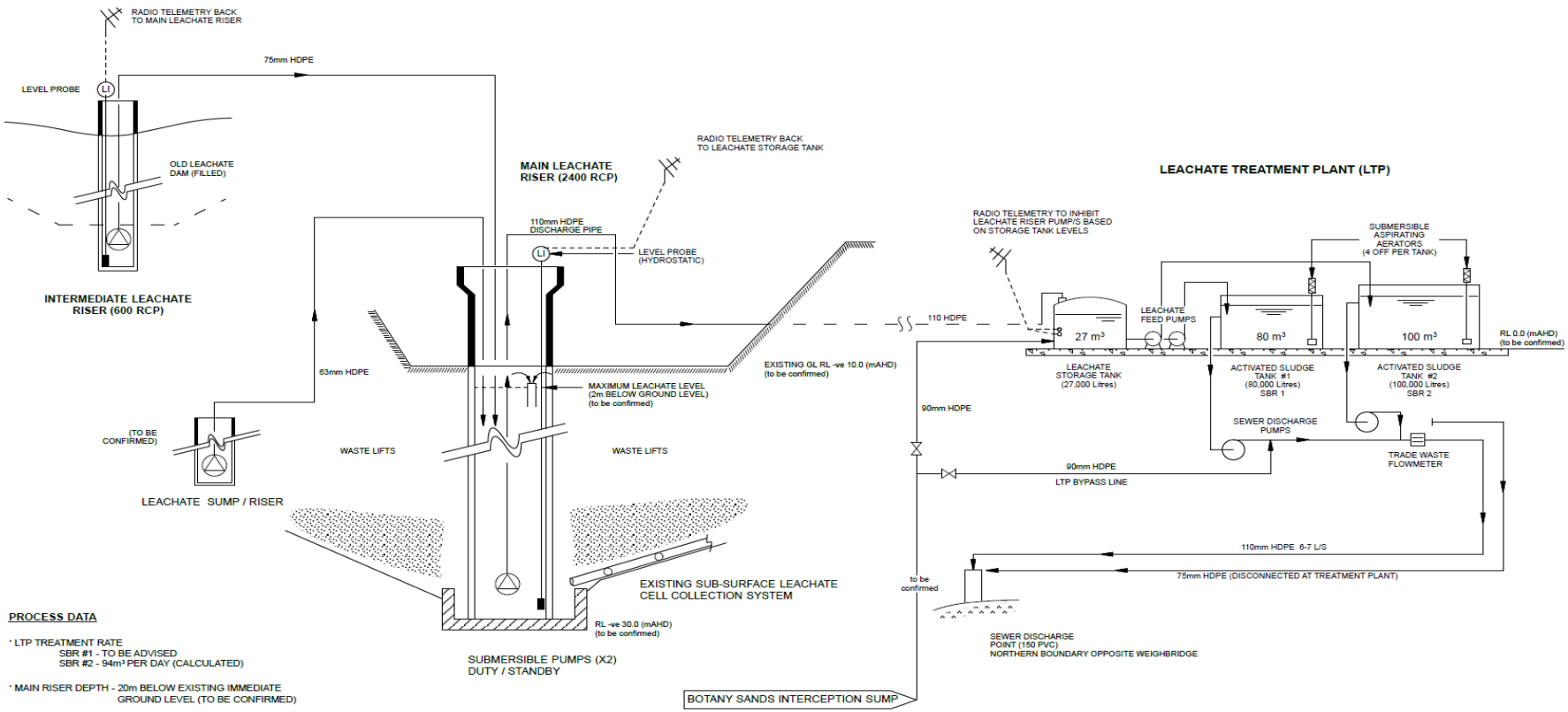
JPG Engineering carried out a first principles design review of the LTP taking into account the above observations and investigations. The review concluded thatit is unlikely that the original leachate treatment plant configuration was capable of treating the leachate volumes currently being generated at the Alexandria Landfill to an effluent quality suitable for compliant discharge to Sydney Water sewer.

Due to the lack of operating history, it is difficult to determine how the original system was being operated to achieve the documented compliant ammonia discharge levels or why the recorded discharge volumes are so much lower than the currently observed dry weather generation volumes for the site.

ST PETERS INTERCHANGE
WESTCONNEX DELIVERY AUTHORITY

DRAFT PROCESS FLOW DIAGRAM

ALEXANDRIA LANDFILL LEACHATE COLLECTION & TREATMENT SYSTEMS



PROCESS DATA

- LTP TREATMENT RATE
  SBR #1 - TO BE ADVISED
  SBR #2 - 94m³ PER DAY (CALCULATED)
- MAIN RISER DEPTH - 20m BELOW EXISTING IMMEDIATE GROUND LEVEL (TO BE CONFIRMED)

NOTE: THIS DRAWING IS FOR PRELIMINARY INFORMATION ONLY. FINAL DETAILS ARE TO CONFIRMED. **NOT** TO BE USED FOR CONSTRUCTION PURPOSES.

PROCESS CONSULTANT / PRINCIPLE CONTRACTOR: JPG ENGINEERING [redacted]	CONSULTANT	MANAGING CONTRACTOR: NSW GOVERNMENT Waste Assets Management Corporation	DESIGNED BY: JG	JOB NO.: J1430	CLIENT/PROJECT: **WestConnex Delivery Authority** St Peters Interchange Alexandria Landfill Leachate Systems
			DRAWN BY: JG/EL	DATE: 10/04/15	TITLE: ORIGINAL LEACHATE TREATMENT PLANT PROCESS FLOW DIAGRAM
			SCALE: NTS	SHEET SIZE: A3	This drawing is the property of JPG Engineering and must not be copied, reproduced or used in whole or part without written permission of JPG Engineering
			DRAWING No.: AL - LS01	SHT No.: 1 of 1	ISSUE.: 01a

REV	DATE	REVISION	BY	CHK'D	APPR'D
01a	10/04/15	MAIN RISER PUMP REMOVED	EL	JPG	EDG
01	10/02/15	TELEMETRY DETAIL ADDED	EL	JPG	EDG
00	09/02/15	ORIGINAL DRAFT	EL	JPG	EDG

2.2 Stormwater and Groundwater

Based on the historical sewer discharge volume data it appears that stormwater or groundwater has not been discharged to sewer, instead being transferred to stormwater or used for dust suppression.

We have been advised that stormwater collected during significant rain events was quickly pumped from the bottom stormwater collection area off site to the Canal Road Stormwater system using the existing submersible pump plus additional large diesel pump/s when required.

The stormwater collected at the base of the site during the recent April 2015, 3 day, 242mm rain event contained ammonia levels well in excess of stormwater discharge levels and as such was treated as low strength leachate and discharged direct to sewer, (i.e. as ammonia levels were below the sewer discharge limit of 100 mg/l).

Stormwater previously pumped at high rates to the Canal Road Stormwater system may have contained non-compliant levels of ammonia (ie greater than 0.95 mg/l) and possibly other substances.

During the April 2015 rain event the leachate ammonia levels, via dilution, dropped below the 100mg/l sewer discharge limit such that both the leachate and leachate affected stormwater could be pumped direct to sewer.

It is envisaged that future stormwater collected at the lower levels of the landfill site during the construction phase may be leachate affected and off-site disposal via the stormwater systems will not be an option. This will mean that stormwater currently discharged automatically, at low volumes, will need to be considered as low strength leachate (< 100mg/L NH_3) and as such discharged directly to sewer.

Sydney Water approved a request by WDA to increase the maximum daily discharge volume from 620 kL/day to 1,000 kL/day to assist with the off-site disposal of leachate and leachate affected stormwater during periods of significant rainfall. This approval includes a new instantaneous maximum sewer discharge rate of 15 L/s.

This increase in maximum sewer discharge volume and instantaneous rate has been allowed for and incorporated in the proposed Leachate Treatment Plant upgrade.

Groundwater (Botany Sands Systems) generated at the Landfill appears to have been collected and used for dust suppression around the site, with the unused balance overflowing to stormwater. It is envisaged that groundwater generated on site will be used for dust suppression, with an additional option to blend with leachate.

3.0 PROCESS DESCRIPTION AND OPERATING PHILOSOPHY – UPGRADED SYSTEM

3.0 PROCESS DESCRIPTION AND OPERATING PHILOSOPHY – UPGRADED SYSTEM

3.1 General Upgrade Description

The aim of the Leachate Treatment Plant Upgrade is to provide a compliant interim Leachate Treatment Facility (LTP) that will provide suitable operation and effluent treatment during the Interchange construction period.

This will be achieved by implementing the following:

(i) Increased reactor (SBR) volume to increase the hydraulic retention time (HRT).

(ii) Re-design of the aeration system (and SBR depth) to achieve increased oxygen transfer rates.

(iii) Increased SBR cycle times to reduce the decant fraction and hence biomass loss.

(iv) Increased hydraulic (pump) capacities to allow increased sewer discharge volumes.

(v) Provision of LTP bypass and blending capability to allow high volume discharge of both low strength (<100 mg/l NH_3) leachate and leachate affected stormwater.

(vi) Provide treated leachate collection and controlled discharge, rather than directly discharging to sewer from the SBR, to allow full use of the allowable sewer discharge volume and provide maximum blending and discharge options during periods of high leachate generation.

3.2 Aim Treatment Capacity

The aim treatment capacity for the interim (construction period) leachate treatment plant (LTP) upgrade is listed below.

- Nominal Leachate Treatment Rate - 100 m^3/day
- Maximum Ammonia Concentration (NH_4/N) - 400 mg/l
- Maximum Ammonia Load - 40 kg (NH_4/N) per day
- Max. Leachate Treatment (SBR) Rate - 133 m^3/day
- Maximum Sewer Discharge Rate - 15 L/s
- Maximum Daily Discharge Volume* - 1000 m^3/day

*__Note__: Would include low strength leachate and /or leachate affected stormwater typically generated during significant rain events. These effluent streams would be blended and pumped direct to sewer.

The treated leachate water quality would comply with the following:

Substance	LTADM (kg/day)	MDM (kg/day)	Standard (mg/L)
Ammonia as N	10	90	100
Suspended Solids	30	180	600
Total Dissolved Solids	500	1,200	10,000
Barium	0.21	2	5
Iron	0.7	9	50

Notes: LTADM – Long Term Average Daily Mass; MDM – Maximum Daily Mass.

3.3 Process Overview

(Refer to the attached Process Flow Diagram: AL-LS01 Rev. 06 and General Arrangement: AL-LTPGA)

The Leachate Ammonia Treatment Facility at Alexandria Landfill is a biological nitrification pre-treatment facility utilising the sequencing batch reactor process.

The process is designed to biologically oxidise the ammonia (NH3/NH4+) content of the Leachate to the nitrate (NO^{3-}) and nitrite (NO^{2-}) species prior to discharging to sewer according to the following:

$$NH_4^+ + 2O_2 \xrightarrow[\text{NITROBACTER}]{\text{NITROSOMONAS}} NO_3^- + 2H^+ + H_2O$$

(i) (ii) (iii) (iv) (v) (vi)

Where:

(i) Ammonium ion, ie NH3 (ammonia) dissolved in water

(ii) Oxygen, used by organisms and taken up as dissolved oxygen in water

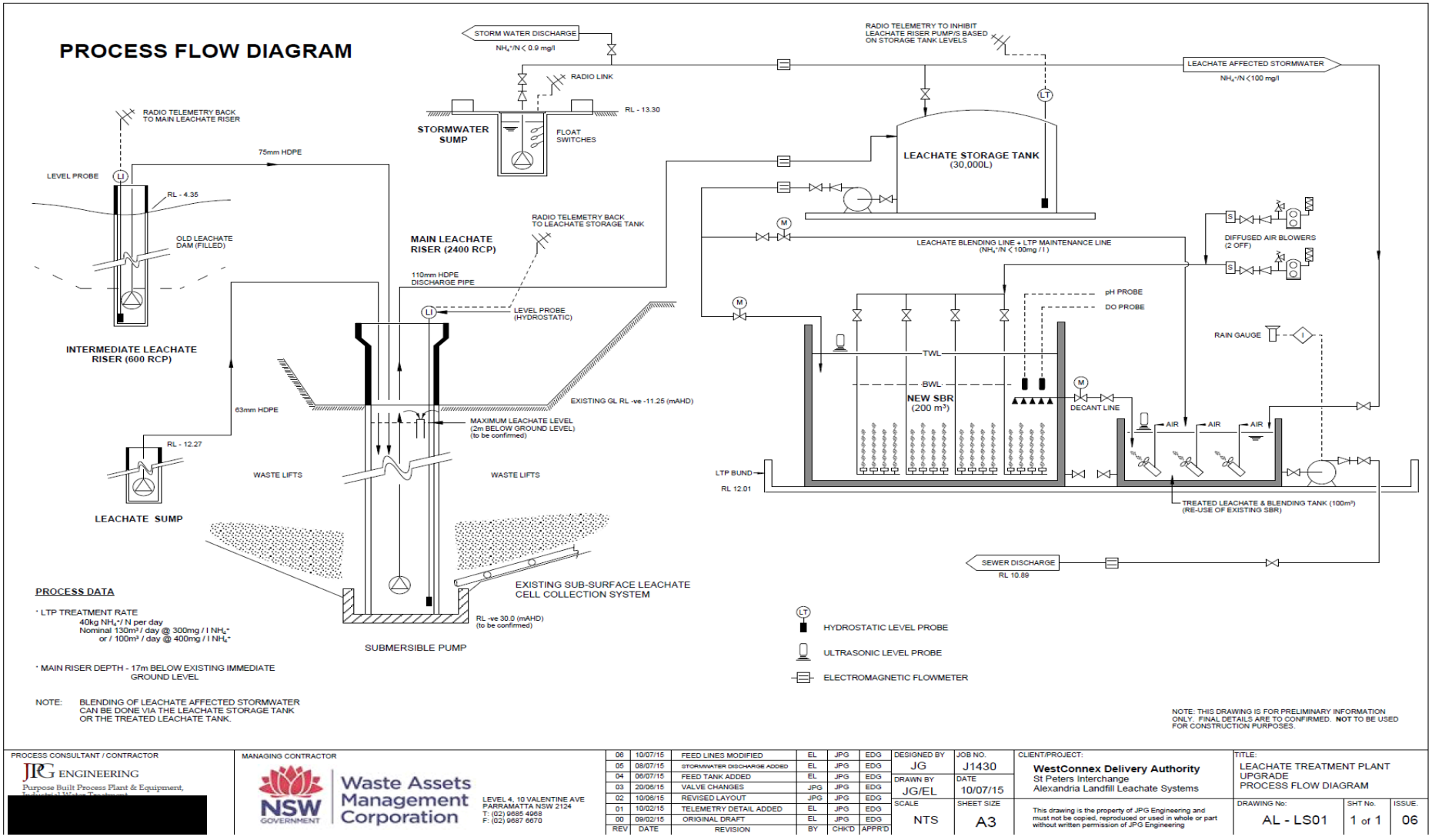
(iii) Nitrifying micro-organisms (biomass)

(iv) Nitrate ion (oxidised product of NH_3)

(v) Hydrogen ions, which produce acidity, hence the possibility for alkalinity (or NaOH) addition to neutralise

(vi) Water

A dedicated denitrification stage for the oxidised ammonia has not been included in the process. The treated leachate, with the ammonia content having been oxidised to nitrite/nitrate, will be discharged to sewer where the inherent COD mass and retention time will achieve complete nitrogen removal via denitrification to nitrogen gas.


PROCESS FLOW DIAGRAM
STORM WATER DISCHARGE
NH4+/N < 0.9 mg/l
RADIO LINK
RL - 13.30
STORMWATER SUMP
FLOAT SWITCHES
RADIO TELEMETRY BACK TO MAIN LEACHATE RISER
75mm HDPE
LEVEL PROBE
LI
RL - 4.35
OLD LEACHATE DAM (FILLED)
INTERMEDIATE LEACHATE RISER (600 RCP)
RADIO TELEMETRY BACK TO LEACHATE STORAGE TANK
MAIN LEACHATE RISER (2400 RCP)
110mm HDPE DISCHARGE PIPE
LEVEL PROBE (HYDROSTATIC)
EXISTING GL RL -ve -11.25 (mAHD)
63mm HDPE
MAXIMUM LEACHATE LEVEL (2m BELOW GROUND LEVEL) (to be confirmed)
RL - 12.27
WASTE LIFTS
WASTE LIFTS
LEACHATE SUMP
EXISTING SUB-SURFACE LEACHATE CELL COLLECTION SYSTEM
RL -ve 30.0 (mAHD) (to be confirmed)
SUBMERSIBLE PUMP
RADIO TELEMETRY TO INHIBIT LEACHATE RISER PUMP/S BASED ON STORAGE TANK LEVELS
LEACHATE AFFECTED STORMWATER
NH4+/N <100 mg/l
LT
LEACHATE STORAGE TANK (30,000L)
M
LEACHATE BLENDING LINE + LTP MAINTENANCE LINE (NH4+/N <100mg / l)
DIFFUSED AIR BLOWERS (2 OFF)
S
pH PROBE
DO PROBE
RAIN GAUGE
I
TWL
BWL
NEW SBR (200 m3)
DECANT LINE
AIR
AIR
AIR
LTP BUND
RL 12.01
TREATED LEACHATE & BLENDING TANK (100m3) (RE-USE OF EXISTING SBR)
SEWER DISCHARGE
RL 10.89
HYDROSTATIC LEVEL PROBE
ULTRASONIC LEVEL PROBE
ELECTROMAGNETIC FLOWMETER
PROCESS DATA
* LTP TREATMENT RATE
40kg NH4+/ N per day
Nominal 130m3 / day @ 300mg / l NH4+
or / 100m3 / day @ 400mg / l NH4+
* MAIN RISER DEPTH - 17m BELOW EXISTING IMMEDIATE GROUND LEVEL
NOTE: BLENDING OF LEACHATE AFFECTED STORMWATER CAN BE DONE VIA THE LEACHATE STORAGE TANK OR THE TREATED LEACHATE TANK.
NOTE: THIS DRAWING IS FOR PRELIMINARY INFORMATION ONLY. FINAL DETAILS ARE TO CONFIRMED. NOT TO BE USED FOR CONSTRUCTION PURPOSES.
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06 10/07/15 FEED LINES MODIFIED EL JPG EDG
05 08/07/15 STORMWATER DISCHARGE ADDED EL JPG EDG
04 06/07/15 FEED TANK ADDED EL JPG EDG
03 29/06/15 VALVE CHANGES JPG JPG EDG
02 10/06/15 REVISED LAYOUT JPG JPG EDG
01 10/02/15 TELEMETRY DETAIL ADDED EL JPG EDG
00 09/02/15 ORIGINAL DRAFT EL JPG EDG
REV DATE REVISION BY CHK'D APPR'D
DESIGNED BY JG
JOB NO. J1430
DRAWN BY JG/EL
DATE 10/07/15
SCALE NTS
SHEET SIZE A3
CLIENT/PROJECT: WestConnex Delivery Authority
St Peters Interchange
Alexandria Landfill Leachate Systems
TITLE: LEACHATE TREATMENT PLANT UPGRADE PROCESS FLOW DIAGRAM
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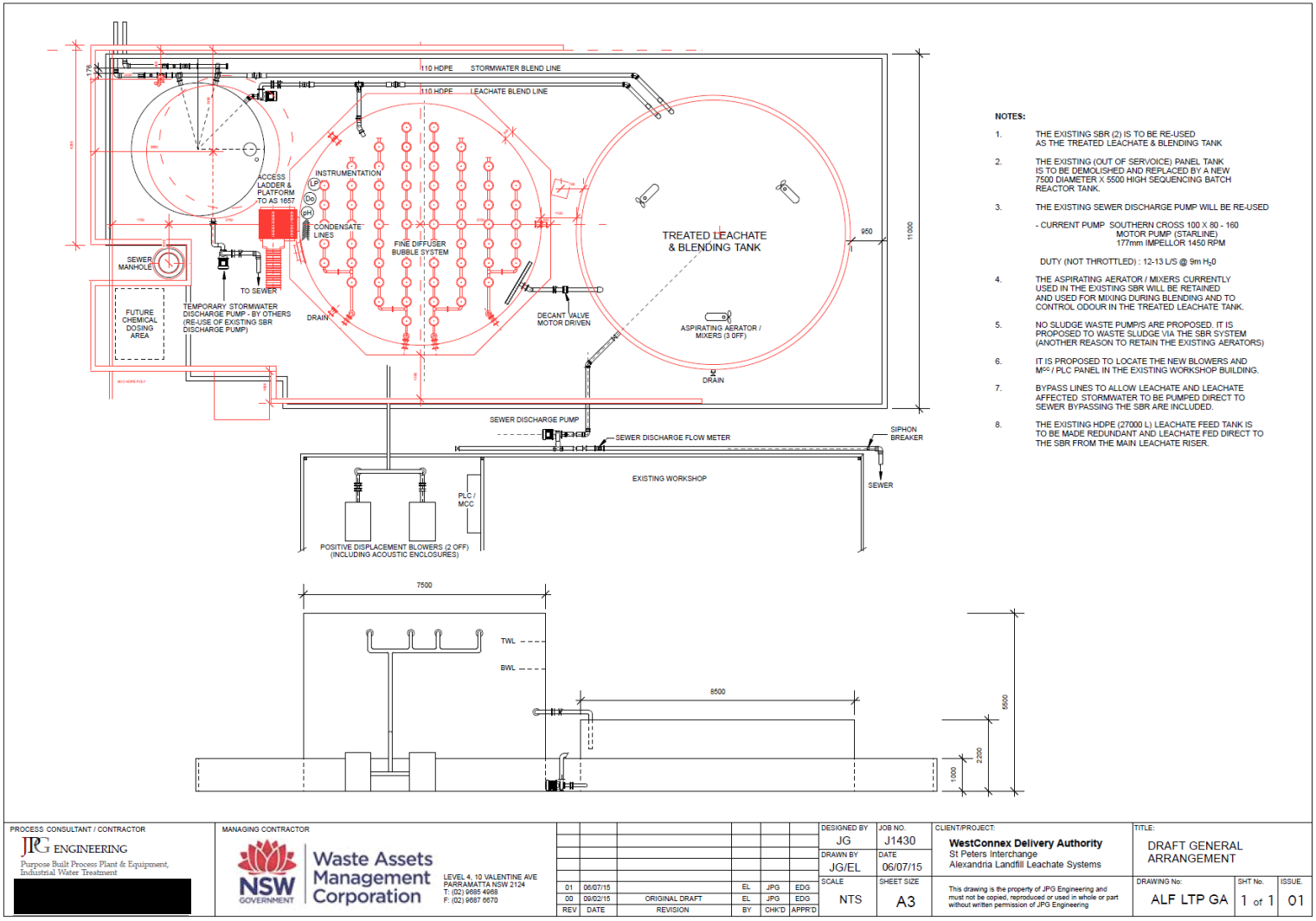
DRAWING No: AL - LS01
SHT No. 1 of 1
ISSUE. 06



NOTES:

1. THE EXISTING SBR (2) IS TO BE RE-USED AS THE TREATED LEACHATE & BLENDING TANK
2. THE EXISTING (OUT OF SERVOICE) PANEL TANK IS TO BE DEMOLISHED AND REPLACED BY A NEW 7500 DIAMETER X 5500 HIGH SEQUENCING BATCH REACTOR TANK.
3. THE EXISTING SEWER DISCHARGE PUMP WILL BE RE-USED
   - CURRENT PUMP SOUTHERN CROSS 100 X 80 - 160 MOTOR PUMP (STARLINE) 177mm IMPELLOR 1450 RPM
   DUTY (NOT THROTTLED) : 12-13 L/S @ 9m H_20
4. THE ASPIRATING AERATOR / MIXERS CURRENTLY USED IN THE EXISTING SBR WILL BE RETAINED AND USED FOR MIXING DURING BLENDING AND TO CONTROL ODOUR IN THE TREATED LEACHATE TANK.
5. NO SLUDGE WASTE PUMPIS ARE PROPOSED. IT IS PROPOSED TO WASTE SLUDGE VIA THE SBR SYSTEM (ANOTHER REASON TO RETAIN THE EXISTING AERATORS)
6. IT IS PROPOSED TO LOCATE THE NEW BLOWERS AND MCC / PLC PANEL IN THE EXISTING WORKSHOP BUILDING.
7. BYPASS LINES TO ALLOW LEACHATE AND LEACHATE AFFECTED STORMWATER TO BE PUMPED DIRECT TO SEWER BYPASSING THE SBR ARE INCLUDED.
8. THE EXISTING HDPE (27000 L) LEACHATE FEED TANK IS TO BE MADE REDUNDANT AND LEACHATE FED DIRECT TO THE SBR FROM THE MAIN LEACHATE RISER.

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REV	DATE	REVISION	BY	CHK'D	APPR'D
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00	09/02/15	ORIGINAL DRAFT	EL	JPG	EDG

DESIGNED BY	JG
JOB NO.	J1430
DRAWN BY	JG/EL
DATE	06/07/15
SCALE	NTS
SHEET SIZE	A3

CLIENT/PROJECT:
WestConnex Delivery Authority
St Peters Interchange
Alexandria Landfill Leachate Systems

TITLE: DRAFT GENERAL ARRANGEMENT

DRAWING No:	SHT No.	ISSUE.
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The leachate generated at the closed Alexandria Landfill is collected by a number of concrete leachate risers constructed at the low points of the landfill.

The collected leachate is then pumped automatically to the Leachate Treatment Plant (LTP) for biological ammonia removal prior to controlled discharge to sewer.

The LTP is PLC controlled with operator interface and instrumentation provided to monitor SBR reactor feed and discharge flowrates, pH levels, dissolved oxygen levels and aeration rates.

The facility is designed to treat both leachate and leachate affected stormwater. The option to control blend these feed streams is provided at the Leachate Storage Tank and the Treated Leachate Tank.

Discharge to sewer from the Treated Leachate Tank is controlled so as not to exceed the instantaneous (15 l/s) discharge flowrate or the daily maximum volume (1000m^3/day) nominated in the site's Sydney Water Trade Waste Agreement.

An additional Trade Waste License condition is that sewer discharge be inhibited during rain events in excess of 10 mm/hr. A rain gauge has been connected to the control PLC to automatically stop sewer discharge in the event of rain being detected.

The LTP facility is located on the North West boundary of the site on an area approximately 11.5 m x 22m in size.

The facility is contained within an approximately 1000mm high concrete bund capable of containing in excess of 110% of the SBR volume.

3.4 Leachate Collection and Transfer System

Main Leachate Riser

The Main Leachate Riser is a vertically constructed 2400mm diameter concrete sump located at the low point of the original landfilling area.

The riser is 17.28m deep with the invert 13.28m (as at September 2015) below existing ground level.

A Flygt sewage type submersible pump is installed on a 300mm high stand at the base of the sump. This pump transfers collected leachate at a nominal 10 l/s automatically to the LTP.

The Main Leachate Riser Pump can discharge either to the Leachate Storage Tank or the Treated Leachate Tank, which is a manual changeover.

Transferring to the Treated Leachate Tank and hence bypassing the SBR, may be required during periods of high leachate generation when ammonia levels are low enough (<100 mg/l) to allow direct high rate discharge to sewer.

A hydrostatic level probe is installed within the Main Leachate Riser providing continuous level indication. This level is transmitted via radio telemetry to the LTP PLC.

The leachate discharge line between the Main Leachate Riser and the LTP is 600m of 110mm (SDR11) HDPE pipe.

The discharge flow from the Main Leachate Riser Pump is measured continuously by an electromagnetic flowmeter located at the LTP.

Intermediate Leachate Riser

The Intermediate Leachate Riser is a vertically constructed 600mm diameter concrete sump located in the centre of the old leachate dam 150m north of the Main Leachate Riser.

The riser is 14.7m deep with the invert 12.50 below existing ground level (as at September 2015).

A Grundfos bore type submersible pump is installed in the base of the sump. The Intermediate Leachate Riser Pump transfers leachate automatically to the Main Leachate Riser via a 75mm OD HDPE discharge line.

A hydrostatic level probe installed within the riser provides continuous riser level indication. The Intermediate Leachate Riser Pump is controlled by level permissives within the Intermediate Riser only.

A mechanical turbine type flowmeter mounted on the side of the Main Leachate Riser allows the Intermediate Leachate Riser flow to be measured.

Leachate Sump

The Leachate Sump is a 3 metre deep vertically constructed 600mm diameter concrete sump located at the toe of the southern batter of the old leachate dam (filled) area.

A Zenit submersible pump, operating off flow switches within the sump, transfers collected leachate automatically to the Main Leachate Riser via a 63mm OD HDPE discharge pipe.

A mechanical turbine type flowmeter mounted on the side of the Main Leachate Riser allows the Leachate Sump flow to be measured.

3.5 Stormwater Collection

Stormwater at the base of the site is collected in a 3 meter deep concrete sump at the sites low point adjacent to the south batter of the old leachate dam area.

A Tsurumi submersible pump located on a 300mm stand at the base of the sump transfers collected stormwater to either the Canal Road stormwater system or to the LTP for treatment and/or blending prior to discharge to sewer. The discharge line is 110mm OD HDPE pipe.

The Stormwater Pump when pumping to the LTP can discharge to either the Leachate Storage Tank or the Treated Leachate Tank with discharge selection requiring a manual changeover.

The Stormwater Sump Pump transfers at a nominal 10 l/s when pumping to the LTP and 32 l/s when pumping to Canal Road stormwater system. Changeover between these discharge points is a manual operation.

The ammonia level in the stormwater must be less than 0.95 mg/l to allow discharge to the stormwater drain system.

It is not envisaged that ammonia levels will typically be low enough to allow automatic discharge to the Canal Road stormwater system.

As such, the Stormwater Sump pump will be set up to automatically discharge to the LTP where it will be treated via the SBR or blended with treated leachate prior to discharge to sewer.

The Stormwater Sump Pump will be controlled by level permissives within the Stormwater Sump, Leachate Storage Tank and Treated Leachate Tank.

A Hydrostatic level probe within the Stormwater Sump provides continuous level indication. The sump level is transmitted via radio telemetry to the LTP PLC.

The discharge flow (when discharging to sewer) is measured continuously by an electromagnetic flowmeter located at the LTP.

3.6 Leachate Treatment System

3.6.1 Leachate Feed Tank

The Leachate Feed Tank is a 30,000 litre HDPE 4.15m diameter x 2.4m high storage tank located in the south east corner of the LTP.

The Leachate Feed Tank provides surge capacity for the SBR Feed Stage and allows blending of leachate and leachate affected stormwater prior to treatment via the SBR.

The Leachate Storage Tank is equipped with a hydrostatic level probe providing continuous level indication.

Separate 100 NB inlets to the Leachate Storage Tank are provided that receive discharge from the Main Leachate Riser and the Stormwater Sump.

Level permissives within the Leachate Storage Tank will inhibit both the Main Leachate Riser and the Stormwater Sump Pumps.

SBR Leachate Feed Pump

The SBR Leachate Feed Pump transfers leachate to the SBR during the SBR Feed Stage and raw leachate to the Treated Leachate Tank at the end of the Feed Stage for blending.

The SBR Leachate Feed Pump is a centrifugal motor pump designed to feed at a nominal 11 l/s (adjustable) to both the SBR and Treated Leachate Tank.

An electromagnetic flowmeter provides continuous raw leachate feed and blend leachate flow indication.

Electrically actuated butterfly valves with open/closed indication are provided to allow discharge to be sent to the SBR or Treated Leachate Tank automatically.

3.6.2 Sequencing Batch Reactor (SBR)

The biological oxidation of the nutrients in the feed influent is carried out in a single circular reactor using the sequencing batch process.

The reactor (SBR) is 7.5 metres in diameter operating with a top water level of 4.5 metres. At top water level the operating volume is 200m^3.

At the proposed maximum nominal treatment rate of 100 m^3/day the average hydraulic retention (HRT) time will be 48 hours. The actual HRT based on react time, operating on 6 hr cycles is 34 hours.

The SBR will operated with a nominal six hour cycle (adjustable) comprising: (refer to attached SBR Cycle Configuration Diagram in Section 7.1)

Cycle Description	Duration (hr) (adjustable)
1. Aerated Feed	1
2. Aeration (including 1)	4
3. Settle	1
4. Decant	1
Total Cycle Duration	**6**

Note: (i) The SBR will feed concurrent with the first one hour.

(ii) Sludge wasting will be carried out during the last hour of the Aeration Cycle.

The SBR cycle time and duration of each cycle will be adjustable via the Operator Interface..

The SBR is equipped with dedicated fine bubble diffused aeration, dissolved oxygen control, pH control, Antifoam dosing, level measurement (Ultrasonic), waste sludge and decant systems.

The feed to the SBR will be introduced at the top of the tanks.

Each SBR includes:

- a fixed decant mechanism
- an emergency overflow to the LTP Bund
- drain line to the Bund Drainage System
- an access platform for maintenance access to instrumentation, valves and local control panels

The decant mechanism is a fixed 2m wide horizontal header set approximately 1200 mm below top water level providing a decant volume of up to 50 m^3 per cycle. This level has been set to provide a safety margin above the nominal maximum treatment volume per cycle of 35 m^3 and to allow for future increase in treatment rate.

The decant header has inlet holes spread evenly along its length to distribute approach velocity to the decant mechanism and minimise the risk of sludge “wash out”.

The SBR will operate as a batch process with the following occurring during each stage:

(i) Feed Stage

During the feed stage leachate will be transferred from the Leachate Storage Tank to the SBR for treatment.

The maximum design treatment volume per cycle has been set at 35 $m^{3.}$ This will give a feed stage time of 53 minutes at the maximum nominal design feed rate of 40 m^3/hr.

The leachate volume treated per cycle is calculated by the PLC from the Maximum Leachate Treatment Rate and the Cycle time Setpoint, both entered manually via the Operator Interface.

The SBR Leachate Feed Time is then calculated using the Feed Flow Rate Setpoint to determine the Feed Stage SBR Leachate Feed Pump Run Time.

The Leachate Feed will be stopped once the calculated Feed Time is achieved or the Leachate Storage Tank low level is reached.

The aeration system is allowed to run during the feed stage to maximise aeration time.

At the end of the SBR Feed Stage or during the Decant Stage the Leachate Blend Valve will open and leachate will be bypassed directly to the Treated Leachate Tank for the Leachate Blend Time, calculated by the PLC using the Leachate Feed Pump Run Time and the Leachate Blending Ratio Setpoint.

(ii) Aeration Cycle

During the aeration stage the SBR is aerated to provide the oxygen required by the biological mass to facilitate nitrification of the ammonia.

The dissolved oxygen (DO) level in the reactor is monitored and the air flow rate adjusted to maintain a minimum dissolved oxygen setpoint. It is envisaged the DO setpoint will be 2 mg/l which will be adjustable via the operator interface.

The nitrification process is acid producing (ie generates H+ ions). During the aeration stage the pH of the SBR is measured. Allowance has been made in the control system for the future addition of caustic to the SBR to control pH if required. Note that the caustic dosing hardware has not been included at this stage.

The aeration stage will be approximately four and a half hours (270 mins) per cycle and will include the feed stage.

During the aeration stage the ammonia content of the SBR will be oxidised to residual levels only, ie less than 2 mg/l.

(iii) Settling Stage

Following the completion of the Aeration Stage the air blowers will be turned off and the biomass allowed to settle. Settling of the biomass will provide a top layer of low suspended solids treated leachate that can be decanted for discharge to sewer.

The settling characteristics of a nitrifying biomass are typically good and it is envisaged that a settling time of between 40 and 60 minutes will be used. The settling time will be set and adjustable via the operator interface.

(iv) Decant Stage

Once the biomass has been settled, a quantity of the treated leachate will be decanted to the Treated Leachate Storage Tank for controlled discharge to sewer.

The decant system is a fixed header system within the SBR with an electrically actuated valve used to initiate and control the decanting of the reactor.

The decant header within the reactor is set approximately 1200 mm below the top water level of the reactor providing a decant volume of up to 50 m^3 per cycle. This level has been set to provide a safety margin above the nominal maximum treatment volume per cycle of 35 m^3 and also to allow for future increases in treatment rates.

The decant maximum flowrate has been designed at approximately 70 m^3/hr providing a minimum decant time of 30 minutes.

3.6.3 Diffused Aeration System

(Refer to attached Diffuser Layout drawing)

The Diffused Aeration System is provided to supply the oxygen required to support the biological oxidation (or nitrification) of nutrients in the feed effluent to the SBR.

The oxygen is provided by blowing air into the reactor to maintain a minimum dissolved oxygen level.

The air is introduced into the reactor using positive displacement “Roots” type blowers via a stainless steel air distribution header system and fine bubble type air diffusers.

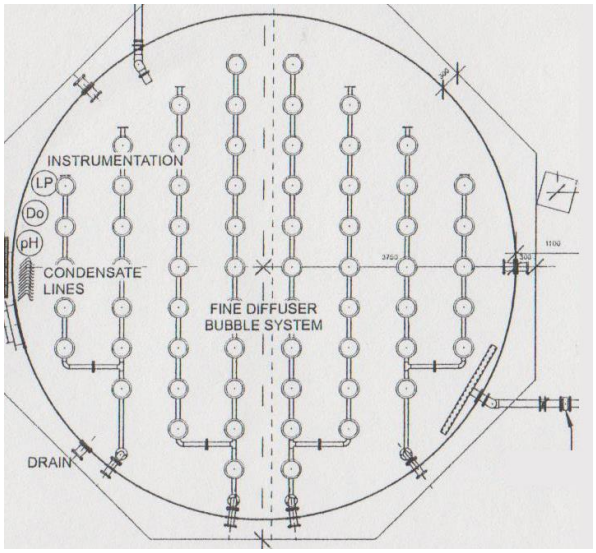
Two air blowers are provided, each being allowed to operate as duty blowers.
The two air blowers have a nominal capacity of 300 Nm^3/hr at 65 kPa discharge pressure and incorporate variable speed drives and silencers for noise attenuation.

The diffuser system in the SBR is fixed to the reactor floor and is fitted with 20 mm HDPE purge lines to discharge the condensate generated by the air system.

The SBR is fitted with 64 disc type fine bubble membrane diffusers rated at a continuous 8 Nm^3/hr per diffuser. The diffusers can operate at up to 12 Nm^3/hr for intermittent periods of time.

The Diffused Air Blowers are provided with variable speed (VVVF) drives to allow the air delivery to be varied to the diffuser system to achieve a dissolved oxygen setpoint (2.0 mg/l - nominal).

SBR Diffuser General Arrangement
No of Diffusers – 64
Maximum Continuous Flowrate – 600 Nm3/hr (1 am, 20oC)



An amperometrical type dissolved oxygen (DO) probe is located in the reactor to provide dissolved oxygen level for feedback control of the diffused air blower variable speed drives.

The DO probe is fixed in position at approximately 500 mm below decant bottom water level. DO indication is provided locally (at the SBR) and on the Operator Interface.

The second duty blower will be allowed to turn off if not required, giving approximately a 5:1 turndown or 120 to 600 Nm^3/hr air flow range.

3.6.4 SBR pH and Dissolved Oxygen Control (Future)

The SBR incorporates a pH measurement (potentiometric) system to provide continuous pH measurement.

The biological oxidation of ammonia produces the oxides of nitrogen, water and hydrogen ions and hence is acid producing.

Based on the stoichiometry the reaction needs at least 7.5 grams of alkalinity per gram of ammonia oxidised. Historical analysis of the Alexandria Landfill leachate has shown that the alkalinity to ammonia ratio is sufficiently high such that the addition of alkalinity (ie caustic or equivalent) should not be required.

pH control via alkalinity addition has not been included in the process, however, control functionality has been allowed to incorporate pH control in the future should it be required.

SBR pH is measured and displaced locally and via the Operator Interface.

3.6.5 SBR Decant System

The SBR is equipped with a decant system discharging by gravity to the Treated Leachate Storage Tank.

The decant system, for simplicity, is a fixed header system mounted in the SBR drawing from approximately 300mm below bottom water level. A floating weir decant system has not been incorporated as the nitrifying biomass settling characteristics are good and a low level of suspended solids is tolerable in the decanted treated leachate.

The decant header is a 100mm NB stainless steel assembly with a 2m inlet header incorporating 20mm diameter inlets positioned vertically down to avoid sludge entrainment.

The Decant Stage will commence at the end of the Settling Stage and is controlled by an electric actuated valve positioned in the decant line.

The duration of the Decant Stage will be controlled by SBR level with the decant volume set to match the feed volume which will be subject to plant throughput.

The Decant System has been designed for a nominal maximum decant flow of 75 m^3/hr. A manual throttling valve will allow this flow to be adjusted to allow plant operation to be optimised.

3.6.6 Treated Leachate Storage and Discharge System

The Treated Leachate Tank makes use of the existing 100 m^3 activated sludge tank from the original treatment plant.

This tank is an open top 8 metre diameter by 2.2m high concrete tank located to the west of the new SBR.

The Treated Leachate Tank can be fed from four sources:

(i) Directly from the Main Leachate Riser

(ii) Directly from the Stormwater Sump

(iii) From the Leachate Storage Tank (for blending)

(iv) Decant treated effluent from the SBR

A combination of these feed sources may be utilised at any given time for blending and subsequent sewer discharge subject to leachate generation rate and untreated effluent (leachate) water quality. Blending options will be set manually based on influent ammonia concentrations (discrete tests).

The Treated Leachate Tank is equipped with a hydrostatic level probe to provide continuous level measurement.

Three submersible type aspirating mixer/aerators are located in the Treated Leachate Tank that are used to provide the agitation necessary to prevent wasted sludge and sludge carry over from the SBR from settling out in the Treated Leachate Tank.

This is critical as the system has been designed to waste sludge (biomass) to sewer noting the 600mg/l suspended solids Trade Waste Licence limit.

Treated Leachate Discharge Pump

The Treated Leachate Discharge Pump transfers treated and blended leachate from the Treated Leachate Tank to sewer.

The Treated Leachate Discharge Pump is a centrifugal motor pump designed to discharge at a nominal 15 l/s which is the maximum instantaneous discharge flowrate allowable under the current Sydney Water Trade Waste Agreement.

The sewer discharge line is a 250metre long 110 OD HDPE PN16 line that runs around the north west corner of the site to the sewer discharge point adjacent to the site entrance.

The sewer discharge point is approximately 2 metres below the invert of the Treated Leachate Tank. A siphon breaker is installed in the high point of the discharge line to prevent uncontrolled siphoning of Treated Leachate to the sewer.

3.6.7 Leachate and Stormwater Blending

The design of the storage and discharge systems associated with the LTP has assumed that the majority of stormwater collected at the base of the site will be leachate affected. The level of leachate (ie: ammonia) contamination of the stormwater being variable and somewhat unknown.

It is expected that there will be times (mainly during dry periods) that the ammonia content of the stormwater will exceed 100 mg/l and as such will potentially require treatment via the SBR.

There will also be periods where stormwater quality will be compliant and can be discharged directly to sewer.

To achieve maximum flexibility within the system, blending of stormwater and leachate can be carried out in the Leachate Storage Tank or the Treated Leachate Tank.

The blend option will be selected via the Operator Interface. High Level permissives within the selected blend tank will automatically inhibit the Main Leachate Riser Pump and the Stormwater Sump Pump.

Regular Leachate and stormwater analysis will be required to ensure the LTP is operated in conjunction with the optimum blending option.

3.6.8 Antifoam Dosing

An Antifoam System is provided to control excessive foaming in the SBR during the aeration stage.

Antifoam can be dosed to the SBR throughout the Aeration Cycle based on foam level with the reactor and will be inhibited at other times.

The system incorporates an Antifoam Storage Tank, Antifoam Metering Pump, dosing pipework and injection valve.

The antifoam is stored in a 100 litre HDPE storage tank located in the Process Bund. The storage Tank Level indication is visual only.

The Antifoam Metering Pump is solenoid diaphragm type dosing pump with a maximum nominal dosing rate of 8 litres/hr.

The antifoam is dosed to the reactor via 12 mm HDPE feed line and relies on the mixing from the aeration system to assist with dispersion.

It is envisaged (from test work) that between 0.5 and 1.0 milligram of antifoam per litre of reactor volume will be added to the SBR when required.

The antifoam chemical has been selected so as not to be toxic or inhibiting to the biomass, (ie potable).

3.6.9 Wet Weather Flow Control

A Sydney Water Trade Waste Licence condition for Alexandria Landfill is that discharge to sewer be inhibited during wet weather, designated by a rain event in excess of 10 mm/hr.

A rain gauge (tipping bucket type) measures rainfall and the PLC automatically upon detecting rain intensity in excess of 10 mm/hr will inhibit the Treated Leachate Discharge Pump.

When dry weather conditions resume, discharge to sewer will be allowed to recommence after 1 hour.

4.0 DESIGN PARAMETERS

4.0 PROJECT TIMING AND CONSTRUCTION PROGRAM

4.1 General

Plant capacity (max) – 100 m^3/day @ 400 mg/l NH_4^+/N

Design Ammonia Loading

Maximum: 100 m^3/day @ 400 mg/l NH_4^+/N – 40 kg/day

Nominal: 100 m^3/day @ 300 mg/l NH_4^+/N – 30 kg/day

Note : Treatment rate will increase with controlled blending of raw leachate with treated leachate from the SBR.
An aim treated leachate discharge ammonia content at 70mg/l will allow an additional blend volume of :

- 30 m^3/day @ 300 mg/l NH_4^+/N
- 20 m^3/day @ 400 mg/l NH_4^+/N

4.2 Leachate Risers

Main Leachate Riser

Size		:	2400mm diameter
Construction		:	Concrete pipe
Depth	- from top	:	17.28m
	- from ground level	:	13.28 m

(Note : ground level RL: -11.25)

Main Leachate Riser Pump

No. off	:	1
Make	:	Flygt (Xylem)
Type	:	Submersible
Model	:	NS3153•181SH270
Duty	:	10 l/s @ 46mH_2O
Suction	:	-
Discharge	:	100 mm Table D
Impeller	:	Code 270 – 215 mm
Drive	:	15kW 2 pole 415/3/50 2920 rpm
Mount	:	Stand mounted

Intermediate Leachate Riser

Size		:	600mm diameter
Construction		:	Concrete pipe
Depth	- from top	:	14.30
	- from ground level	:	12.10 m

(Note : ground level RL: -4.350)

Intermediate Leachate Riser Pump

No. off	:	1
Make	:	Grundfos
Type	:	Submersible (bore type)
Model	:	SP30-2
Duty	:	$24m^3/hr$ @ $46mH_2O$
Suction	:	In built c/w strainer
Discharge	:	80 mm BSPF
Drive	:	2.2kW 415/3/50
Mount	:	Stand mounted
Discharge Pipework	:	75 mm OD HDPE

Leachate Sump

Size		:	600 mm diameter
Construction		:	Concrete Pipe
Depth	- from top	:	3.0 m

(Note : ground level RL: -12.274)

Leachate Sump Pump

No. off	:	1
Make	:	ZENIT
Type	:	Submersible
Model	:	DG Blue P 200T
Duty	:	60 l/min @ $14.1mH_2O$ @ 3.5 m H_2O
Suction	:	Bottom entry, stand
Discharge	:	50 mm
Drive	:	1.5kW 2 pole 415/3/50
Mount	:	Stand mounted
Discharge Pipework	:	75 mm OD HDPE

4.3 Stormwater Collection Sump

Size	:	900 mm diameter
Construction	:	Concrete pipe and lid
Depth - from top	:	3.0 m

(Note : ground level RL: -13.30)

Stormwater Sump Pump

No. off	:	1
Make	:	Tsurumi
Type	:	Submersible (free standing)
Model	:	LH615-51
Duty	:	10 l/min @ 49 mH_2O
Suction	:	Bottom entry
Discharge	:	150 mm Table E
Drive	:	15kW 2 pole 415/3/50 (27.5 Amps)
Mount	:	Stand mounted
Weight	:	213 kg

4.4 Leachate Storage and Feed System

Leachate Storage Tank

Type	:	HDPE
Volume	:	30,000 litre
Dimensions	:	4120mm diameter x 2950 high
	:	2320 vertical wall height

SBR Leachate Feed Pump

No. off	:	1
Make	:	Southern Cross
Type	:	Centrifugal (motor pump)
Model	:	MUED44 J-F 100 X 80 – 160/165 MM CI SSSS
Duty	:	11 l/s @ 8 mH_2O
Suction	:	100 mm Table E
Discharge	:	80 mm Table E
Drive	:	1.5kW 4 pole 415/3/50
Impeller	:	165 mm

4.5 Sequencing Batch Reactor (SBR)

Type	:	Sequencing Batch (1 off)
Dimensions	:	7.5 m diameter x 5.93 m high
Volume (working)	:	200 m^3 (max)
TWL	:	4530 mm
Decant BWL	:	3794 mm
BWL (invert)	:	0 (relative)
Freeboard	:	1400 mm
Nominal Maximum Flowrate	:	130 m^3
Hydraulic Retention Time	:	37 hrs (24 hr average)
Minimum	:	26.2 hrs (based on 17 hrs/day aeration)
Minimum Overflow Capacity	:	35 l/s (150NB @ 200 mm H_2O)

Envisaged Cycle Details

- Feed volume per cycle	:	32.5 m^3 maximum
- Cycles per day	:	4
- Cycle time	:	360 minutes
o Feed	:	50 minutes
o Aerator	:	255 minutes
o Settle	:	60 minutes
o Decant	:	45 minutes

4.6 Diffused Aeration System (Fine Bubble)

Note: Based on treating 40 kg NH_4^+/N with 17 hrs per day react (or aeration time)

Average Total Oxygen Demand	:	198 kg O_2/day
Peak OTR (17 hours aeration)	:	11.65 kg O_2/hr
Air Flowrate (estimate)	:	437 Nm^3/hr (α factor = 0.7)
	:	602 Nm^3/hr (α factor = 0.5)

Diffusers and Air Distribution System

Make	:	Ecologix Technologies
Type	:	Ecoflex-350V (EPDM membrane)
Distribution System	:	Stainless Steel Fixed
Diffusers per SBR	:	64
Diffuser Banks per SBR	:	8
Design Flow per Reactor	:	500 Nm^3/hr (max)
Design Flow per Diffuser	:	9.7 Nm^3/hr
Maximum Flow per Reactor	:	620 Nm^3/hr (continuous)
Maximum Flow per Diffuser	:	8 Nm^3/hr (continuous)
Maximum Flow per Diffuser	:	12-16 Nm^3/hr (intermittent)
Diffuser Submersion Depth (@4530) TWL	:	4380 mm
SOTE (%) (@4.38m)	:	26% (as new)

SBR Diffused Air Blowers

No. of	:	2
Make	:	Blower Package – PDA Blower Company
	:	Blower Assembly – Ingersoll Rand
Type	:	"Roots" type Tri-lobe positive displacement
Model	:	S2H42
Duty	:	300 m^3/hr @ 65 kPa (@20^oC, 1 atm) – 2200 rpm
Turndown	:	2:1 Single Duty Blower
	:	4:1 Two Duty Blower
Air Temp Rise	:	70^oC
Maximum Flow	:	650 m^3/hr (2 blowers)
Absorbed Power	:	8.5 kw
Drive	:	11 kw 2 pole 425/3/50
Noise Levels	:	72 dB(A) @ 1 meter with acoustic enclosure
Discharge	:	80 mm (Table E)
Silencer	:	80 mm (inline, one per blower set)

4.7 Antifoam Dosing System

Make	:	Prominent Fluid Controls
Type	:	Solenoid Diaphragm metering pump
Model	:	GALA0708PPE200UC012000P2
Duty	:	8 l/hr @ 3.5 bar back pressure
Turndown	:	100:1
Drive	:	22w (max) 240/1/50 Solenoid
No. off	:	1
Storage Tank	:	100 litre

4.8 Treated Leachate Storage Tank

Type	:	Concrete (open top)
Size	:	8.2 m diameter x 2.2 m high
Volume	:	100 m^3

4.9 Treated Leachate Discharge Pump

No. off	:	1
Type	:	Centrifugal (motor pump)
Make	:	Southern Cross (Pentair)
Model	:	MUGD48J-F 100 x 65 – 250/251 mm CISSSS
Duty	:	15 l/s @ 21 mH_2O
Drive	:	5.5 kw 4 pole
Suction	:	100mm Table E
Discharge	:	65mm Table E
Impeller	:	251 mm

5.0 Instrumentation

5.1 Main Leachate Riser Hydrostatic Level Probe
5.2 Intermediate Leachate Riser Hydrostatic Level Probe
5.3 Stormwater Sump Level Probe
5.4 Leachate Feed Tank Hydrostatic Level Probe
5.5 Leachate Riser Discharge Electromagnetic Flowmeter
Stormwater Sump Discharge Electromagnetic Flowmeter
SBR Feed Electromagnetic Flowmeter
5.6 SBR Ultrasonic Level Probe
5.7 SBR pH Measurement System
5.8 SBR DO Measurement System
5.9 Treated Leachate Tank Hydrostatic Level Probe
5.10 Sewer Discharge Electromagnetic Flowmeter

5.0 INSTRUMENTATION

5.1 Main Leachate Riser Hydrostatic Level Probe

Type	:	Hydrostatic
Make	:	Mercoid (Dwyer Instruments)
Model	:	PBLT2 – 20M-27M-P Submersible Level TX
Range	:	0-20m H_2O

Wetted Materials: 316 SS, 316L SS, epoxy adhesive; Cable: Polyether polyurethane or ETFE.
Accuracy: ±25% full scale.

Temperature Limits: 0 to 200^{0}F (-18 to 93^{0}C).

Compensated Temperature Range: 0 to 180^{0}F (-18 to 82^{0}C).
Thermal Effect: Less than±0.2%/^{0}F.

Pressure Limit: 2X full scale.

Power Requirement: 13 to 30 VDC.

Output Signal: 4 to 20 mA DC, two wire.

Response Time: 50 msec.

Loop Resistance: 850 ohms at 30 VDC.

Electrical Connection: Wire Pigtail.

Mounting Orientation: Suspended in tank below level being measured. Can be placed on the bottom of the tank on it's side.

Weight: 4.3 lb (2.0 kg).

Electrical Protection: Lightning and Surge protection.

5.2 Intermediate Leachate Riser Hydrostatic Level Probe

Type	:	Hydrostatic
Make	:	Mercoid (Dwyer Instruments)
Model	:	SBLT2 – 10M-18M
Range	:	10m H_2O

Wetted Materials: 316 SS, 316L SS, epoxy adhesive; Cable: Polyether polyurethane or ETFE.
Accuracy: ±25% full scale.

Temperature Limits: 0 to 150^{0}F (-18 to 66^{0}C).

Compensated Temperature Range: 0 to 140^{0}F (-18 to 60^{0}C).
Thermal Effect: Less than±0.02% full scale/^{0}F.

Pressure Limit: 2X full scale.

Power Requirement: SBLT2: 13 to 30 VDC.

Output Signal: 4 to 20 mA DC, two wire.

Response Time: 50 msec.

Max. Loop Resistance: 900 Ω at 30 VDC.

Electrical Connection: Wire Pigtail.

Mounting Orientation: Suspended in tank below level being measured.

Weight: 2.2 lb (1.0 kg).

Electrical Protection: SBLT2: Lightning and Surge protection.

5.3 Stormwater Sump Level Probe

Type	:	Float
No. off	:	3
Make	:	TBA

5.4 Leachate Feed Tank Hydrostatic Level Probe

Type	:	Hydrostatic
Make	:	Endress and Hauser
Range	:	0-2.5m H_2O
Model	:	FMX21-3R10/187
		FMX21-AA221GGJ10A+POPS
		Waterpilot FMX21
		Level measurement, Hydrostatic.
		Process membrane: CERAPHIRE, dry, rugged.
		Additional specifications

	Low range value	0.000	kPa
	Upper range value	25.000	kPa
	Damping[S]	2	

AA	Approval: Non-hazardous area
2	Output:4-20mA HART
2	Probe Tube: 316L, d=42mm/1,66in, flush mount
1G	Sensor Range: 600mbar/60kPa/9psi gauge, 6mH2O/20ftH2O/240inH2O
G	Reference Accuracy: Standard
J	Calibration; Unit: Customised pressure; see Additional spec.
10	Probe Connection:10m cable, shortable, PE
A	Seal: FKM Viton
PO	>>Accessory Enclosed: Suspension clamp, 316L
PS	>> Accessory Enclosed: Terminal box IP66/67

5.5 Leachate Riser Discharge Electromagnetic Flowmeter
Stormwater Sump Discharge Electromagnetic Flowmeter
SBR Feed Electromagnetic Flowmeter

Type	:	Electromagnetic
Make	:	Endress and Hauser
Range	:	0-2.5 l/s
Model	:	50W1H-S70AA0AAAA
		Promag 50W1H, DN100 4"

Additional specifications

	Assign line 1	Volume Flow	
	Assign line 2	Totalizer 1	
	Assign totalizer 1	Volume Flow	
	Unit totalizer 1		dm3
	Assign totalizer 2	Volume Flow	
	Unit totalizer 2		dm3
	Assign current output	Volume Flow	
	Current span	4-20mA HART NAMUR	
	Value 20 mA	1,200.000	dm3/min
	Time constant	3.000	s
	Failsafe mode current output	Min. current	
	Assign pulse output	Volume Flow	
	Pulse value (per pulse)	10.00000	dm3
	Pulse width	100.000	ms
	Output signal	Passive – positive	
	Failsafe mode pulse output	Fallback value	

S	Liner: Hard rubber HR
7	Process Connection: Table E, carbon steel, flange AS2129
0	Electrodes:1.4435/316L
A	Calibration: 0.5%
1	Additional Test, certificate: w/o
A	Approval: Non-hazardous area
A	Housing: Compact Alu, IP67 NEXA4X
0	Cable, Remote Version: not used
A	Cable Entry: Gland M20 (EEx d>thread M20)
A	Power Supply; Display: 85-260VAC, WEA, 2-LINE+ Push buttons, WEA= language DE+EN+FR+IT+ES+PT+NL
A	Adjustment; Software Feature: Factory setup; basic version
A	Output, Input: 4-20mA SIL HART + frequency

5.6 SBR Ultrasonic Level Probe

Type	:	Ultrasonic
Make	:	Endress and Hauser
Range	:	0-6 m H_20
Model	:	FMU41-ARB2A2
		Prosonic M FMU41
		Level, ultrasonic, contactless.
		Application: liquids, solids.
	A	Approval: Non-hazardous area
	R	Process Connection: Thread ISO228 G2, PVDF
	B	Power Supply; Output: 2 wire , 4-20mA HART
	2	Operation: 4-line display VU331, envelope curve
		Display on site
	A	Housing: F12 Alu, coated, IP68 NEMA6P
	A	Cable Entry: Gland M20 (EEx d>thread M20)

5.7 SBR pH Measurement System

Type	:	Potentiometric
Make	:	Endress and Hauser
Range	:	5-9 pH units (0-14 possible)
Transmitter		
Model	:	CM442-2D56/0
		CM442-AA2A2F060A+AA
		Liquiline CM 442
		Transmitter liquid analysis
		Multiparameter + Multichannel
		applicable for controlling
	AA	Approval: Non-hazardous area
	M2	Sensor Input: 2xdigital sensor
	A2	Communication: 2x output 0/4..20mA, HART
	F0	Additional Features: W/0
	6	Power supply: 24 V DC
	0	Cable Entry: Metric
	A	Cable Entry Set: enclosed
	AA	>Presetting Operation Language: English

Sensing Electrode and Cable

Model	:	CPS11D-7BA21
		Orbisint CPS11D Memosens
		pH comb. electrode
		Diaphragm: PTFE
	7	Version: Basic version
	BA	Application Range: 0-14pH, 0…135oC, 16 bar, Sterilisable
	2	Shaft Length: 120mm
	1	Approval: Non-hazardous area
Model	:	CYK10-A151
		Meas. Cable CYK10 Memosens
		Application: digital sensors with inductive Memosens plug head
		Working limit: mzx -20…135oC
	7	Version: Basic version
	A	Approval: Non-hazardous area
	15	Cable Length: 15m
	1	Cable Connection: Wire terminals
Model	:	CPA640-C111
		Ecofit CPA640, Adapterset
		Universal electrode holder
		Application : Process pG13,5
		Electrode: pH-/Redox 120mm.
	C	Process Connection; material: Thread NPT ¾ “, PVDF
	1	Immersion Depth: 25mm / 1”
	1	Seal: Viton O-ring
	1	Additional option: w/o

5.8 SBR DO Measurement System

Type	:	Amperometrical
Make	:	Endress and Hauser
Range	:	0-10 mg/l
Transmitter		
Model	:	CM442-2D56/0
		CM442-AA2A2F060A+AA
		Liquiline CM 442
		Transmitter liquid analysis
		Multiparameter + Multichannel
		applicable for controlling
	AA	Approval: Non-hazardous area
	M2	Sensor Input: 2xdigital sensor
	A2	Communication: 2x output 0/4..20mA, HART
	F0	Additional Features: W/0
	6	Power supply: 24 V DC
	0	Cable Entry: Metric
	A	Cable Entry Set: enclosed
	AA	>Presetting Operation Language: English
DO Sensor		
Model	:	COS51D-AS800
		Oxymax W COS51D
		Dissolved oxygen Sensor, amperometrical
		Application: Water, Wastewater
	A	Approval: Non-hazardous area
	S	Head type: thread NPT 3/4; G1; memosens connector
	8	Cable length; standard version, without cable
	0	Membrane cap: normal, T90, ca. 3 min.
	0	Accessories: no

5.9 Treated Leachate Tank Hydrostatic Level Probe

Type	:	Hydrostatic
Make	:	Endress and Hauser
Range	:	0-2.5m H_2O
Model	:	FMX21-3R10/187
		FMX21-AA221GGJ10A+POPS
		Waterpilot FMX21
		Level measurement, Hydrostatic.
		Process membrane: CERAPHIRE, dry, rugged.

5.10 Sewer Discharge Electromagnetic Flowmeter

Type	:	Electromagnetic
Make	:	ABB
Range	:	0-20 l/s
Model	:	TBA

6.0 CONTROL SYSTEM DESCRIPTION

6.0 CONTROL SYSTEM DESCRIPTION

6.1 General

The Alexandria Landfill Leachate Treatment Facility is a fully automated process designed to treat leachate and leachate affected stormwater generated at the site.

The main control panel for the Facility is located in the Blower Room and incorporates the Motor Control Centre (MCC) for the Treatment Plant Drives, Blower Variable Speed Drives, PLC and Operator Interface.

The LTP Control PLC is an Allen-Bradley Compact Logix 1400 (TBC) processor using RS Logics 5000 software with analogue input/output modules for flow, dissolved oxygen, pH, level and metering pump control.

The Operator Interface is a Red Lion G308A210 Industrial Touch Screen Process Monitor. Field telemetry equipment used are Elpro radio telemetry units.

Remote access monitoring and control is provided via the internet incorporating password protection.

The electrical controls for the Main Leachate Riser, Intermediate Leachate Riser, Leachate Sump and Stormwater Sump utilise existing systems. Control permissives are communicated to and from these field systems via radio telemetry.

6.2 Process Screens (*To Be Added Once Developed)*

6.2.1 Process Overview Screen

6.2.2 Process Variable Setpoint Screen (SBR Details Screen)

6.2.3 Alarm Screen

6.2.4 Trend Screens

Note: All of the Process Screens will be remotely accessible via the internet (password protected).

7.0 CONTROL LOOP DESCRIPTIONS

7.0 CONTROL LOOP DESCRIPTIONS

7.1 LTP and SBR Cycle Control

The LTP is equipped with the following modes:

- Off (Out of Service)
- Manual
- Automatic

with Mode Selection via a 3 position selector switch on the Main Control Panel or via the Operator Interface.

In "OFF" Mode all sequential and manual control of the SBR drives and valves is inhibited.

In "Manual" Mode sequential control for the LTP will be inhibited. The drives and valves can be operated using the stop/start and open/close push button icons on the Operator Interface once Manual Mode for the device on the Operator Interface has been selected.

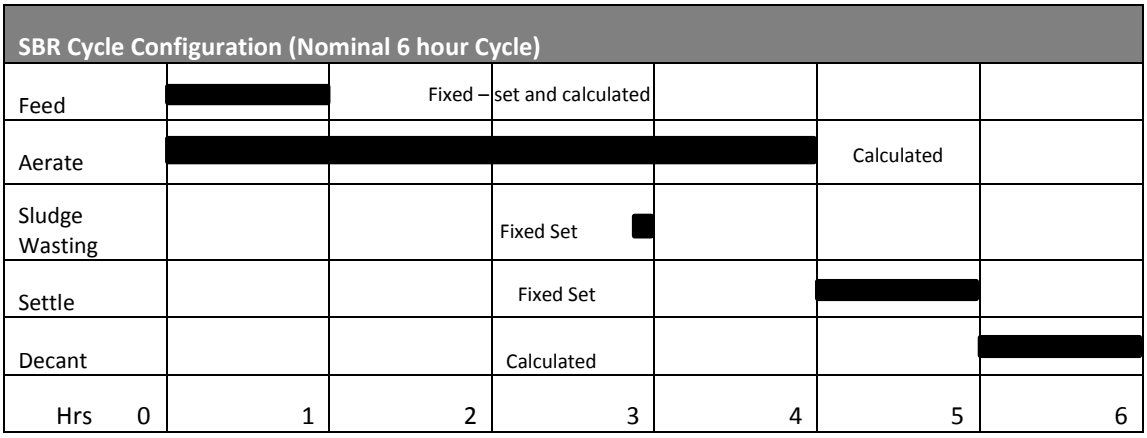
In "Automatic" Mode the SBR will be controlled by the PLC.

SBR Cycle Control

An SBR Automatic Cycle will consist of the following stages:

- Feed Stage
- Aeration Stage (including Sludge Wasting)
- Sludge Settling Stage
- Decant Stage

Refer to the attached SBR Cycle Configuration Diagram below:



Sludge wasting, if required, will be carried out at the end of the Aeration Cycle.

The overall cycle duration (SBR Cycle Time) is set and adjustable via the Operator Interface. The maximum and minimum SBR Cycle Times are as follows:

Maximum SBR Cycle Time – 720 minutes
Minimum SBR Cycle Time – 180 minutes.

In Automatic Mode the operation and length of each stage of the SBR Cycle is determined according to the following:

(i) Feed Stage (0-180 minutes – calculated)

The Feed Stage will commence at the end of the Decant Cycle. The length of the Feed Stage (minutes) is calculated from the LTP Rate (m^3/day), SBR Cycle Time (Mins) and SBR Feed Rate (l/s) as follows:

$$\text{Feed Stage Run Time (mins)} = 0.01157 \left[\frac{\text{LTP Treatment Rate } (m^3/\text{day}) \times \text{SBR Cycle Time}}{\text{SBR Feed Rate (l/s)}}\right]$$

The LTP Treatment Rate (m^3/day), SBR Cycle Time (mins) and SBR Feed Rate (l/s) are all set and adjustable via the Operator Interface. The calculated Feed Stage Run Time will be displayed on the Operator Interface SBR Details Screen.

(ii) Aeration Stage (0-600 mins – calculated)

The Aeration Stage of the cycle will commence at the same time as the Feed Stage commences.

The length of the Aeration cycle is determined as follows:

Aeration Cycle (mins) = SBR Cycle Time – [Sludge Settling Time + Decant Time]

(iii) Sludge Wasting Stage (0-300 seconds)

The Sludge Wasting Stage commences a preset time before the end of the Aeration Cycle and continues for a preset time up to a maximum of 5 minutes. The Sludge Waste Flowrate will equal the decant flowrate.

The Sludge Waste Start Time (5-10 min) and the Sludge Waste Run Time (0-300 secs) are set and adjustable via the Operator Interface.

(iv) Sludge Settling Stage (0-120 mins)

The Sludge Settling Stage will commence at the end of the Aeration period.

The length of the Sludge Settling Stage is manually set and adjustable via the Operator Interface.

(v) Decant Stage

The Decant Stage commences at the end of the Sludge Settling Stage.

The Decant Stage Time is determined by the time it takes to decant to the calculated Bottom Water Level (BWL) Setpoint.

The BWL Setpoint is calculated from the LTP Treatment Rate (m^3/day), the SBR Cycle Time (min) and the SBR Top Water Level (STWL) (mm) – all set and adjustable via the Operator Interface.

The Decant BWL Setpoint is calculated as follows:

$$\text{Decant BWL} = \text{STWL} - 0.01572 \left[\frac{\text{LTP Treatment Rate}}{(m^3/\text{day})} \right] \left[\frac{\text{SBR Cycle Time}}{(\text{mins})} \right]$$

The calculated Decant BWL is displayed on the SBR Details Screen.

Note that the Decant Time used to calculate the Aeration cycle time will be the length of the last Decant Period. Hence, in "Automatic" Mode the overall cycle time is allowed to vary slightly from cycle to cycle.

7.2 Main Leachate Riser Pump Control

The Main Leachate Riser Pump (as of September 2025) is a freestanding sewage type submersible pump located at the base of the Main Leachate Riser.

The Main Leachate Riser Pump is an existing system that is controlled by level permissives from either the Leachate Storage Tank or the Treated Leachate Tank.

If the "Leachate Riser Pump – Leachate Storage Tank Discharge" is selected (via the Operator Interface) then the Leachate Storage Tank High Level Permissive will inhibit the Main Leachate Riser Pumps.

If the "Leachate Riser Pump – Treated Leachate Tank Discharge" is selected via the Operator Interface) then the Treated Leachate Tank High Level permissive will inhibit the Main Leachate Riser Pump.

The Main Leachate Riser Pump will automatically transfer leachate from the Main Leachate Riser to the selected LTP receival tank provided the receival tank is below High Level and there is leachate in the riser.

An electromagnetic flowmeter, Main Leachate Riser Discharge Flowmeter – FIT01, located adjacent to the Leachate Storage Tank provides continuous leachate discharge flow measurement and totalised flow. Low and High Flow alarms are provided with alarm setpoints set and adjustable via the Operator Interface.

Action Upon Failure

(i) Leachate Feed Flowmeter Failure

- Alarm

(ii) **Main Leachate Riser Pump Failure**
(detected by low flow)

- Alarm

(iii) **Leachate Storage Tank Level Probe Failure**

- Stop the pump and alarm

(iv) **PLC Failure**

- Pump will stop

Interlocks

The Main Leachate Riser Pump will inhibit if:

(i) The selected receival tank is above High Level (all modes)

Control Locations and Type

Local

- Contactor and Circuit Breaker

Indications	**Range**
(i) Operator interface	
• Main Leachate Riser Pump Running	NA
• Main Leachate Riser Level	0-100%
• Main Leachate Riser Discharge Flowrate	0-20 l/s

Alarms	**Lag Time**
• Main Leachate Riser Failed to Start	Immediate
• Main Leachate Riser Discharge Low Flow	10 s
• Main Leachate Riser Discharge High Flow	5 s
• Main Leachate Riser Discharge Flowmeter Failure	Immediate
• Stormwater Sump Discharge Flowmeter Failure	Immediate

7.3 Intermediate Leachate Riser Pump Control

The Intermediate Riser Pump is an existing system located in the old leachate dam area. The pump is a bore type submersible controlled off level permissives measured by a hydrostatic level probe located in the riser. The Intermediate Riser discharges to the Main Leachate Riser.

The pump is started and stopped by level permissives set in the local pump control panel with no interlocks from the Main Leachate Riser.

The system is stand alone with no pump run or level indication displayed other than at the local control panel adjacent to the riser.

Future addition of radio telemetry communication would allow Pump Run, Riser Level and control functionality to be incorporated into the overall system and is recommended.

7.4 Leachate Sump Pump Control

The Leachate Sump Pump is an existing system comprising a vortex type submersible pump operating automatically off float type switches within the sump.

The Leachate Sump Pump is a stand-alone system that discharges to the Main Leachate Riser. No interlocks exist between the Main Leachate Riser and the Leachate Sump Pump.

7.5 Stormwater Sump Pump Control

The Stormwater Sump Pump is an existing system located in the base of the Stormwater Sump at the low point of the site.

The Stormwater Sump Pump is a high head submersible pumps controlled by float type level switches within the sump, that automatically discharges to the Canal Road stormwater system, the LTP or direct to sewer. When pumping to the LTP (either the Leachate Storage Tank or the Treated Leachate Tank) an electromagnetic flowmeter (FIT02) provides continuous flow and totalised flow monitoring

The pump is a stand-alone system with no pump run or level indication displayed other than at the local control panel adjacent to the Stormwater Sump.

Future addition of radio telemetry and analogue level control to allow automatic operation and monitoring via the LTP PLC is recommended. ***Functionality to be added.***

UPGRADED LTP CONTROL SYSTEMS

7.6 SBR Leachate Feed Pump Control

The SBR Leachate Feed Pump (P01) is a fixed speed centrifugal pump mounted adjacent to the Leachate Storage Tank.

During the SBR Feed Stage the pump feeds leachate stored in the Leachate Storage Tank to the SBR. At the completion of the Feed Stage the SBR Leachate Feed Pump then pumps raw leachate to the Treated Leachate Tank for blending.

Electrically actuated valves, SBR Leachate Feed Valve (AV01) and SBR Blend Valve (AV02), are provided to allow raw leachate to be pumped to either the SBR or the Treated Leachate Tank.

The SBR Leachate Feed Valve (AV01) and the SBR Blend Valve (AV02) can be selected to Manual or Automatic Mode via the Operator Interface. In Manual Mode the valves are operated using the open/closed pushbuttons on the Operator Interface. In Automatic Mode the valves are controlled by the PLC.

Leachate Feed Electromagnetic Flowmeter (FIT203) provides continuous feed leachate flow and totalised flow indication. Throttling valves in the discharge lines to both the SBR and the Treated Leachate tank are provided to allow discharge flowrates to be adjusted and set. It is envisaged that SBR and Treated Leachate Blend flowrates will be set the same (nominal 11 l/s).

The SBR Leachate Feed Pump is equipped with the following modes:

- Manual
- Automatic

selected via the Operator Interface.

In Manual Mode the pump is controlled using the stop/start icons on the Operator Interface.

In Automatic Mode the pump is controlled by the PLC. The following Feed Stage Process Setpoints are manually entered and adjustable via the Operator Interface SBR Details Screen:

- LTP Treatment Rate (m^3/day)
- SBR Cycle Time(mins)
- SBR Feed Rate (l/s)
- Leachate Blend Ratio (%)

In Automatic Mode the Feed Stage of the overall SBR cycle is initiated at the end of the Decant Stage.

Upon automatic initiation of the Feed Stage the SBR Leachate Feed Valve (AV01) will be given a signal to open (NB: opening time of 6 secs). Once the valve open limit is made the SBR Leachate Feed Pump will start. The pump will continue to run until the calculated Feed Stage Run Time is reached.

At the completion of the Feed Stage the SBR Leachate Feed Valve (AV01) will close and 3 seconds later the SBR Blend Valve (AV02) will open. The SBR Leachate Feed Pump will continue to pump raw leachate into the Treated Leachate Tank until the calculated Blending Run Time (mins) is reached.

The Blending Run Time (mins) is calculated as follows:

Blending Run Time (mins) = Leachate Blend Ratio (%) x Feed Stage Run Time (mins)

The calculated Blending Run Time (mins) is displayed on the SBR Details Screen on the Operator Interface.

The level in the Leachate Storage Tank is measured using a hydrostatic level probe (LIT01) providing continuous level indication.

The Leachate Storage Tank level permissives are as follows:

Permissive	Level (mm above tank invert)	Display %
Overflow Level	2200	100
High-High Alarm	2090 (Adjustable)	95
High Alarm Pump Stop *	1780 (Adjustable)	90
Low Alarm Pump Start *	1540 (Adjustable)	70
Low Alarm - Pump Protection	440 (Adjustable)	20
Tank Invert	0	0
*Main Leachate Riser and Stormwater Sump Pump start/stop level permissives		

Action Upon Failure

(i) **Leachate Feed Flowmeter (FIT203) Failure**

Alarm

(ii) **SBR Leachate Feed Pump Failure**

Alarm, stop the pump and close valves AV01 and AV02

(iii) **Leachate Storage Tank Level Probe Failure (LIT01)**

Alarm, stop the pump

(iv) **Treated Leachate Tank Level Probe Failure**

Alarm, stop the pump if Blend Valve Open

(v) **PLC Failure**

Pump will stop and alarm

Interlocks

The SBR Leachate Feed Pump will be inhibited if:

(i) Discharge flow is not detected (mask time : 5s) (Auto mode only)

(ii) Discharge valves AV01 or AV02 fails to open

(iii) The Leachate Storage Tank is at Low Low Level

(iv) The SBR is at High Level and the SBR Feed Valve is open

(v) The Treated Leachate Tank is at High High and the Blend Valve is Open

(vi) The local Emergency Stop is latched.

Control Locations and Type

(i) Operator Interface
- Leachate Storage Tank level permissives
- LTP Treatment Rate (m^3/day)
- SBR Cycle Time (mins)
- SBR Feed Rate (l/s)
- Mode Selection
- Stop/start pushbuttons

(ii) MCC
- Isolation
- Emergency Stop

(iii) Local
- Full current local Isolator
- Emergency Stop

Indications

(i) Operator interface	**Range**
• Auto/Manual Mode Selection	NA
• Leachate Storage Tank level permissives	0-100%
• LTP Treatment rate (m^3/day)	0-200 m^3/day
• SBR Cycle Time (mins)	0-720 mins
• SBR Feed Rate Setpoint (l/s)	0-20 l/s
• Leachate Blend Ratio (%)	0-50%
• Leachate Discharge high/low flow alarm	0-20 l/s
• Discharge valve AV01 and AV02 open/closed	NA
• Calculated Blend Time	0-60 mins
• SBR Feed Run Time	0-120 mins
• SBR Leachate Feed Pump Running	NA
• SBR Leachate Feed Rate (l/s)	0-20 l/s

(ii) Local	
• SBR Leachate Feed Rate (l/s)	0-2- l/s
• Discharge valves AV01 and AV02 open/closed	

Alarms	**Lag Time**
• SBR Leachate Feed Pump Failed to Start	Immediate
• SBR Leachate Feed Pump Low Flow	8 s
• SBR Leachate Feed Pump High Flow	8 s
• Leachate Storage Tank Low Low Level	8 s
• Leachate Storage Tank High High Level	8 s
• Discharge valve AV01 failed to open	8 s
• Discharge valve AV01 failed to closed	8 s
• Discharge valve AV02 failed to open	8 s
• Discharge valve AV02 failed to closed	8 s
• Leachate Feed Flowmeter (FIT03) Failure	Immediate
• Leachate Storage Tank Flowmeter Failure	10 s
• SBR High Level	Immediate
• SBR Low Level	10 s

Trends	**Range**
• SBR Leachate Feed Flowrate	0-20 l/s
• Leachate Storage Tank Level	0-100 %
• Main Leachate Riser Discharge Flowrate	0-20 l/s
• Stormwater Sup Discharge Flow	0-20 l/s

7.7 SBR Dissolved Oxygen (DO) Control

Two identical positive displacement air blowers (B01/02) are provided to supply oxygen (air) to the SBR during the Aeration Stage.

The blowers are equipped with variable speed drives to allow blower discharge air volumes to be regulated. The speed range of each individual blower has been limited to between 25 and 50 Hz to avoid air temperature rise and motor overload problems.

Both blowers are duty blowers with Duty 1 and Duty 2 allocated to each blower automatically by the PLC on a run time basis.

Manual selection of Blower duty and Automatic Mode can be made via the Operator Interface.

Each blower has a dedicated cooling fan to prevent excessive heat build-up in their acoustic enclosures. The cooling fans will operate whenever the blower is running. No separate controls are provided for the cooling fans.

The SBR is fitted with dissolved oxygen (DO) probe and transmitter (DOT 01) to measure dissolved oxygen levels during the Feed and Aeration Stages.

A common air discharge line connects both blowers to the SBR diffuser aeration system.

The SBR Diffused Air Blowers are equipped with the following modes:

- Manual
- Automatic

In Manual Mode the blowers are controlled using the stop/start pushbuttons located on the Operator Interface. The speed of the blowers in Manual Mode is manually set and adjustable via the Operator Interface.

In Automatic Mode the Aeration Cycle will commence at the end of the Decant Cycle.

Upon initiation of the Aeration Cycle the Duty 1 Blower will start at 50% speed (25 Hz).

The PLC, via a simple PID control algorithm, will generate a control signal output to the Duty 1 Blower variable speed drive to vary the air flowrate to control the SBR DO to the DO setpoint (envisaged to be set at 2.0 mg/l).

If the Duty 1 Blower has run at 100% (50Hz) for more than 5 minutes with the DO(MV) below setpoint (adjustable) then the Duty 1 Blower will ramp down to 50% speed and the Duty 2 Blower will start at minimum speed (ie: 50% or 25 Hz) and run in parallel with the Duty 1 Blower.

The Duty 2 Blower will stay at minimum speed (ie. 50%) until Duty 1 Blower has reached 100%. The Duty 2 Blower will then be allowed to ramp up to achieve DO setpoint as required. As the system air requirement drops the Duty 2 Blower will ramp down first to minimum speed, followed by the Duty 1 Blower. Once both blowers have run at minimum speed for more than 5 minutes the Duty 2 Blower will stop and the Duty 1 Blower ramped back up to 100%, then allowed to control.

DO Low and High alarms (adjustable) are set to indicate loss of DO control. These alarms are masked (adjustable 0-20 mins) and self-resetting during the Aeration Cycle and are masked during the Decant and Settling stages (ie. when the blowers are not running).

If the Duty 1 Blower is running at minimum speed the DO Out of Range High Alarm will be masked.

Action Upon Failure

(i) Duty 1 Diffused Air Blower Failure

- Alarm, stop the Duty 1 Blower and start the Duty 2 Blower if not already running and allow to control

(ii) Duty 2 Diffused Air Blower Failure

- Alarm

(iii) Diffused Air Blower Cooling Fan Failure

- See (i) and (ii)

(iv) Dissolved Oxygen Transmitter Failure

- Alarm, run the Duty 1 Blower at default speed and start Duty 2 Blower and run it at default speed (adjustable 50 – 100%).

(v) PLC Power Supply Failure

- Drives will stop and alarm

Interlocks

The Diffused Air Blowers will be inhibited if:

(i) Blower Cooling Fan fails to start or fails during operation (all modes)

(ii) The MCC Emergency Stop Button is latched (all modes)

Control Locations and Type

(i) Operator Interface
- Duty/Standby Selection
- DO Setpoint stop/start pushbuttons
- Blower speed (Local Mode) 50 – 100% (ie 25 - 50 Hz)
- Blower Default Speed (50 – 100%)

(ii) MCC
- Isolation
- Emergency Stop

Indications

(i) Operator Interface	Range
• Diffused Air Blower #1 speed	0 – 100%
• Diffused Air Blower #2 speed	0 – 100%
• Diffused Air Blower #1 Manual Setpoint	0 – 100%
• Diffused Air Blower #2 Manual Setpoint	0 – 100%
• SBR1 DO Setpoint	0 – 5 mg/l
• SBR1 DO MV (actual)	0 – 5 mg/l
• Diffused Air Blower Duty status	NA
• Diffused Air Blower/s Mode	NA
• Diffused Air Blower/s Running/Stopped	NA
• DO Out of Range mask time	0 – 20 mins adjustable
• Blower Default Speed	50 – 100%

(ii) Local
- SBR1 DO MV 0 – 5 mg/l

(iii) VVVF	
• Blower Running	NA
• Blower Speed (frequency)	0-50 Hz

Alarms	**Lag Time**
• SBR Diffused Air Blower #1 Failed to Start	Immediate
• SBR Diffused Air Blower #1 Cooling Fan Failed to Start	Immediate
• SBR Diffused Air Blower #2 Failed to Start	Immediate
• SBR Diffused Air Blower #2 Cooling Fan Failed to Start	Immediate
• SBR Diffused Air Blower #1 VVVF Fault	Immediate
• SBR Diffused Air Blower #2 VVVF	Immediate
• Emergency Stop Latched	Immediate
• SBR DO High	60 secs
• SBR DO Low	60 Secs

Trends	**Range**
• SBR Dissolved Oxygen	0 – 10 mg/l
• Diffused Air Blower #1 Speed	0 – 100%
• Diffused Air Blower #2 Speed	0 – 100%
• Aeration Cycle Time*	0 – 720 mins

*Shown on Overall Cycle Trend

7.8 Antifoam Dosing Control

An Antifoam System is provided to control foaming levels in the SBR during the aeration cycle.

The Antifoam Metering Pump is a 240 volt solenoid driven metering pump dosing antifoam chemical into the SBR Cycle during the aeration cycle.

The Antifoam Metering Pump is started and stopped based on SBR level throughout the Aeration Cycle.

The "Antifoam Start Level 0-100%" and the "Antifoam Stop Level 0-100%" are adjustable via the operator interface.

So as not to overdose the SBR with antifoam an "Antifoam Maximum Cycle Dose Time" (adjustable 0-300 mins) is provided.

The Antifoam Metering Pump is equipped with the following modes:

- Manual
- Sequence

In Manual Mode the Antifoam Metering Pump is operated via the stop/start pushbutton located on the front of the pump. Note that the Antifoam Metering Pump stroke length and stroke rate are also manually adjustable via the controls located on the front of the pump.

In Sequence Mode the Antifoam Metering Pump is controlled via the PLC to dose antifoam based on SBR Level start and stop permissives adjustable via the Operator Interface. This control is achieved by automatically turning the power supply to the pump on and off.

Action Upon Failure

(i) Antifoam Metering Pump Failure

- Alarm, stop the pump and hold.

(ii) PLC Power Supply Failure

- Drive will stop and alarm.

Interlocks

The Antifoam Metering Pump will be inhibited if:

(i) The SBR is not in the Aeration Cycle.

(ii) An Emergency Stop Button is latched (all modes).

(iii) The SBR level is below the Antifoam Dosing Start level.

Control Locations and Type

(i) Operator Interface
- Antifoam Pump Mode Selection
- Antifoam Start Level
- Antifoam Stop Level
- Antifoam Maximum Cycle Dose Time

(ii) MCC (Main)
- Isolation
- Emergency Stop

(iii) Local (at pump)
- Remote ON/OFF control
- Stroke Length
- Stroke Rate
- Local start/stop

Indications

(i) Operator Interface	**Range**
• Antifoam Start Level	0 – 100%
• Antifoam Stop Level	0 – 100%
• Antifoam Maximum Cycle Dose Time	0 – 300 minutes
• Antifoam Pump Running	NA

Pump

• Antifoam Metering Pump Running/Stopped	NA
• Stroke Length	0-100%
• Stroke Rate	0-180/min
• Flowrate l/hr (LCD indication)	0-8 l/hr

Alarms
- Antifoam Metering Pump Not Healthy
- Antifoam Metering Pump not in Sequence Mode
- Antifoam Metering Pump failed to start

Trends	**Range**
• Antifoam Run Time	NA

7.9 SBR pH Control (Future Allowance)

Oxidation of the ammonia content of the leachate effluent produces hydrogen (H^+) ions. If there is a shortfall in alkalinity in the leachate to offset the acid generation then the pH will be lowered during the Aeration Cycle.

If this is shown to be the case then the addition of a Sodium Hydroxide (alkalinity) dosing system to control pH to neutral levels will need to be incorporated into the process. A neutral (pH 7.0-7.2) environment is necessary to maintain the health of the nitrifying biomass and good reaction rate.

At this stage the alkalinity to ammonia ratio in the raw Alexandria Landfill leachate appears to be high enough (ie: greater than 8:1) not to require pH control. As such, control provision in terms of PLC I/O and power supply has been allowed for only. It is noted that the existing LTP system did not include addition of alkalinity.

7.10 Decant System Control

The Decant System consists of a fixed inlet header positioned within SBR and externally mounted SBR Decant electrically activated Valve (AV03) and flow throttling valve.

The liquid level in the SBR is measured by an ultrasonic level probe (LIT02) providing continuous SBR level measurement.

A Decant Stage commences at the end of the Settling Stage and will run until the level in the SBR reaches the calculated Decant Bottom Water Level.

The Decant Bottom Water Level (BWL) is calculated as follows:

$$\text{Decant Bottom Water Level (mm)} = \text{SBR Top Water Level (mm)} - 0.015717 \left[\text{LTP Treatment Rate } (m^3/day) \times \text{Overall Cycle Time (mins)} \right]$$

Where the SBR Top Water Level (TWL) : 0 – 5000 mm is set and adjustable via the SBR Details Screen on the Operator Interface.

The SBR Decant Valve (AV03) can be selected to Manual or Automatic Mode via the Operator Interface.

In Manual Mode the Decant Valve is operated using the open/close pushbuttons on the Operator Interface. In Automatic Mode the valve is controlled by the PLC. Note that the motor driven valve has a 6 second opening and closing time.

Upon initiation of a Decant Stage the SBR Decant Valve will be given a signal to open and will remain open until the calculated Decant Bottom Water Level is reached. The SBR Decant Valve has open and closed limits to provide position feedback to the PLC. Failed to open or closed alarms will be masked for 12 seconds to allow valve opening time.

Action Upon Failure

(i) SBR Decant Valve Fail to Open or Fail Closed.

- Alarm, close the valve and inhibit next Feed Stage.

(ii) Treated Leachate Tank Level Probe Failure

- Alarm, close valve and hold

(iii) SBR Level Probe Failure

- Alarm, close the SBR Decant Valve and inhibit the next Feed Stage.

Interlocks

The SBR Decant Solenoid Valve will be inhibited if:

(i) The Treated Leachate Tank is above High Level

(ii) The SBR level is below Decant BWL

(iii) The Local Emergency Stop Pushbutton has been latched

Control Locations and Type

(i) Operator Interface
- SBR Decant Solenoid Valve Open/Closed selection (Manual Mode only)
- SBR Decant Solenoid Valve Mode selection
- SBR Top Water Level (TWL) (0-5500 mm)

(ii) Local

- Manual valve activation (via manual hand wheel)

Indications

(i)	**Operator Interface**	**Range**
•	SBR Decant Solenoid Valve mode	NA
•	SBR2 Decant Valve open/closed	NA
•	SBR Top Water Level	0 – 5000 mm
•	Calculated Decant Bottom Water Level	0 – 5000 mm
•	SBR Level	0 – 5800 mm

(ii)	**Local**	**Range**
•	SBR1 Level	0 – 5800 mm
•	SBR 1 Decant Solenoid Valves open/closed	NA

Alarms		Lag Time(s)
•	SBR Decant Solenoid Valve AV03 Failed To Open	12
•	SBR Decant Solenoid Valve AV03 Failed To Close	12
•	SBR Decant BWL not reached	NA

Trends		Range
•	Decant Stage Time*	20 – 60 min
•	SBR Level	0 – 5800 mm

(*shown on Overall Cycle Trend)

7.11 Treated Leachate Discharge Pump Control
(Including Wet Weather Control)

The Treated Leachate Discharge pump is a centrifugal motor pump mounted adjacent to the Treated Leachate Storage Tank.

The Treated Leachate Discharge Pump operates off level permissives within the Treated Leachate Storage Tank and is designed to automatically discharge to sewer at a controlled rate not exceeding 15 l/s.

A hydrostatic level probe (LIT03) mounted in the Treated Leachate Tank provides continuous Treated Leachate Tank level indication.

An electromagnetic flowmeter (FIT04) installed in the sewer discharge line provides continuous Treated Leachate discharge flow indication.

The Treated Leachate Discharge Pump is equipped with the following modes:

- Manual
- Automatic

selected via the Operator Interface.

In Manual Mode the pump is controlled by the stop/start pushbuttons located on the Operator Interface. In the Manual Mode all the alarms and process interlocks are inhibited.

In Automatic Mode the Treated Leachate Discharge Pump is started and stopped based on level permissives in the Treated Leachate Storage Tank according to the following:

Permissive	Level (above tank invert)	
Top of Tank	2200	110%
High-High (adjustable)	2000	100%
High (alarm) (adjustable)	1700	85%
Pump Start (adjustable)	800	40%
Pump Stop (adjustable)	500	25%
Low-Low (pump protection)	300	15%

The Sydney Water Trade Waste Agreement for the site requires that leachate not be discharged during rain events.

During periods of wet weather the Treated Leachate Discharge Pump will be inhibited.

Rain Gauge Control is selected ON or OFF manually via the Operator Interface screen.

If rainfall in excess of 10 mm/hr is detected by the rain gauge (tipping bucket type) the Treated Leachate Discharge Pump will be inhibited. Once less than 10 mm/hr is detected in any subsequent period the PLC will automatically revert plant operation back to sewer discharge.

Action Upon Failure

(i) Treated Leachate Tank Level Transmitter Failure

- Alarm, stop the pump

(ii) Treated Leachate Discharge Pump Failure

- Alarm, stop the duty pump

(iii) Treated Leachate Discharge Low Flow Alarm

- Alarm, stop the duty pump

(iv) Treated Leachate Discharge Flowmeter Failure

- Alarm

Interlocks

The Treated Leachate Pump will be inhibited if:

- The Treated Leachate Storage Tank is below Low-Low (all modes).
- Treated Leachate Storage Tank Pump Stop permissive is detected (Auto Mode only).
- An Emergency Stop push button is latched (all modes).
- Rain (> 1 mm/hr) is detected (Auto Mode, Rain Gauge Control Selected).

Control Locations and Type

(i) Operator Interface

- Duty/standby selection
- Treated Leachate Discharge Pump start/stop level permissives
- Treated Leachate Discharge Flowrate High alarm setting
- Treated Leachate Discharge Flowrate Low alarm setting
- Rain Gauge Control Selection (ie: on/off)
- Treated Leachate Tank Level Permissives
- Treated Leachate Discharge Pump Mode Selection
- Treated Leachate Discharge Pump start/stop pushbutton

(ii) MCC

- Isolation
- Emergency Stop

(iii) Local

- Full current Isolator
- Emergency Stop

Indications

(i) Operator Interface	**Range**
• Treated Leachate Storage Tank Level	0 – 100 %
• Treated Leachate Storage Tank High Level alarm	0 – 100 %
• Treated Leachate Storage High High Level alarm	0 – 100 %
• Treated Leachate Discharge Pump Start level permissive	0 – 100 %
• Treated Leachate Discharge Pump Stop level permissive	0 – 100 %
• Treated Leachate Discharge Flow High set point	0 – 20 l/s
• Treated Leachate Discharge Flow Low set point	0 – 20 l/s
• Treated Leachate Discharge Pump Mode Selection	NA
• Treated Leachate Discharge Pump stopped/running	NA
• Treated Leachate Discharge Flow	0 – 10 l/s
• Rain Gauge Control Selection (on/off)	

Alarms	**Lag Time**
• Treated Leachate Discharge Pump Automatic	Immediate
• Treated Leachate Discharge Pump Failed to Start	Immediate
• Treated Leachate Storage Tank Level Low-Low	10 s
• Treated Leachate Storage Tank Level High	10 s
• Treated Leachate Storage Tank Level High-High	10 s
• Treated Leachate Storage Tank Level Probe Failure	Immediate
• Treated Leachate Low Flow	10 s
• Treated Leachate High Flow	10 s
• Treated Leachate Flow Meter Failed	Intermediate

Trend	**Range**
• Treated Leachate Storage Tank Level	0 – 100%
• Treated Leachate Discharge Flowrate	0 -20 l/s

7.12 Treated Leachate Tank Aerator / Mixer Control

Three aspirating type aerator/mixers are located in the Treated Leachate Tank and will be used to provide mixing during Treated Leachate sewer discharge. Note that these units were originally designed to supply oxygen to SBR 2 associated with the original LTP Facility.

The Treated Leachate Tank Aerators will run whenever Treated Leachate Discharge Pumps are running.

In terms of control the three Treated Leachate Tank Aerators will act as one device, however, they will have separate circuit breakers and local isolators.

The Treated Tank Aerators are equipped with the following modes:

- Manual
- Automatic

In Manual Mode the aerators are operated via the stop/start icons on the Operator Interface.

In Automatic Mode the aerators are controlled by the PLC. The Treated Leachate Discharge Pump starts and they will be stopped when the treated Leachate Discharge Pump stops.

Action Upon Failure

(i) Treated Leachate Tank Aerator/Mixer Failure

- Alarm, the remaining healthy aerators to remain running

Interlocks

The Treated Leachate Aerators/Mixers will be inhibited if:

- The Treated Leachate Discharge Pump is not running (Auto Mode only).
- Treated Leachate Storage Tank level is Low Low (Auto Mode only)

Control Locations and Type

(i) Operator Interface
- Mode Selection
- Stop/start pushbuttons

(ii) MCC
- Isolation
- Emergency Stop

(iii) Local
- Full current Isolator (each drive)
- Emergency Stop

Indications

(i) Operator Interface	**Range**
• Treated Leachate Aerators running	NA
• Auto/Manual Mode Selection	NA

Alarms	**Lag Time**
• Treated Leachate Aerator/Mixer No 1 Pump Failed to Start	Immediate
• Treated Leachate Aerator/Mixer No 2 Pump Failed to Start	Immediate
• Treated Leachate Aerator/Mixer No 3 Pump Failed to Start	Immediate

Trend	**Range**
• Treated Leachate Aerator/Mixers running	NA

Annexure I – CQA Outline

1.0 INTRODUCTION

This document provides a preliminary outline of construction quality requirements for a Capping Contractor to be engaged for capping system construction at the Alexandria landfill. Detailed technical specifications are provided separately.

This document shall be read in conjunction with the relevant design package reports, in particular the capping design package M5N-GOL-DPK-900-302-WT-9415, which includes a material specification.

2.0 CONTEXT AND RELATED REQUIREMENTS

Construction quality requirements for capping system construction are one key component of overall remediation validation requirements for Alexandria landfill remediation and redevelopment.

Construction quality assurance requirements for landfill remediation works are presented in Chapter 11 of the NSW EPA draft Landfill Guidelines (2015). The information presented in this document is consistent with the NSW EPA requirements and adopts their terminology with respect to CQA reporting, including the parties involved in CQA activities.

Contractual arrangements for the works are understood to be outlined in the Contract between CDS JV and the Capping Contractor.

Overall Westconnex M5 Project environmental management requirements for the construction works are outlined in the Contract and the landfill rehabilitation Construction Environmental Management Plan (CEMP). Some site specific environmental management requirements for the remediation works are presented in the Remediation Action Plans (RAP) for the landfill site and Bradshaw Mountain (BM) and the neighbouring Canal Road (CR) site.

3.0 CONSTRUCTION QUALITY DOCUMENTS BY CAPPING CONTRACTOR

The Capping Contractor is responsible for document preparation including the major items presented below.

3.1 Pre-Construction Submittals

The Capping Contractor shall prepare and submit for review and acceptance by the Principal, prior to establishment at the Site, the following documents:

- *Construction Program*: Construction Program in Gantt Chart format showing sufficient detail to allow monitoring of progress, including all necessary approvals, and demonstrating consistency with project staging plans compliance with Contract requirements.
- *Safety Plan*: Detailed Safety Management Plan, consistent with the Capping Contractor's internal safety systems and complying with all project requirements.
- *Construction Environmental Management Plan (CEMP)*: Detailed CEMP for their scope of work, complying with all project requirements, including the project wide CEMP.
- *Surface Water Management Plan*: Detailed Surface Water Management Plan, including erosion protection and sediment control measures, to be included in the above CEMP.
- *Quality Management Plan*: Detailed Quality Plan, consistent with the Capping Contractor's internal quality systems and complying with all project requirements.
- *Material Tracking System*: Detailed material tracking system outlining movement and relocation of material onto, out of and within the site.

3.2 Capping Contractor Quality System Records

The Capping Contractor shall prepare Inspection and Test Plans (ITPs) for main construction activities. ITP documents describe in detail what, by who, when and how something will be inspected or tested on site or off-site.

The main items that need to be specified in an Inspection and Test Plan are:

- the item that will be checked/inspected/tested (e.g. density testing, remediation surface, imported material);
- the document that requires this item to be checked (usually it is the Contract or similar document-specification);
- the document that according to, this item will be inspected/tested (usually a standard or a statutory requirement);
- the kind of inspection that needs to be performed (such as visual inspection, document approval);
- the frequency that this inspection needs to be performed (e.g. for density test x tests per 1,000 m^2)
- the objective criteria/tolerance parameters that will determine if the inspection/test for that item has passed or not;
- the kind of document that will be prepared and saved as a record of pass or failure (usually a signed-off form, a test result); and
- the responsibilities of every party involved.

3.3 Work Method Statements

The Capping Contractor shall provide a Work Method Statement presenting the proposed construction methodology of those items identified in the Technical Specification and the RAPs. The following items will require Work Method Statements:

- Construction of capping layer on steep slope (i.e. greater than 3H:1V);
- Survey prior to survey works commencing
- Formation of subgrade
- Topsoil and subsoil placement
- Leachate collection layer drainage aggregate placement
- Leachate sump construction
- Placement of materials in waste mound
- Establishment of exclusion zones for management of contaminated materials; and
- Establishment of Remediation Areas including a map outlining these areas.

Submission of the work method statement for each item constitutes a HOLD POINT. The construction of the items shall not commence until the Hold Point is released.

The work method statement must include, but not necessarily be limited to, the minimum requirements listed below.

- Plant and machinery;
- Maintaining the integrity of the underlying layer during construction;

- Spreading and compaction method for soil/gravel materials in complying with the requirements of the Technical Specification;
- Construction around existing/previously constructed structures;
- Maintain the integrity of the constructed items until covered or handed over;
- Environmental management during construction (including as required by the CEMP and LCMP);
- Environmental management of the remediation works (as required by the RAPs and RASPs); and
- Special requirements for working with the material or the layer.

3.4 Works-as-Executed Survey

The Capping Contractor shall be responsible for setting out the Works and maintaining all benchmarks and set out points needed for the construction of the Works, as well as measurements for payment and Work-as-Executed (WAE) drawings. Setting out works will include setting out of Remediation Areas and exclusion zones.

CDS will provide a surveyor but the contractor will be responsible for booking, co-ordinating and managing the surveyor to deliver the requirements under this specification.

WAE survey is also required for specific items as identified in the technical specification and the RAPs. Surveys shall also include survey of validation sampling and other testing locations.

The Capping Contractor shall ensure that the survey is undertaken on all surfaces required to allow volume or area calculations to be made separately for all construction materials and to document all works constructed. The Capping Contractor shall ensure the surveyor provides volumetric calculations and survey information to satisfy the quality assurance requirements and prepare WAE drawings as required in the Technical Specification. Such calculations and survey information must be sufficient to justify all claims and measurements for payment.

Surveys shall be carried out at maximum 10 m intervals or grid spacing between all survey points and shall pick up the crest and valley lines and all changes in grade. In particular, pipe alignments and invert levels, bottom and top of layers, drains and point features shall be surveyed and documented as required in this Specification.

The Capping Contractor shall provide a Work Method Statement for the survey that shall be approved by the Principal prior to survey works commencing. It shall consider the scope and method of survey, including methodology for the location of data points, and assessment of the thickness of all construction material layers. Submission of the Work Method Statement constitutes a **HOLD POINT**. These activities shall not commence until the Hold Point is released. The Principal shall review the Work Method Statement within 10 business days following receipt.

3.5 Waste Levy and Disposal Documentation

The Capping Contractor shall comply with all requests from the Principal to compile survey records, material purchase and delivery records, and the like to support NSW Waste Levy deduction or exemption claims.

The Capping Contractor shall obtain all required information to track and support (validated) any required off-site treatment and/or disposal of waste materials. This information will be required for inclusion in the EC's Remediation Validation Report.

4.0 CONSTRUCTION QUALITY ACTIVITIES

4.1 Construction Materials Source Approvals and Testing

Refer to requirements in the material specification include in capping design package M5N-GOL-DPK-900-302-WT-9415.

4.2 Hold Points and Inspection Points

Construction quality requirements include 'Hold Points' and 'Inspection Points'. These are defined as follows:

- **HOLD POINT** – An identified point in the construction sequence where the Capping Contractor must halt work and provide required information to the Principal. The Capping Contractor must not resume work until the Hold Point is released, in writing, by the Principal.
- **INSPECTION POINT** – An identified point in the construction sequence where the Capping Contractor is required to provide written notification in advance of commencing work on identified items in order to allow the opportunity for the Principal to directly inspect the Work; the notification must be provided when indicated and in no case less than 24 hours in advance of commencing the Work or as otherwise indicated in this Specification.

4.2.1 Activities Summary

Required construction quality activities, summarised in the table below will generally involve contractor quality plan preparation, contractor quality control activities and reporting/certification, and geotechnical inspection and testing authority (GITA) inspection, testing, and reporting/certification. Detailed requirements will be provided in the Technical Specification. The Capping Contractor should allow for time and costs to undertake these activities and facilitate CQA Engineer requests for samples and inspection access.

Table 1: Construction Quality System Summary for Capping Construction

No.	Activity/Material	Hold Point	Inspection Point	Field Testing by Capping Contractor / GITA	Survey by Capping Contractor	Audit Testing by CQA Engineer
A	**CONSTRUCTION MATERIALS**					
1	Source Approval (each material)	x				x
2	Confirmation of as-delivered material properties (each material)			x		x
B	**CONSTRUCTION ACTIVITIES**					
1	**Formation of Subgrade**					
1.1	*Preliminaries*					
a	Establishment of exclusion zones for management of contaminated materials	x			x	
b	Establishment of Remediation Areas including a map outlining these areas	x			x	
1.2	*Subgrade Preparation*					
a	Work Method Statement	x				
b	Proof roll and repairing soft spots for cap construction in areas other than road pavement		x	x	x	
c	Survey and WAE: drawings and surface analysis	x			x	
Note: * Assuming the work carried out after the enabling works and ground improvement (by others)						
2	**Seepage and Passive Gas Collection System**					
2.1	Trenching and placement of Unit 14 – Collector Drain Pipe, including sand bedding and backfill		x		x	X

No.	Activity/Material	Hold Point	Inspection Point	Field Testing by Capping Contractor / GITA	Survey by Capping Contractor	Audit Testing by CQA Engineer
2.2	Installation of Concrete Pits along Unit 14 alignment and connect Unit 4 to the pits		x		x	
2.3	Trenching and placement of Unit 13A and 13B Feeder Drain and Gas Collection Pipe		x		x	
2.4	Connect Unit 13A and B with Unit 14 and backfill with Unit 19 – Bentonite Pellet		x			
2.5	Backfill trench with Unit 11-Drainage Aggregate and cover with Unit 8 – Separation Geotextile		x			
2.6	Installation of Unit 17 – Gas Vent		x		x	
2.7	Survey and WAE	x			x	
3	**Capping System**					
3.1	*Bearing Layer*					
a	Placement of Unit 4 – Bearing Layer Material		x	x		x
b	Survey and WAE	x			x	
3.2	*Liner Layer*					
a	Geosynthetic Clay Liner (GCL)					
i	Approval of qualified sub-contractor	x				
ii	Panel layout drawings for GCL	x				
iii	Surface preparation for GCL placement	x	x			
iv	Anchor trench excavation and backfill		x	x	x	
v	Placement of Unit 17 – GCL		**full-time**	x		x
b	Placement of Unit 6 – Clay Liner Material					
I	Work method statement for placement of liner on steep slopes					
ii	Placement		x	x		x
c	Survey and WAE	x			x	
3.3	*Subsoil Drainage System*					
a	Placement of Unit 12A – Subsoil Drain		x		x	
b	Placement of Unit 12B – Subsoil Perimeter Drain and connect with Unit 12A		x		x	
c	Installation of outlet pipes					
d	WAE drawings and documentation	x			x	
3.4	*Revegetation Layer (may be amended depending on final design by others)*					
a	Work Method Statement for Unit 1 – Topsoil and Unit 2 – Subsoil Installation	x				

No.	Activity/Material	Hold Point	Inspection Point	Field Testing by Capping Contractor / GITA	Survey by Capping Contractor	Audit Testing by CQA Engineer
b	Placement of first layer of Unit 2 – Topsoil		x	x		
c	Placement of Unit 1 – Topsoil		x	x	x	x
d	Survey and WAE	x			x	
4	**Waste Mound**					
4.1	*Subgrade Preparation (refer item 1.1)*					
4.2	*Underliner Drainage System*					
a	Trenching and placement of Unit 14 – Collector Drain Pipe		x		x	
b	Trenching and placement of Unit 15 – Leachate Feeder Drain and connect to Unit 14		x		x	
c	Backfill trench with Unit 11-Drainage Aggregate and cover with Unit 8 – Separation Geotextile		x			
c	Survey and WAE	x			x	
4.3	*Bearing Layer (refer item 3.1)*					
4.4	*Perimeter Bund*					
a	Setout survey of perimeter bund alignment	x			x	
b	Placement of Unit 5 – Clay Rich Material for the bund		x	x	x	x
c	Survey and WAE	x			x	
4.5	*Liner Layer*					
a	Placement of Unit 5 – Clay Rich Material to form the base		x	x	x	x
b	Survey and WAE	x			x	
4.6	*Leachate Collection System*					
a	Placement of Unit 14 – Collector Drain Pipe		x			
b	Placement of Unit 15 – Leachate Feeder Drain and connect to Unit 14				x	
c	Leachate collection pipe WAE drawings				x	
d	Work Method Statement for placement of Unit 11 – Drainage Aggregate	x				
f	Placement of Unit 7 – Drainage Aggregate		x	x		x
g	Placement of Unit 9 – Filter Geotextile		x	x		x
h	Leachate collection layer WAE drawings (including Leachate Sump)	x			x	
4.7	*Construction of Leachate Sump*					
a	Leachate Sump Construction Work Method Statement	x				
b	Excavation of sump; formation of sump base		x	x	x	
c	Placement of Clay Material and Clay WAE	x	x	x	x	x

No.	Activity/Material	Hold Point	Inspection Point	Field Testing by Capping Contractor / GITA	Survey by Capping Contractor	Audit Testing by CQA Engineer
d	Geosynthetic Materials Installation		x			
e	Installation of Leachate Sump Riser		x		x	
f	Backfilling around the riser with Unit 11 – Drainage Aggregate and covering by Unit 12 – Filter Geotextile		x		x	
4.8	*Waste Mound Filling*					
a	Work Method Statement for placement of materials in waste mound, including wastes, Unit 5 – Clay Rich Material and Unit 3 – Construction Fill	x				
b	Placement of Unit 3 – Construction Fill outside of extent of waste placement			x	x	
c	Placement of Unit 5 – Clay Rich Material along extent of waste placement	x	x	x	x	x
d	Placement of waste		x	x*		
e	Survey and WAE and documentation	x			x	
4.9	*Seepage and Gas Collection System (refer item 2)*					
4.10	*Capping System (refer item 3)*					
	*Method specifications may be developed for waste material not readily testable with conventional methods.					
5	**Active Gas Collection System (by others)**					
6	**Surface water management (to be determined)**					
7	**Revegetation**					
a	Revegetation Plan	x				
b	Additional Construction Quality Management items from future revegetation specification (to be determined)					

5.0 REPORTING REQUIREMENTS

For each Remediation Area (RA) the Capping Contractor shall prepare a preliminary Construction Report within 10 working days of the end of the construction to demonstrate that the constructed capping system satisfies specification requirements. A final report including all laboratory test results outstanding at the time of issue of the preliminary report shall be issued within 5 working days after receipt of all outstanding laboratory test certificates. The Construction Report shall include all construction elements.

To meet an acceptable standard for completeness and detail, the Construction Report should include, but not be limited to, the items outlined below. The Construction Report must be clearly presented.

- all testing and measurement documentation listed in relevant sections in the Technical Specification (to be provided), as well as all items required for the Capping Contractor's Quality Plan
- all WAE documentation
- sufficient discussion and explanation of construction and notable issues encountered to clarify the meaning and significance of all items included in the Construction Report
- Certification: A written statement that the constructed capping system, and all associated works required by the Contract, has been constructed in accordance with Specification requirements.

The Contractor's Construction Report (CCR) for each Remediation Area (RA) will form a significant part of the CQA Engineer's report for each RA. Early examples of the CCR and CQA reports should be provide to the Site Auditor for review. The Site Auditor will rely substantially upon the CCRs and the CQA Engineer's reports in preparation of site audit documentation.

Within two weeks of the completion of capping construction in the final RA, the Capping Contractor shall prepare a final Construction Report covering all construction activities and compiling his separate RA construction reports.

6.0 OTHER ITEMS

6.1 Tolerances and spatial compliance

The final surface tolerances of earthworks, geosynthetics and drainage pipes shall be within the following tolerances:

- Layer thicknesses shall have a tolerance of –0 mm and +100 mm.
- The specified grade of the top of layers, geosynthetics and the invert of drainage pipes is the minimum average grade. The average grade may not be flatter at any location within the works. The Principal may instruct the Capping Contractor to adjust the grades up to ± 2% where they are considered not appropriate for the works without variation to the contract.
- The invert of all pipes shall be within +50 mm to – 50 mm of design levels.
- Tolerance for batter angles – to be confirmed based on the outcomes of the slope stability analysis.
- Tolerance for plan location of constructed features (ie ,Northings and Eastings) – to be confirmed with pavement and structural designers.
- For the works to comply with the specification and design intent the minimum unit thickness and final surface grades as specified on the drawings shall be met. Due to the potential for ground deformation, final surface elevations will not be a point of compliance in areas underlain by waste.

Annexure J – EPA Letter

Our reference: DOC16/248636-03

ROADS AND MARITIME SERVICES
Trading as RMS
Locked Bag 928
NORTH SYDNEY NSW 2059
[redacted]

BY EMAIL & STANDARD POST
26 May 2016

Dear [redacted]

Landfill Closure Management Plan - Environment Protection Licence No. 4627

I refer to CPB Dragados Samsung Joint Venture letter to the Environment Protection Authority ("EPA") dated 29 April 2016 relating to Condition B32(k) of the *Ministers Conditions of Approval for Development for the purposes of the WestConnex New M5 project* and Environment Protection Licence no. 4627 ("the Licence") for the premises located at 10-16 Albert Street, St Peters NSW 2044 ("the Premises").

EPA Endorsement of the LCMP

The EPA has reviewed document titled "Technical Report: St Peters Interchange – Landfill Closure Management Plan LCMP, Golders Associates, 11 April 2016, Document M5N-MNP-900-300-WT-9400-DE and Annexures" and has no outstanding concerns.

If you have any questions in relation to the above please contact Philip Nevill on (02) 9995 6523.

Yours sincerely

[redacted]

[redacted]
Unit Head Waste Compliance
Environment Protection Authority

PO Box A290 Sydney South NSW 1232
59-61 Goulburn St Sydney NSW 2000
Tel: (02) 9995 5000 Fax: (02) 9995 5999
TTY (02) 9211 4723
ABN 43 692 285 758
www.environment.nsw.gov.au

Annexure K – Odour Management Protocol

New M5 - Requests for relocation, respite or individual mitigation solutions regarding landfill odour

Management protocols

Submitted to DPE 4 July 2017

Determining eligibility relocation, respite or individual mitigation solutions regarding landfill odour

SMC and CDS-JV will consider requests for relocation/respite/mitigation on a case by case basis.

SMC and CDS-JV will consider offering individual mitigation solutions where the resident or business person genuinely indicates they are experiencing issues such as (but not limited to):

- significant distress/anxiety and associated symptoms such as loss of sleep
- significant disruption to their lives or business
- chronic health problems that may be heightened by experiencing odour (or other construction impacts) or where discomfort is increased as result of odour (or other construction impacts)
- significant and prolonged impact to amenity, such as continuous exposure (3 consecutive days or more) to high odour
- a high degree of cumulative construction impacts

Generally, SMC and/or CDS-JV will request a meeting or phone conversation with the individual to establish their issues and consider suitable solutions for their needs and circumstance.

SMC and CDS-JV may request documentation such as a medical certificate which diagnoses the health condition or medical assessment to establish the validity of an individual's request for relocation.

SMC and CDS-JV may undertake monitoring (for gas, odour, noise, vibration etc) at the property to establish the establish the validity of an individual's request for relocation.

SMC and/or CDS-JV may refer the case to the New M5 Environmental Representative for consideration and determination if an agreement cannot reasonably be met between the individual and SMC/CDS-JV.

Options available for odour mitigation or respite

Solutions for odour mitigation/respite/relocation will be tailored to the individual. Examples include (but are not limited to):

Mitigation/respite solution	**Examples where this would be generally considered suitable**
Air purification unit	Where relocation is not suitable and where cumulative, long term impacts are being experienced
Hotel accommodation	Where impacts are being experienced during the day and or overnight. Suitable for periods from 1 night to several nights.

Serviced office facilities	Relocation for business people, including those who work from home. Suitable for periods from 1 day to several weeks.
Movie tickets	Short term respite of a few hours

CDS-JV and SMC may consider other mitigation/respite/relocation solutions where reasonable and feasible and where there is demonstrated alleviation of impacts to the stakeholder.

Request escalation process

Stakeholder requests relocation/mitigation solution (outside of licence/COA requirements). This includes requests directed to CDS-JV, SMC, RMS, EPA, DPE, NSW Health
OR
New M5 Project Team (SMC or CDS-JV) identifies a stakeholder who is experiencing significant distress/health impacts/disruption as a result of the project who may require respite, relocation or individual mitigation solutions to manage their wellbeing.

Stakeholders requesting relocation/mitigation solution/respite can expect to have their request acknowledged within 2 hours during standard construction hours.

SMC Community Engagement advised of all requests for relocation/mitigation solutions (outside of licence/COA requirements). DPE will also be advised of these requests.

CDS-JV makes initial recommendation regarding the request and presents this to SMC for consideration.

To validate a stakeholder's request and to inform a decision, either SMC or CDS-JV may request documentation such as a medical certificate with a diagnosis or medical assessment or may request to undertake monitoring (such as for gas, odour, noise, vibration etc) at the stakeholder's property.

CDS-JV will consult with SMC prior to making such requests from a stakeholder.

SMC reviews CDS-JV's recommended decision and endorses or over-rules the decision. Over-ruling the decision may involve offering different or additional mitigations.

CDS-JV and SMC will notify DPE of the decision prior to notifying the stakeholder and will provide supporting documentation if required (subject to the stakeholder's agreement).

CDS-JV advises the stakeholder of the decision and where applicable the mitigations being offered. The authority involved in the initial request will also be notified of the decision.

SMC and CDS-JV is to provide the stakeholder with a decision on their request within 24 hours. Further time may be required to required to determine substantial or complex relocation requests (for example for multiple days/weeks of relocation) or where further documentation is required to demonstrate the validity of the request (for example a medical certificate with a diagnosis). In instances where a decision cannot be made within 24 hours, the stakeholder will be advised of expected timeframes for a decision.

The case may be referred to the New M5 Environmental Representative for consideration and determination if an agreement cannot reasonably be met between the individual and SMC/CDS-JV.