Appendix B5

SGWPW-JHSW-NWW-PM-PLN-000518

Landfill Leachate, Gas and Odour Management Sub Plan – SSI 9737

Sydney Gateway Road Project

August 2021

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Document control

Approval and authorisation

Title	Landfill Leachate, Gas and Odour Management Sub Plan
Endorsed by Environment Representative	Cameron Weller Hutchison Weller Pty Ltd
Signed	
Dated	
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The document is uncontrolled when printed. One controlled hard copy of this Plan, as part of the CEMP and supporting documentation, will be maintained by the Quality Manager at the Project office (and on the Project website).

Copy number	Issued to	Version
1	Transport for New South Wales	
2	Independent Verifier	
3	Environmental Representative	
4	Project Director	
5	Environment and Sustainability Manager	
6	Quality Manager	

Glossary/ Abbreviations

Abbreviations	Expanded text
AQMP	Air Quality Management Sub Plan
BOM	Australian Government Bureau of Meteorology
CEMP	Construction Environmental Management Plan
CoA	Conditions of Approval
COC	Contaminants of Concern
CSSI	Critical State Significant Infrastructure
DPIE	NSW Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EPL	Environmental Protection License
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
ER	Environmental Representative
EWMS	Environmental Work Method Statements
JHSWJV	John Holland Seymour Whyte Joint Venture
LEL	Lower Explosive Limit
LLGOMP	Landfill Leachate, Gas and Odour Management Sub Plan
MDP	Major Development Plan
OU	Odour Unit
PID	Photoionisation Detector
POEO Act	*Protection of the Environment Operations Act 1997*
TWA	Trade Waste Agreement
TWP	Technical Working Paper
TfNSW	Transport for NSW (formerly Roads and Maritime Services)
UMM	Updated Management Measures
VRA	Voluntary Remediation Agreement

Abbreviations	Expanded text
VRP	Voluntary Remediation Proposal

1 Introduction

1.1 Context

This Landfill Leachate, Gas and Odour Management Sub Plan (LLGOMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for Design and Construction of Sydney Gateway Stage 1 & 3 (the Project).

This Plan has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the environmental management measures listed in the Projects combined Environmental Impact Statement (EIS) / Major Development Plan (MDP), Updated Management Measures (UMM's) from the Response to Submissions Report and all applicable legislation and TfNSW requirements.

Note – this Plan has been developed specifically for works occurring within NSW State owned land under approval SSI 9737, which is administered by the NSW Department of Planning, Industry and Environment (DPIE).

1.2 Environmental Management Systems Overview

The environmental management system overview is described in Section 1.6 of the CEMP. Used together, the CEMP, issues specific environmental management plans, strategies, procedures and environmental work method statements (EWMS) which form management guides that clearly identify required environmental management actions for reference by JHSWJV personnel and contractors.

1.3 Background

1.3.1 Background

Transport for NSW (TfNSW) have gained approval to deliver a high capacity road connection linking the Sydney motorway network at St Peters interchange with Sydney Airport's domestic and international terminals and the Port Botany Precinct. The Project is located on both State and Commonwealth land.

For areas on State land, the Project was declared to be critical State significant infrastructure (CSSI) under the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) and was approved by the NSW Minister for Planning and Public Spaces on 27 August 2020.

Commonwealth approval under the *Airports Act 1996* (the *Airports Act*) was granted by the Australian Minister for Infrastructure, Transport and Regional Development on 23 September 2020.

John Holland Seymour White Joint Venture (JHSWJV) have been contracted by Transport for New South Wales (TfNSW) for the Design and Construction of Sydney Gateway Stage 1 & Stage 3 (the Project).

1.3.2 Project Objectives

The objectives of the Project are to connect Sydney Airport Terminal 1 (the International Terminal) and Terminals 2/3 (the Domestic Terminals) with each other and with the Sydney motorway network via St Peters interchange. The Project aims to facilitate the movement of traffic towards Port Botany via General Holmes Drive, and will provide three main routes for traffic:

- Between the Sydney motorway network and Terminal 1, and towards the M5 motorway and the Princes Highway
- Between the Sydney motorway network and Terminals 2/3, and towards General Holmes Drive, Port Botany and Southern Cross Drive

- Between Terminal 1 and Terminals 2/3.

The Project also aims to provide improved access to Sydney Airport land located on both sides of Alexandra Canal and across the Botany Rail Line.

1.3.3 Detailed Description

The Project is located about eight kilometres south of the Sydney Central Business District, in the suburbs of Tempe, St Peters and Mascot. It sits within the boundaries of the Inner West, City of Sydney and Bayside local government areas.

The key features of the Project are illustrated in Figure 1-1, which include:

- Road links to provide access between the Sydney motorway network and Sydney Airport's terminals, consisting of the following components:
    - St Peters interchange connection – a new elevated section of road extending from St Peters interchange to the Botany Rail Line, including an overpass over Canal Road.
    - Terminal 1 connection – a new section of road connecting Terminal 1 with the St Peters interchange connection, including a bridge over Alexandra Canal and an overpass over the Botany Rail Line.
    - Qantas Drive upgrade and extension – widening and upgrading Qantas Drive to connect Terminals 2/3 with the St Peters interchange connection, including a high-level bridge over Alexandra Canal.
- Terminal links – two new sections of road connecting Terminal 1 and Terminals 2/3, including a bridge over Alexandra Canal.
- Terminals 2/3 access – a new elevated viaduct and overpass connecting Terminals 2/3 with the upgraded Qantas Drive.
- Road links to provide access to Sydney Airport land:
    - A new section of road and an overpass connecting Sydney Airport's northern lands on either side of the Botany Rail line (the northern lands access)
    - A new section of road, including a signalised intersection with the Terminal 1 connection and a bridge, connecting Sydney Airport's existing and proposed freight facilities on either side of Alexandra Canal (the freight terminal access)
- An active transport link, about 3 kilometres long and located along the western side of Alexandra Canal, to maintain connections between Sydney Airport, Mascot and the Sydney central business district.
- Intersection upgrades and/or modifications.
- Construction of operational ancillary infrastructure including maintenance bays, new and upgraded drainage infrastructure, signage and lighting, retaining walls, noise barriers, flood mitigation basin, emplacement mounds, utility works and landscaping.

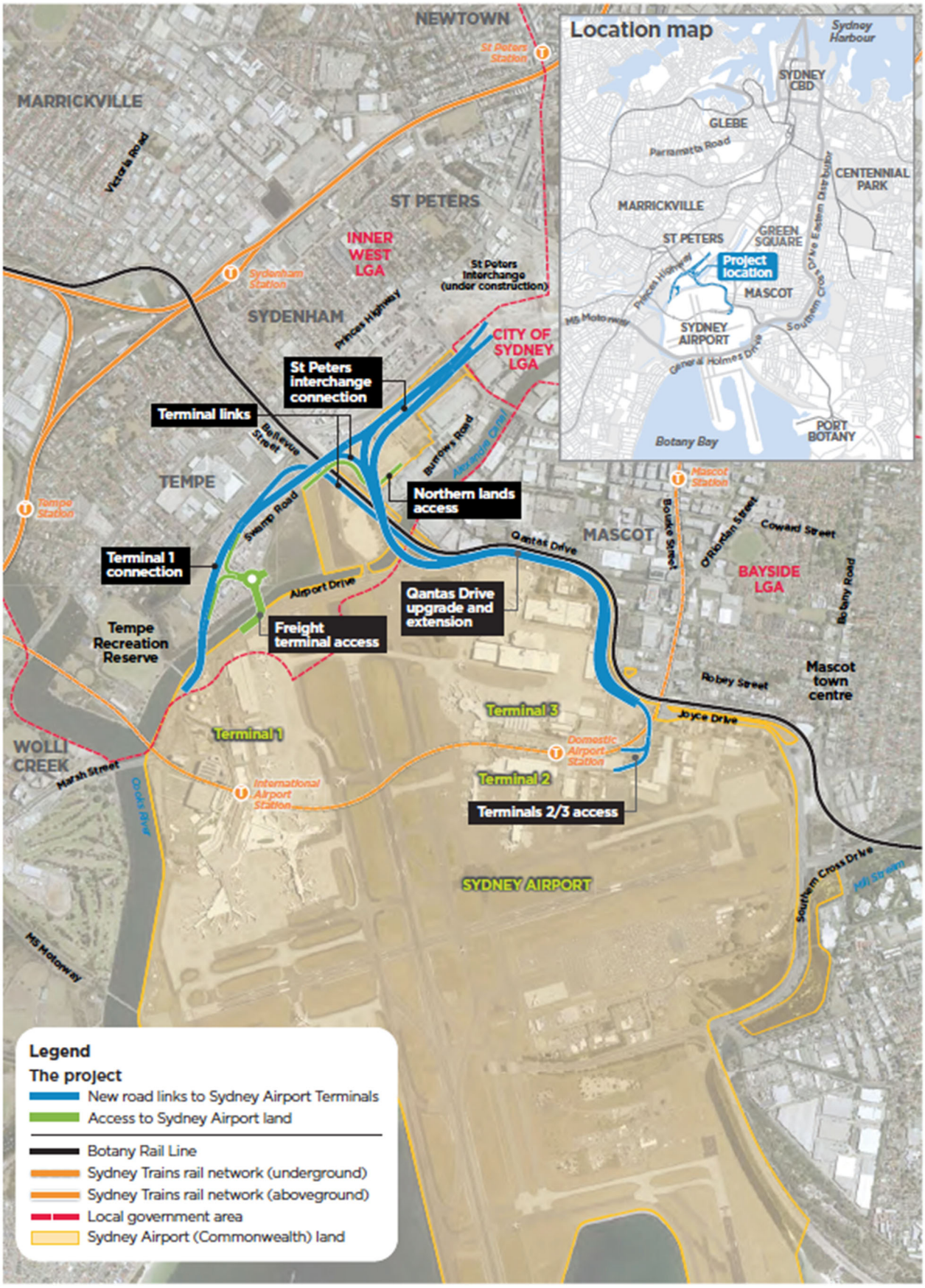


Figure 1-1 Project overview

2 Purpose and Objectives

2.1 Purpose

The purpose of this Plan is to describe how the JHSWJV intends to manage leachate, gas and odours during construction and to satisfy the number of relevant conditions of approval as detailed in Section 3 below.

Note that this document has been prepared to manage leachate, landfill gas and odour in the context of construction activities only.

2.2 Objectives

The key objective of this Plan is to ensure all requirements relevant to the landfill leachate, gas and odours at the former Tempe Landfill are captured, scheduled and assigned responsibility as outlined in:

- The combined Environmental Impact Statement (EIS) / Major Development Plan (MDP) prepared for the Sydney Gateway Project – Stages 1 & 3.
- Conditions of Approval for SSI 9737 issued by the Minister for Planning and Public Spaces (NSW), on 27 August 2020.
- Updated Management Measures (UMM) detailed in the Response to Submissions Report.
- Roads and Maritime specifications G36, G38 and G40.
- The Project's Environmental Protection Licence (EPL).
- Relevant legislation and other requirements described in Section 3.1 of this Plan.
- The objectives of the Voluntary Remediation Agreement (VRA) (Ref. 26050), EMP and any RAPs prepared for the Project.

2.3 Targets and performance outcomes

The following targets have been established for the management of landfill leachate, odour and gas impacts during the delivery of the Project:

- Ensure compliance with the relevant legislative requirements, CoA and UMM.
- Meet environment protection licence (EPL) requirements (note that at the time of preparing this LLGOMP, the EPL had not been finalised so the exact requirements of the Licence are not known).
- Implement management measures to minimise and manage impacts from landfill leachate, gas and odour during construction.

The performance outcomes relevant to this management plan (as identified in Chapter 27.4 Compilation of performance outcomes of the EIS/MDP) are detailed in Table 2-1.

Table 2-1 – Environmental performance targets and outcomes

No.	Performance Outcomes	Where addressed
1	Impacts to water quality during construction and operation are minimised.	The details required by CoA C7 of the Planning Approval and the development of this Plan address the
2	Existing contamination is managed in accordance with relevant regulatory requirements	

No.	Performance Outcomes	Where addressed
3	Odour impacts are minimised through the implementation of the former Tempe landfill odour management plan.	requirements of these performance outcomes.

3 Environmental Requirements

3.1 Relevant Legislation and Guidelines

3.1.1 Legislation

Legislation relevant to this Plan is as follows:

- Environmental Planning and Assessment Act 1979.
- Protection of the Environment Operations Act 1997.
- Contaminated Land Management Act 1997.
- State Environmental Planning Policy No. 55 (Remediation of Land).

For more information relating to legislation refer to Section 3.2.3 of the CEMP. Conditions of Approval specific to items covered in this plan are included in Section 3.3 of this document.

3.1.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this plan include:

- Contaminated Land Guidelines: Assessment and Management of Hazardous Ground Gases (NSW EPA 2020).
- National Environment Protection Councils (NEPC) – National Environment Protection Measure (NEPM) for Ambient Air Quality Guidelines.
- AS 3580.1.1-2007 Methods of Sampling Analysis of Ambient Air. Part 1.1 Guide to Siting Air Monitoring Equipment.
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC 2005).
- Environmental Guidelines: Solid Waste Landfills. Second Edition (NSW EPA 2016).
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000).
- PFAS National Environmental Management Plan (HEPA 2020) (Version 2.0).
- Managing Urban Stormwater: Soils and Construction, Volume 1 (Landcom 2004) and Volume 2 (DECC 2008) (the “Blue Book”).
- Roads and Maritime QA Specification G36 – Environmental Protection (Management System).
- Roads and Maritime QA Specification G38 – Soil and Water Management (Soil and Water Management Sub Plan).
- Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (DEC 2006).
- Workplace Exposure Standards for Airborne Contaminants (Safe Work Australia 2018).

3.2 Conditions of Approval – SSI 9737

The Conditions of Approval (CoA) relevant to this Plan are listed in Table 3-1 below. A cross reference is also included to indicate where the condition is addressed in this Plan or other Project management documents.

Table 3-1 Conditions of Approval Relevant to the LLGOMP

Source	Requirement	How Addressed
CoA C5(f)	The following CEMP Sub-plans must be prepared in consultation with the relevant agencies identified for each CEMP Sub-plan. Details of all information requested by the agency during consultation must be included in the relevant CEMP Sub-plan, including copies of all correspondence from those agencies. (f) Landfill Leachate,, Gas and Odour Relevant Councils.	Consultation has been undertaken with Inner West Council noting they are the only Relevant Council for consultation on this Plan.
CoA C6	The CEMP Sub-plans must state how: (a) the environmental performance outcomes identified in the documents listed in Condition A1 will be achieved; (b) the mitigation measures identified in the documents listed in Condition A1 will be implemented; (c) the relevant terms of this approval will be complied with; and (d) issues requiring management during construction, as identified through ongoing environmental risk analysis, will be managed.	(a) The environmental performance outcomes are detailed in Section 2.3 of this Plan (b) mitigation measures are detailed in Section 6. (c) Section 3 of this Plan details out compliance with the approvals; and (d) issues requiring management during construction and the ongoing review is details in Section 5 and Section 6 of this Plan.
CoA C7(a)	The Landfill Leachate, Gas and Odour CEMP Sub-plan must include: (a) measures to manage landfill gas emissions and limit odours generated during construction so as not to cause offensive odour beyond the boundary of the construction footprint, including site specific action criteria and notification procedures for receivers potentially affected by odour generation;	This Plan covers all of the requirements as noted below. The Plan has been prepared in accordance with the objectives of the existing Voluntary Remediation Proposal

Source	Requirement	How Addressed
		(Agreement No. 26050) as detailed in Section 4.2 of this Plan. Specifically for requirement (a), measures to manage landfill gas emissions and limit odour are detailed in Section 6 of this Plan, as well as in the relevant Appendices (being Appendix B and C). Site specific action criteria are detailed in Appendix B and Cof this Plan for landfill gas and odour respectively. Notification procedures for receivers potentially affected by odour generation from works within the former landfill area are included in Section 6.3 and Appendix C.
CoA C7 (b)	(b) measures to monitor and manage landfill gases accumulating in buildings, basins and subsurface trenches and pits associated with the CSSI;	Monitoring of landfill gas is detailed in Appendix B of this Plan.
CoA C7 (c)	(c) details of the closure and stabilisation of the impacted area of landfill so it is suitable for its intended uses;	The final design of the works will consider the necessary capping and stabilisation to ensure the area is suitable for the intended final use.
CoA C7 (d)	(d) methods for the management of leachate including treatment and disposal as well as measures for preventing leachate resulting from Work migrating from the landfill off site;	Measures to manage leachate are detailed in Section 6.1 of this Plan.

Source	Requirement	How Addressed
CoA C7 (e)	(e) reporting triggers and contingency actions in the event that unacceptable levels of odours, and landfill gases are reached or reported above safe thresholds at the boundary of the construction footprint;	Monitoring Programs detailed in Appendix A (leachate), Appendix B (landfill gas) and Appendix C (odour) detail monitoring requirements and contingency actions as required by this condition.
CoA C7 (f)	(f) reporting triggers and contingency actions should leachate migrate of/site from the landfill or if there is any environmental or health problems caused by leachate;	Monitoring Programs detailed in Appendix A (leachate), Appendix B (landfill gas) and Appendix C (odour) detail monitoring requirements and contingency actions as required by this condition.
CoA C7 (g)	(g) community engagement processes to be undertaken if nuisance odours move beyond the construction boundary;	Detailed on actions in response to community complaints is detailed in the landfill gas monitoring program included in Appendix B of this Plan
CoA C7 (h)	(h) evidence that an EPA accredited Site Auditor has reviewed the Landfill Leachate, Gas and Odour CEMP Sub-plan and has issued an interim audit advice or a Section B Site Audit Statement regarding the appropriateness of the Sub-plan; and	This Plan has been provided to the EPA accredited Site Auditor. A copy of the Interim Audit Advice has been included in Appendix F of this Plan.
CoA C7 (i)	(i) evidence that the Landfill Leachate, Gas and Odour CEMP Sub-plan and the interim audit advice or a Section B Site Audit Statement regarding the appropriateness of the Sub-plan issued by the accredited Site Auditor has been submitted to the relevant council and the EPA and they have no further concern.	This Plan has been provided to the EPA Accredited Site Auditor. This Plan has been provided to IWC and the EPA along with the Interim Audit Advice has been received.

Source	Requirement	How Addressed
		Refer to Section 3.4 of this Plan.
CoA C7 (cont'd)	A copy of any advice or recommendations required by this condition must be submitted to the Planning Secretary for information with the Sub-plan. The Sub-plan must be developed in accordance with the objectives of the existing Voluntary Remediation Proposal (Ref. 26050) approved by the EPA.	As noted in this condition, a copy of the Site Auditor advice is provided in Appendix F of this Plan and will be provided to DPIE with submission of this Sub Plan. The Plan has been prepared in accordance with the objectives of the existing Voluntary Remediation Proposal (Agreement No. 26050) as detailed in Section 4 of this Plan.
CoA C9	Any variations to the Landfill Leachate, Gas and Odour CEMP Sub-plan and Contaminated Aquatic Sediments in Alexandra Canal CEMP Sub-plan must be approved in writing by the EPA accredited Site Auditor and evidence of the approval submitted to the Planning Secretary for information with the amended Sub-plan.	The process for updating of this Plan, including the requirements of this condition, are detailed in Section 8.2 of this Plan
CoA C15(b)	C15 The following Construction Monitoring Programs must be prepared in consultation with the relevant agencies identified for each program to compare actual performance of construction of the CSSI against the predicted performance and to inform management measures. (b) Leachate, landfill gas and odour – Relevant councils.	Construction Monitoring Programs are detailed in Appendix A (leachate), Appendix B (landfill gas) and Appendix C (odour) detail monitoring of this Plan.
CoA C16	Each Construction Monitoring Program must provide: (a) details of baseline data available; (b) details of baseline data to be obtained and when; (c) details of all monitoring of the project to be undertaken; (d) the parameters of the project to be monitored;	Construction Monitoring Programs are detailed in Appendix A (leachate), Appendix B (landfill gas) and Appendix C (odour) detail monitoring of this Plan.

Source	Requirement	How Addressed
	(e) the frequency of monitoring to be undertaken; (f) the location of monitoring; (g) the timeframes and format for reporting of monitoring results and the agencies that will be provided with copies of the monitoring reports; (h) procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and (i) any consultation to be undertaken in relation to the monitoring programs.	
CoA C17	The Landfill Leachate, Gas and Odour Monitoring Program must include, but not be limited to: (a) methods for monitoring landfill gas and odour emissions within construction areas, at the construction boundary and in areas outside of the construction boundary where there is a potential for landfill gas and offensive odours, including odour sampling of Tempe landfill material; (b) a monitoring bore network to monitor any leachate movement offsite; (c) reporting triggers and contingency actions in the event that unacceptable levels of gas or odour are reached or reported above safe thresholds; and (d) detail how the results of the monitoring program will inform the management measures in the CEMP Sub-plan for Landfill Leachate, Gas and Odour.	Construction Monitoring Programs are detailed in Appendix A (leachate), Appendix B (landfill gas) and Appendix C (odour) detail monitoring of this Plan.
CoA E1	In addition to the performance outcomes, commitments and mitigation measures specified in the documents listed in Condition A1, all reasonably practicable measures must be implemented to minimise the emission of dust and other air pollutants during the construction and operation of the CSSI.	Refer to the Air Quality Management Sub Plan as well as Section 6.2 and 6.3 relating to landfill gas and odour respectively.
CoA E2	The CSSI must not cause or permit the emission of offensive odour beyond the boundary of the construction footprint.	Protocols outlined in Section 6 and sub-sections of this Plan. Odour monitoring to confirm no offensive odour beyond the boundary is detailed in Appendix C of this Plan.
CoA E46	Should remediation be required to make land suitable for the final intended land use, or if the current leachate management system for Tempe Landfill is to be modified or breached, a Remediation Action Plan must be prepared. Prior to commencing with the remediation, the Proponent must submit to the	A Remediation Action Plan (RAP) will be developed for the former Tempe Landfill and

Source	Requirement	How Addressed
	Planning Secretary for information, the Remediation Action Plan and an Interim Audit Advice or a Section B Site Audit Statement from a NSW EPA accredited Site Auditor that certifies that the Remediation Action Plan is appropriate and that the site can be made suitable for the proposed use. The Remediation Action Plan must be developed in accordance with the objectives of the existing Voluntary Remediation Proposal (Ref. 26050) approved by the EPA. The Remediation Action Plan must be implemented and any changes to the Remediation Action Plan must be approved in writing by the EPA-accredited Site Auditor. *Notes: The leachate management system (as defined by the Voluntary Remediation Proposal Ref. 26050) consists of a cut-off wall, leachate drain, rising main and pump wells.* *It is strongly recommended that a site auditor is engaged as early in the assessment and remediation process as possible, as early communication between parties improves the efficiency of the audit.*	issued to the EPA Accredited Site Auditor for Approval. An Interim Audit Advice (IAA) must be received from the Site Auditor prior to the commencement of excavation below the capping layer. A copy of the RAP will be submitted to the Planning Secretary for information along with the IAA once approved.
CoA E92	Groundwater generated from the dewatering of excavations and leachate from Tempe Landfill cannot be directly discharged to surface waters unless an EPL is in force in regard to the discharge which permits the discharge.	Leachate from Tempe Landfill will be discharged via an approved Trade Waste Agreement with Sydney Water directly to sewer. This is detailed in Section 6.1 of this Plan. Groundwater management (for areas outside the former Tempe landfill) are detailed in the Groundwater Management Sub Plan.

3.3 Other Requirements Relevant to the Development of this Plan

Other requirements detailed in the EIS/MDP, Submissions Report and relevant TfNSW Specifications (G36, 38 and 40) are detailed in Table 3-2 below. This includes reference to relevant documents or sections of this Plan where these requirements are addressed.

Table 3-2 Other Environmental Requirements Relevant to this Plan

Source	Requirement	How addressed
TfNSW G36 – Section 4.4.1	Prepare and implement an Air Quality Management Sub-Plan as part of the CEMP, or include mitigation strategies within the CEMP, to minimise the impact of dust, offensive odour, and other air pollutants on the surrounding environment, including adjacent properties and sensitive places.	This Plan covers the relevant landfill gas monitoring requirements as well as odour as they relate to the Tempe Landfill. Refer to Section 6 of this Plan. All other requirements of this condition are detailed in the Air Quality Management Sub Plan
TfNSW G36 – Section 4.4.1	Comply with the requirements of the POEO Act and any conditions of licences, notifications, approvals or permits in relation to maximum air pollutant levels.	An Environmental Protection Licence will be obtained for the Project. Relevant details will be included in this Plan.
TfNSW G36 – Section 4.4.1	Where air quality monitoring is required, it must comply with the EPA publication "Approved Methods for Sampling and Analysis of Air Pollutants in NSW".	Appendix C of this Plan detailed odour monitoring. All other air quality monitoring is detailed in the Air Quality Management Sub Plan.
UMM – AQ1	The detailed design of the project will seek to minimise the need to expose waste at the former Tempe landfill in order to eliminate potential odour issues during construction.	The alignment of the Sydney Gateway project has been determined by the road corridor acquired by TfNSW. JHSW has designed the Project to minimise excavation and has chosen construction methods, such as concrete modular columns (CMC) in the landfill area which displaces the waste and soil material rather than removes it, and then fills the core with concrete without expose of waste to the surface, thereby minimising waste exposure. The relevant JHSW Design Reports include: • RD-1310 Alignments – South Zone 2000 International Terminal and Tempe • DR-1450 – Drainage Design – South zone 2000 International Terminal and Tempe • GT-1460 Geotechnical Design and Ground Improvement Works

Source	Requirement	How addressed
UMM – AQ2	A Construction Air Quality Management Plan will be prepared as part of the CEMP and implemented during construction. The plan will detail processes, responsibilities and measures to manage air quality, odour and landfill gas and minimise the potential for impacts during construction. The plan will include an air quality, odour and landfill gas monitoring program, and will detail the measures that will be implemented to compare the actual performance of construction against the predicted performance. Monitoring will be undertaken for the duration of construction.	This Plan covers the relevant landfill gas monitoring requirements as well as odour as they relate to the Tempe Landfill. Refer to Section 6 of this Plan and also to Appendix B (landfill gas) and Appendix C (odour). All other requirements of this condition are detailed in the Air Quality Management Sub Plan.
UMM – AQ3	Odour impacts at the former Tempe landfill will be minimised as far as possible by: • Construction planning to minimise the need to expose waste, and/or the area exposed at any time and to minimise contact between surface water and exposed waste • Where there is the potential to generate odour, implementing the odour management strategy (measure AQ4). Further modelling will be carried out to demonstrate that the proposed excavation methodology for the former Tempe Landfill can comply with the 2 OU criterion. This will be informed by sampling of the waste to determine the actual waste odour emission rates likely to occur.	The alignment of the Sydney Gateway project has been determined by the road corridor acquired by TfNSW. JHSW has designed the Project to minimise excavation and has chosen construction methods, such as concrete modular columns (CMC) in the landfill area which displaces the waste and soil material rather than removes it, and then fills the core with concrete without expose of waste to the surface, thereby minimising waste exposure and potential for odour. Odour impact minimisation protocols are presented in Table 6-3 of this Plan and specifically mitigation measures O3. Monitoring relating to compliance with the 2 OU criterion is detailed in Appendix C Odour Monitoring Program. In addition, an odour model is currently being finalised which takes into account the extent and areas of excavations to calculate the expected odour generation at sensitive receivers. This model will be used to ensure that the size of open excavations in specific areas is managed to ensure compliance with the 2 Odour Units at sensitive receivers.

Source	Requirement	How addressed
UMM – AQ4	An odour management strategy will be developed and implemented for the duration of works involving ground disturbance at the former Tempe landfill. The strategy will include: • Proposed work methods and mitigation measures that aim to limit odour at sensitive receptors to no more than the 2 OU criterion • Routine observation of weather conditions • Regular odour surveys at receptor locations by appropriately qualified professionals (see AQ5) • Measures to minimise the generation of odour • Mechanisms for investigating odour complaints, including conduct of additional odour surveys • Contingency and rectification measures (e.g. use of deodorisers, aeration of leachate storage(s)) should significant odour issues occur at sensitive receivers in the vicinity of the project site.	Details on odour management are included in Section 6 of this Plan. Information relating to odour monitoring and surveys, as well as contingency measures are detailed in Appendix C of this Plan.
UMM – AQ5	Odour surveys will be undertaken at downwind receptors for the duration of works involving ground disturbance at the former Tempe landfill generally in accordance with Determination of odorants in ambient air by field inspection (VDI 3940, 1993). The odour surveys will be undertaken: • Daily, for one hour when works commence, and prior to works completing • If wind conditions drop below three metres per second ν If an odour complaint is received • Downwind of leachate storage(s). If significant odour issues are observed in the vicinity of sensitive receptors or from leachate storage(s), the contingency and rectification measures defined by the odour management strategy will be implemented (see AQ4).	Information relating to odour monitoring and surveys, as well as contingency measures are detailed in Appendix C of this Plan.

Source	Requirement	How addressed
UMM – GW5	A leachate management strategy will be developed to manage leachate at the former Tempe landfill during construction and ensure that the objectives of the site's voluntary remediation agreement continue to be met. The strategy will: • Identify predicted changes in leachate volumes due to the project, based on the detailed construction methodology • Identify any required changes to the existing leachate management system due to predicted changes in leachate volume and concentration and any other changes due to the project • Describe a framework for monitoring leachate levels and water quality to ensure that no leachate migrates into Alexandra Canal as a result of the project. The strategy will be developed in consultation with Inner West Council, Sydney Water and the NSW EPA.	Details on leachate management are included in Section 6 of this Plan. Information relating to leachate monitoring, as well as contingency measures are detailed in Appendix A of this Plan. Consultation with Inner West Council, Sydney Water and NSW EPA is ongoing with regards to leachate management.
UMM – GW7	A condition assessment of the leachate collection, monitoring and treatment system will be carried out by a suitably qualified specialist prior to project activities that could affect leachate generate and management. A final condition assessment will be carried out at the completion of construction to ensure the leachate collection, monitoring and treatment system is returned to council with the same functionality and condition, subject to fair wear and tear.	This UMM is not the subject of this Plan and will be covered through a separate condition assessment report.

Source	Requirement	How addressed
UMM – SW11	The management of surface water runoff for works within the former Tempe landfill will adopt the following principles: • Isolate exposed waste from surface water runoff from other areas • Minimise contact between rainfall and surface water runoff and exposed waste • Capture and store (temporarily) surface water runoff from areas of exposed waste (leachate) • Size leachate storage(s) based on updated water balance modelling to reflect the proposed construction methodology and to minimise the risk of the capacity being exceeded.	Partially covered in Section 6 and sub-sections of this Plan but also discussed in the Soil and Water Management Sub Plan.

3.4 Consultation

This plan will be provided to Inner West Council for consultation in accordance with CoA C5 (f) and further to Sydney Water and NSW EPA in accordance with UMM GW5. Refer to Section 2 and Section 3 of the CEMP for consultation requirements relating to the CEMP and all Sub-plans.

It is considered that as this Plan applies to the former Tempe Landfill area, the only relevant Council is therefore Inner West Council.

This Plan will be provided to the EPA accredited Site Auditor for review and approval. An interim audit advice will then be provided by the Auditor as well request for confirmation on the suitability of proposed controls and monitoring and the appropriateness of this Plan (refer Appendix F for the Interim Audit Advice). The EPA accredited site Auditor will also be responsible for approval of any updates to this Plan as detailed in Section 8.2.

Upon receipt of the interim audit advice by the EPA accredited Site Auditor, this Plan will be submitted to Inner West Council and the EPA in accordance with the requirements of CoA C7(i).

4 Existing Environment

The EPA declared the former Tempe landfill as a Remediation Site (now known as a "significantly contaminated land") on 25 July 2000 under the *Contaminated Land Management Act* (Declaration No. 21005) due to the findings that leachate generated by the buried waste was migrating from the landfill towards Alexandra Canal (NSW EPA, 2000).

On 19 March 2003, Council entered into Voluntary Remediation Proposal (VRP) No. 26050 with the EPA to manage the environmental risks identified (NSW EPA, 2003). The objective of the Proposal was to "ensure that the water quality of Alexandra Canal is not adversely impacted by the leachate originating from the site". The principal feature noted in the VRP which would be required to achieve this objective was the construction and operation of a leachate management system that consists of a cut-off wall, leachate drain, rising main, pump wells and treatment system. These items are discussed further in Section 4.5 and 4.6 of this Plan.

Various remediation efforts have been undertaken, resulting in multiple Remediation Action Plans (RAPs), Environmental Management Plans, Site Audit Statements and Site Audit Reports being prepared. These documents are summarised in the EIS/MDP TWP 16.

The 11 general boundary areas (refer Figure 4-1 below)were identified during the remediation works and have received some level of remediation, as identified in the EIS/MDP TWP 16, although Areas 2 and 3 do not have existing remediation and audit reports, and no information exists on their remediation status. Areas 2 and 3 were most recently utilised by the IWC as a container storage area and previous drilling works undertaken by AECOM in 2018 indicated the presence of a fill layer approximately 3.0m deep across this section. The layer consisted of 0.5m-1.0m of fine to coarse gravel, followed by 1-1.5m of clay and 1-2m of sand. It is unknown when this layer was installed.

Figure 4-1 Former Tempe Landfill Remediation Areas

4.1 Landfill Integrity

In 2003, Coffey prepared a Remedial Action Plan (RAP). The purpose of the RAP was to comply with the requirements of the VRP and to make the land suitable for its intended future use(s). The RAP outlined the remediation strategy for the initial management requirements for the operation of the leachate treatment system, the establishment of a containment system, and the associated ongoing monitoring of the success of the leachate treatment (Coffey Geosciences Pty Ltd, 2003). The site areas defined in the RAP and discussed below are shown in Figure 4-2.

Remediation works undertaken in 2004 included the installation of a bentonite cut-off wall along the boundary with Alexandra Canal, as well as a capping layer, and leachate management systems.

The implementation of the RAP was reported in a Validation Report that was certified by the Site Auditor.

4.2 Capping Layer

Landfill cap validation reports have been prepared for Areas 1A/1B and Areas 4-11, which were reviewed as part of the applicable Site Audit Reports. The auditor noted that the cap was generally constructed as per specifications, using VENM capping to a minimum of 0.5m thickness and compacted to 100% standard compaction. Roads in Area 4 and small sections of Area 5 were capped to a thickness less than 0.5m due to the use of additional asphalt coverage. Areas 8-10 were to remain under Council control and were capped to approx. 0.2m thickness.

Some of the capping materials used by the former Marrickville Council within the container storage area, along with some bulk filling areas or areas below roads in Areas 4-11 were not consistent with VENM or inert waste classifications (note: Inner West Council advises that the remediation was validated by Coffey and signed off by an accredited Site Auditor).

4.3 Bentonite Cut-off Wall

A bentonite cut-off wall has been constructed along the southern, eastern and western sides of the former Tempe landfill, as shown below in Figure 4-2. Under the VRA (26050), the principal requirement of the bentonite cut-off wall was to ensure the permeability was low enough to prevent leachate entering Alexandra Canal and that the wall has no defects to allow significant leakage and extends to the full depth of potential leachate migration.

The validation report for the bentonite cut-off wall advised that the wall was installed down to an average depth of -10 mAHD (range: -4.0m to -12.0m AHD), although it was unknown whether this depth reached impenetrable rock along the entire wall. Various surveys of the bentonite wall identified that the height of the wall was more varied than expected.

Figure 4-2 Monitoring wells and leachate pump pits located along the bentonite wall

4.4 Landfill Leachate

4.4.1 Leachate Collection and Treatment System

The principal requirements of the collection and treatment system was to ensure leachate generated from the landfill was first collected to prevent over topping and collected and appropriately transported to the leachate treatment system. Once at the leachate treatment system, the treated leachate is discharged to sewer under an industrial Trade Wastewater Agreement (TWA) with Sydney Water.

The leachate management system consists of a 1.4km subsoil drainage system, six leachate pumping stations, a leachate transfer pipework/drain, and an on-site leachate treatment plant. Leachate generated from the landfill flows towards Alexandra Canal and is then intercepted by the drainage system leading to a series of leachate sumps. Leachate is then pumped to the leachate treatment plant, treated and then disposed to sewer in accordance with the Sydney Water TWA.

4.4.2 Leachate Characterisation

The EIS/MDP and various Technical Working Papers summarises existing leachate as follows. In 2019 Golder Associates undertook a round of groundwater monitoring across the existing well network (a total of 49 monitoring well locations on and adjacent to the former Tempe Landfill footprint). Samples were collected for laboratory analysis of a range of contaminants of potential concern. The section below presents a summary of the general findings of the monitoring:

- Across the majority of the dataset there were exceedances of the adopted criteria for ammonia, phosphorus, nitrogen, boron and cobalt.

- Occasional exceedances of lead, copper, nickel, zinc, heavier end total recoverable hydrocarbon (TRH) fractions and polycyclic aromatic hydrocarbons (PAHs) were identified.
- PFAS were detected in the samples, albeit at low concentrations.
- Detectable concentrations of dissolved methane were identified in the majority of the monitoring wells with concentrations ranging from below the limit of reporting to 12 mg/L (at locations MPI_2 and MPI_17).

Post-remediation monitoring undertaken by Coffey Environments in 2006 identified that the concentration of ammonia in external monitoring wells had reduced from a pre-remediation average of 89.46 mg/L (measured close to bentonite wall location) to a post remediation average of 53.68 mg/L (inside wall), and that concentrations on the outside of the wall had decreased to 8.59 mg/L (Coffey Environments, 2007). The report also indicated that CoCs were below detection limits and ammonia was generally below the guideline threshold in surface water samples collected from the canal.

The lower ammonia levels detected in the external wells compared to internal wells is generally supported by 2018 and 2019 monitoring, although the concentrations are higher than those reported in 2006. Current leachate conditions within the monitoring wells and within Alexandra Canal are reported in the EIS/MDP TWP 8 – Water Quality and TWP 16 – Former Tempe Landfill Assessment.

4.5 Landfill Gases

A landfill gas monitoring program was initially carried out in 2005, which identified offsite landfill gas migration was occurring. The initial monitoring program indicated that the risk of significant impacts to residents and workers health was low and concluded that gas generation was expected to be within Phase 4 of a landfill cycle, with stable concentrations of methane, carbon dioxide, and nitrogen, and with ongoing reductions in methane production. Finally, the report indicated that landfill gas generation is likely to continue reducing from current levels as most of the organic and putrescible fill material was deposited over 30 years ago.

A number of monitoring wells were installed between 2005 and 2006 (wells GW9-14 and GW16-21) to monitor the site along the affected areas, both on IWC-owned land and within surrounding properties as conditions of the surrender notice (Surrender Condition Notice 1048787). Monitoring results indicated that off-site landfill gas migration was occurring through the north-western property boundary, which resulted in a passive interception and venting trench being installed along the impacted boundary. The trench included a series of 6m tall venting stacks fitted with wind-driven ventilators. The trench and passive venting system extend into the current IKEA property footprint.

Table 4-1 Landfill gas monitoring results between 2016 and 2018 along IKEA border

Date	Gas	Inside Passive Interception and Venting Trench					Outside Passive Interception and Venting Trench			
		GW9A	GW10A	GW12A	GW13A	GW14	GW11A	GW16	GW19A	GW21A
29/2/16	CH_4 (%)	21.1	0.0	0.0	0.9	0.0	1.9	0.0	0.0	0.0
	CO_2 (%)	5.9	0.0	0.0	3.0	0.0	8.5	15.5	0.0	0.7
	O_2 (%)	1.8	20.7	20.9	15.8	20.9	7.2	2.7	20.7	20.6
	Flow Rate (l/hour)	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6/9/16	CH_4 (%)	26.6	Not Sampled	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CO_2 (%)	7.0		0.0	0.1	0.1	14.8	4.8	5.2	8.4
	O_2 (%)	0.0		20.4	20.3	20.3	0.6	14.1	13.0	14.0
	Flow Rate (l/hour)	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
17/2/17	CH_4 (%)	34.5	Not sampled	9.9	30.2	7.0	5.6	0.0	0.0	0.0
	CO_2 (%)	8.0		7.6	12.0	16.0	16.1	19.8	7.0	4.6
	O_2 (%)	0.0		10.1	11.1	0.4	0.0	1.6	11.5	17.0
	Flow Rate (l/hour)	5.8		1.3	1.3	2.1	0.0	1.8	0.1	0.1
6/2/18	CH_4 (%)	21.4	54.7	Destroyed	Destroyed	5.0	NS	0.6	1.0	NS
	CO_2 (%)	8.7	22.0			14.0		0.1	0.1	
	O_2 (%)	0.0	0.0			0.4		21.0	20.0	
	Flow Rate (l/hour)	0.0	0.0			0.0		0.0	0.0	

Recent investigations carried out on behalf of TfNSW in early 2019 have identified the presence of methane at 30-50% volume/volume (v/v) in the golf driving range and former container storage depot (AECOM, 2019). Landfill gas was also identified at 5% v/v in one of the external wells along the Alexandra Canal (MPE7, Figures 5-6 Sheet 2), east of the former container storage depot. The area west of the depot, including the dog park, had concentrations varying between 0.0 and 0.2% v/v methane.

Further ground gas assessment was completed by Coffey in May 2021 (Landfill Gas Monitoring Results Update, April 2021 – Gateway Project). The monitoring included surface gas and subsurface gas at selected locations. The results indicate high concentrations of methane (and carbon dioxide) gas present within the landfill, with most locations reported concentrations of methane gas in exceedance of the EPA criteria of 1.0 %v/v. Some positive stabilised gas flow rates were also reported at several locations located over the waste mass. The results are relatively consistent with the historical gas monitoring undertaken by other parties. Several surface gas exceedances of the NSW EPA action level criteria were obtained within the former container storage yard. The other exceedances were generally limited to the Dog Park area and one minor exceedance located within Sydney Airport land.

4.6 Odour

To date no baseline investigations have been undertaken on the site which allow for direct quantification of odour risk during works. However, based on indirect information derived from related investigations on the site, the key sources identified to date include landfill waste and leachate either exposed or close to the surface which may emit an offensive odour.

Key identified receptors include the following:

- Residential landuse to the north-west.
- Parkland to the south-west.
- Commercial landuse to the north.

5 Environmental Aspects and Impacts

The works taking place across and immediately adjacent to the footprint of the former Tempe Landfill have the potential to expose or in some way disturb historic landfill waste. Based upon available reports and test pit trials undertaken in February 2021, shallow materials across the majority of the construction footprint in the landfill comprises capping and largely inert fill soils with some construction and demolition waste incorporated into it. This material is underlain by more materials derived from a range of sources. This material is considered to likely be impacted by a range of contaminants and comprise putrescible materials. These materials and contaminants have the potential to generate the following issues which can potentially impact the Project:

- Leachate – the product of water within the waste, surface water infiltration and groundwater mixing with leachable contaminants within the waste and becoming impacted by those contaminants over time.
- Landfill gas – biological and chemical degradation of the waste can result in the generation of gases and vapours which can potentially be hazardous to human health and the environment.
- Odour – biological and chemical degradation of the waste, and the very waste itself has the potential to generate nuisance odours which may impact upon the amenity of human receptors on and adjacent to the site during works.

Excavation within the former landfill area will be stages such that each cut is progressed in approximately 1.5 metre sections followed by placement of soil nails and shotcrete for ground support. This sequencing of the works will minimise the extent of excavation open at any one time and will limit the potential volume of leachate within the excavation which has the potential to cause odour during the works. Regular dewatering of excavations will be undertaken to minimise leachate volumes in the excavations (with leachate being directed to the LTP). This will also reduce potential odour generation. In any case, regular review of excavations will also ensure odour mitigation is implemented (eg use of an air curtain around the excavation area) if odour is observed so as to ensure no offensive odour beyond the boundary of the construction site. The deepest area of cut is approximately 6-7 metres closest to Swamp Road and then reduces in depth to approximately 2 metres towards the south west corner of the landfill area.

5.1 Construction Activities

Key aspects of the Project that could result in landfill leachate, gas and/or odour impacts include:

- General earthworks and disturbance within the former Tempe landfill encountering waste.
- Drilling, piling, excavation and benching within the former Tempe landfill encountering leachate as well as gas.
- Concrete modular columns in the former Tempe landfill have the potential to impact existing leachate and gas pathways
- Exposing waste on excavation faces and emplacement areas resulting in potential for gas and odour.
- Disturbance and handling of waste potentially resulting in release of odour and leachate and a pathway for gas migration.
- Treatment of contaminated sites which may potentially result in release of leachate and exposure of malodorous landfill waste.

- Groundwater and leachate extraction/treatment which may result in leachate spills or uncontrolled release.

5.2 Impacts

The potential for impacts with regards to landfill leachate, gas and odour will depend on a number of factors. Primarily impacts will be dependent on the nature, extent and magnitude of construction activities and their interaction with the former Tempe landfill management measures. Meteorological conditions can also affect the extent of impact.

Potential impacts attributable to construction might include:

- Potential odour impacts to surrounding receivers.
- Potential safety hazards due to the explosive potential of methane if concentrations reach five and 15 per cent by volume in air.
- Potential adverse health effects due to an increase in landfill gases (eg methane, carbon dioxide, hydrogen sulphide and carbon monoxide).
- Impacts on water quality and ecology in the Alexandra Canal as a result of poor leachate management.
- Complaints from the public relating to odours.

Some impacts on landfill leachate, gas and odour management attributable to the Project are anticipated and have been described in the EIS/MDP. Section 6 and sub-sections provide a suite of mitigation measures that will be implemented to avoid or minimise those impacts. Appendices A, B and C detail monitoring requirements for leachate, landfill gas and odour respectively and provides a number of contingencies in the event of failure of management and mitigation activities during works.

5.3 Factors Likely to Affect Landfill Leachate, Gas and Odour Impacts

In addition to the inherent risk of key construction activities and their potential to result in landfill leachate, gas and odour impacts, a number of other environment factors also influence these risks. These include (but are not limited to):

- Wind direction – influences the direction of odour impacts.
- Wind speed – governs how much the odour impacts are dispersed.
- Barometric pressure – governs gas flow with lower and dropping pressure increasing potential for gas flow out of a source waste mass.
- Rainfall – rainfall increases the infiltration into the former Tempe landfill leachate.
- Temperature – an increase in temperature could increase the potential odour impact.
- Humidity – increase potential for odour to be perceptible for longer due to increased moisture in the air.

It is recognised that there are a number of other factors such as groundwater levels and other development works which may also influence these impacts.

6 Environmental Control Measures

Specific measures, requirements and management protocols to meet the objectives of this LLGOMP and to address potential impacts from landfill leachate, gas and odours are outlined in the following sections.

All works to be undertaken within the former Tempe Landfill footprint are to be undertaken in accordance with this LLGOMP. In order to achieve this, any proposed works will be assessed by the JHSW Construction Manager or their delegate for the Project using the following flow chart (refer Figure 6.1).

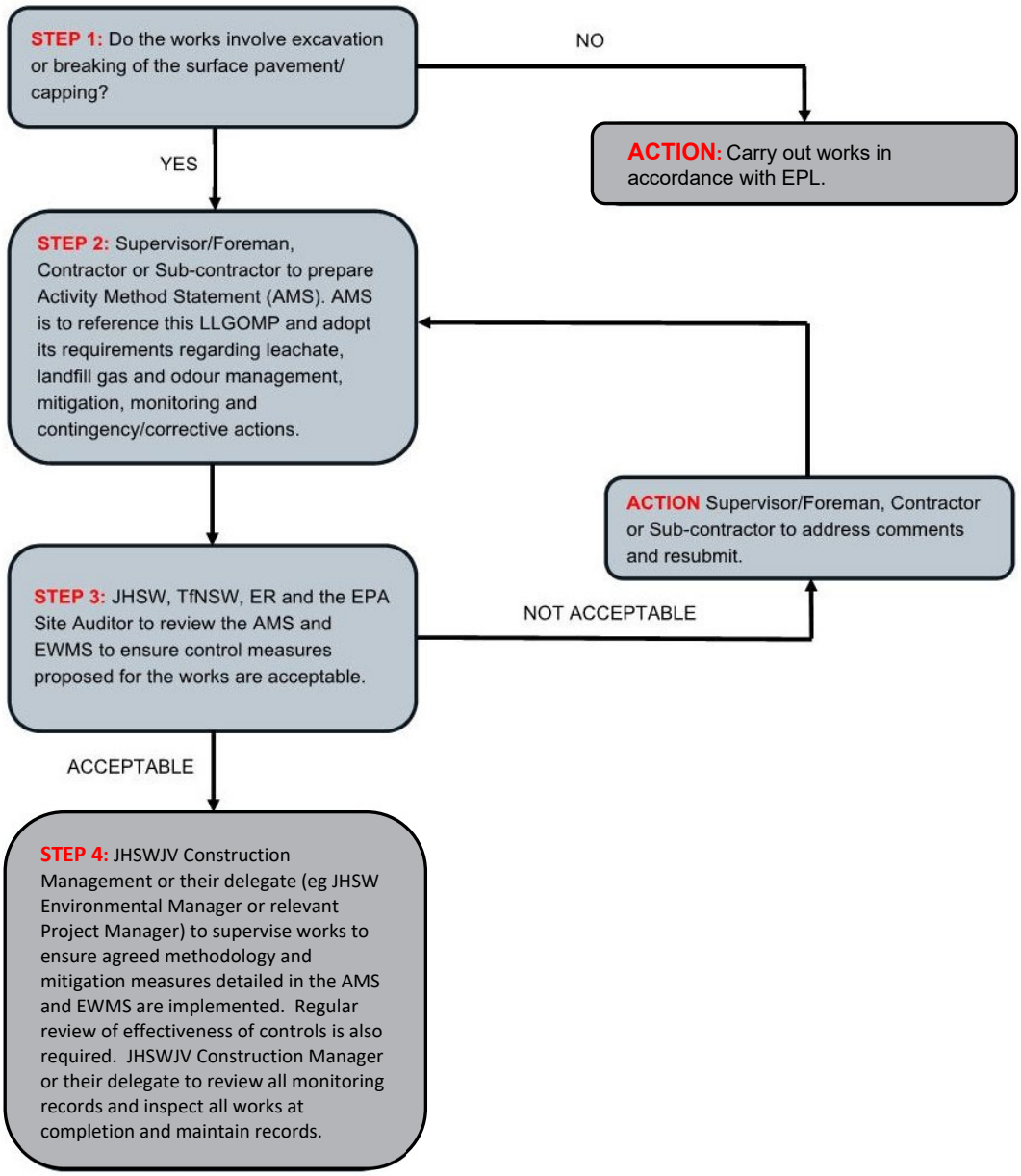


Figure 6-1 Project Control Flowchart

6.1 Landfill Leachate Management and Mitigation

The landfill leachate management and mitigation measures are based around three central objectives:

- Diversion of upgradient flow to prevent runoff into open excavations and reduction of potential for infiltration of runoff into underlying waste.
- Effectively managing increased leachate generation from the works as well as maintain the existing landfill leachate collection system and LTP to mitigate leachate migration from the work site..
- Identification, monitoring and management of leachate across the site extent (including both within excavations and on caps, batters and other permeable and semi-permeable areas across the area of the Tempe Landfill that we will be impacting by construction activities that affect the capping layer) to ensure there is no off site migration.

This Plan refers to the downgradient cut-off wall and leachate extraction and treatment system as a primary means of leachate management for the Project. Section 6.1.1 below provides an overview of the Leachate Treatment Plant (LTP) as a primary control for managing leachate encountered during construction works within the former Tempe Landfill. Additional measures to manage leachate are detailed in Table 6-1 within Section 6.1.3.

6.1.1 Leachate Treatment Plant

As part of the EIS, water balance modelling (using Hydrologic Evaluation of Landfill Performance - HELP) was undertaken to simulate leachate production during the construction phase. The modelling was undertaken using two different scenarios. The first scenario identified an average leachate production rate of 200 kL/day during an average rainfall year. The second scenario presented a range of leachate production (between 200 kL/day and 450 kL/day). Following the EIS water balance modelling, Coffey undertook further HELP modelling as part of their 2021 *Hydrogeological and Groundwater Interpretive Report*. The modelling calculated that in its current unaltered state, leachate generation is averaging 81 kL/day and that during works leachate generation will peak at 368 kL/day before decreasing to 220 kL/day when the working platform is constructed. These results appear to generally correlate with those of the EIS modelling.

JHSW will establish and operate an upgraded LTP for the duration of activities that interact with the former Tempe Landfill. Any groundwater or construction water within the former Tempe Landfill area will be directed to the LTP for treatment and disposal. This upgraded LTP will be operational prior to commencing works within the former Tempe Landfill area.

The proposed LTP is a Sequencing Batch Reactor (SBR). This biological process involves utilising a maintained inventory of nitrifying bacteria to oxidise Ammonia within the raw leachate into Nitrate and Nitrite prior to discharge to sewer. The indicative arrangement for the LTP is shown in Figure 6-2 below.

The upgraded LTP will have a treatment capacity of 450m3/day, equating to approximately 5L/s. This 450m3/day treatment capacity will be achieved by utilising a 200m3/day treatment capacity in the SBR and a hydraulic blending capacity of 250m3/day. Hydraulic blending is a process in which the SBR-treated leachate, with a very low ammonia concentration, is mixed with raw leachate of a higher ammonia concentration, in a 100m3 storage tank. The result is a processed leachate with a combined ammonia concentration that is below the Trade Waste Agreement limit.

The hydraulic blending process has been selected for the following reasons:

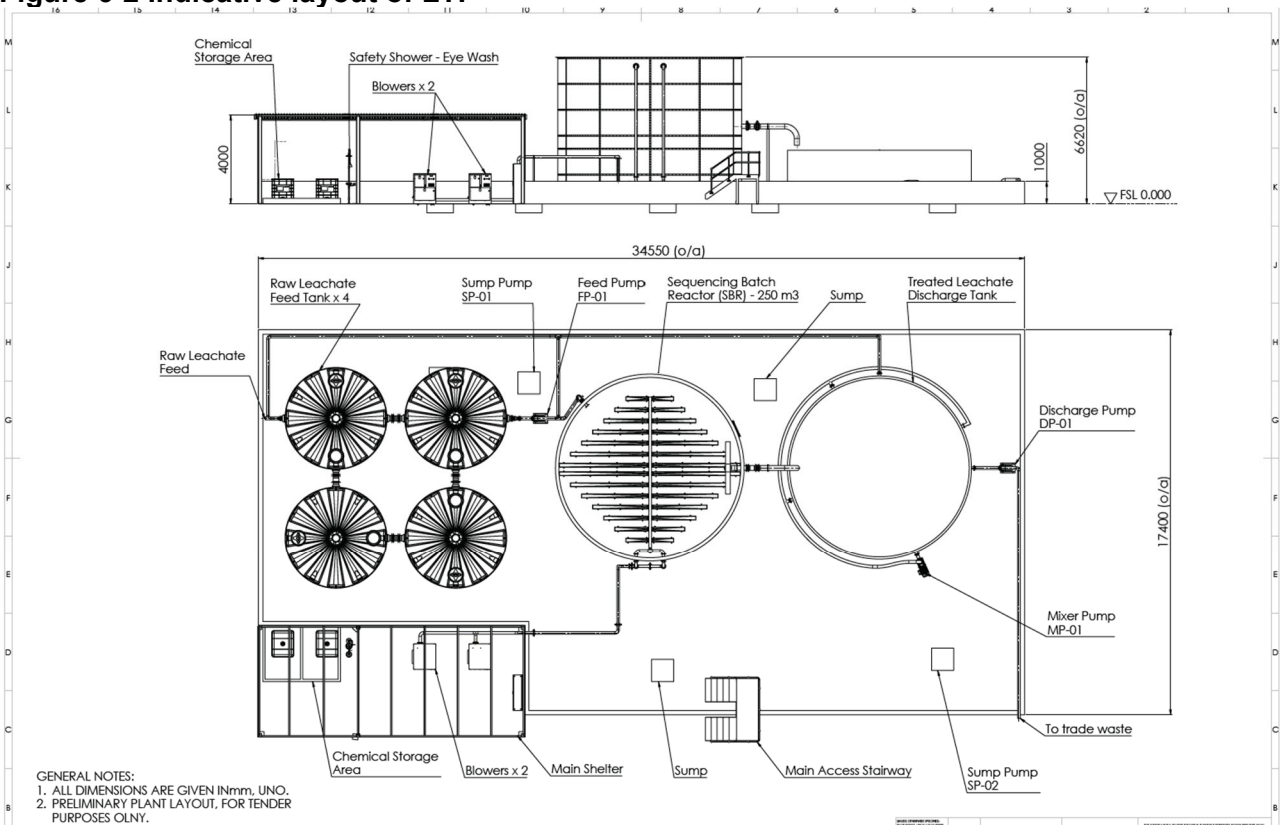
- The leachate generated by the landfill is mature, and typically meets the Trade Waste Agreement limits without treatment, so only minimal treatment is required.

- For the majority of the project timeframe the upper treatment capacity of 450m3/day will not be required. The hydraulic blending allows the treatment to be scalable, without the need to build an oversized plant.
- The SBR treatment capacity of 200m3/day will meet the requirements of leachate treatment for the long term, should the plant be retained following Project completion.

The leachate will be collected using the existing leachate collection system, avoiding impacts to the bentonite wall. The current pump and pipe network has sufficient capacity to meet the 5L/s treatment capacity. Prior to operation of the upgraded LTP the functionality of the pumps will be tested and if they do not meet the 5L/s pumping capacity they will be replaced. The upgraded LTP also includes 200m3 of raw leachate storage to facilitate pumping and storage.

Leachate will be treated to the requirements outlined in the Sydney Water Trade Waste Agreement (TWA35548).

Figure 6-2 Indicative layout of LTP



6.1.2 Dewatering within the former Tempe Landfill

There are three potential methods for dewatering of excavations (leachate management) within the former Tempe Landfill area:

1. Leachate within the former Tempe landfill area will be managed through the LTP in accordance with the discharge limits in place through the Trade Waste Agreement from Sydney Water.
2. Ponded surface water (may or may not contain leachate) may be removed from the site area/excavation via vacuum truck or sealed tanker and transported to the WTP for appropriate treatment and disposal. Testing regimes and discharge limits are in place for

the Water Treatment Plant (subject to finalised EPL). Monitoring results will be provided to the EPA on a monthly basis. Note: The WTP will primarily be in place to treat groundwater as detailed in the Groundwater Management Sub Plan.

3. Leachate will be removed from the site area/excavation via vacuum truck or sealed tanker, tested and disposed offsite as liquid waste to a facility lawfully able to accept the waste. A waste classification report will be prepared prior to lawful disposal. Details will be maintained in the Waste Tracking register.

4. Prior to the commencement of dewatering activities, a Dewatering Permit must be signed off by the relevant Environment Manager. This will include a location map showing the area of the site that will require dewatering; a description and justification of all selected dewatering method; and confirmation of any testing that has been undertaken to confirm discharge criteria. Dewatering may not commence without a signed Permit. This Permit system also applies for transfer of water/leachate from one area of works within the project to another area of the project for final discharge (ie from excavation to WTP/LTP).

6.1.3 Leachate Management and Mitigation Measures

Addition management and mitigation measures to be implemented during works within the former Tempe Landfill are detailed in Table 6-1 below.

Table 6-1 Landfill Leachate Management and Mitigation Measures

ID	Target Hazard	Measure/Requirement	When to implement	Responsibility	Evidence
L1	Minimisation of leachate being generated due to excess surface water infiltration during works.	Clean runoff generated upgradient and adjacent to open excavations/ zones of removed capping will be diverted around the open areas and into on-site stormwater infrastructure. Controls may include construction of stormwater retention ponds, temporary drains, diversion bunds or a combination of all of these. Any stormwater management structures are required to be designed in accordance with Landcom (2004) and in accordance with the Erosion and Sediment Control Plan (ESCP).	Prior to and during earthworks	Supervisor/Foreman. Ongoing review and modification with Supervisor/Foreman	Site Inspections Progressive ESCPs
L2	Minimisation of leachate being generated due to excess surface water infiltration during works.	All existing stormwater systems and structures on the site are to be inspected, reviewed and maintained (to the extent practicable) throughout the project to minimise inflow into open excavations and onto unsealed areas.	During earthworks	Ongoing review and modification with Supervisor/Foreman	Site Inspections Progressive ESCPs
L3	Potential for over-topping of the bentonite wall resulting in a release of leachate	An upgraded LTP will be constructed prior to works commencing in the former Tempe landfill area. This Plant will have additional capacity (total of approx. 450m3/day) than the existing Plant (approx. 81 kL/day) and allowance has been made for expected daily discharge in the Trade Waste Agreement with Sydney Water	Prior to earthworks commencing	Construction Manager/ Environment Manager	LTP Specification Trade Waste Agreement with Sydney Water
L4	Management of WHS risk to site workers and off-site impacts of leachate during site works.	Where reasonable and practical to do so, works will be progressively staged and undertaken to minimise the extent of former landfill area that is opened each day (thereby minimising leachate generation and subsequent potential odour generation, as well as the potential for any off site migration). Excavation will proceed based on approximately 1.5 meter cuts prior to soil nails and shotcrete being placed in the excavated sections. In addition, the weekly forecast will be reviewed by the Site Supervisor and the Environment team to allow for preparation for any expected weather conditions (eg rainfall). Any changes to the works for the week and/or day will depend on the weather expected (eg rain or high winds), the active excavation areas, and the stage of the works. The changes to works will need to be considered on a case by case basis.	During earthworks	Construction Manager/ Environment Manager	Site inspections Progressive ESCPs

ID	Target Hazard	Measure/Requirement	When to implement	Responsibility	Evidence
L5	Management of WHS risk to site workers and off-site impacts of leachate during site works.	Prior to the completion of each days works during excavation in the landfill waste, review and document the site conditions to determine if any mitigation is required. The steps outlined in Appendix E will be documented on a daily basis.	Daily when landfill waste or other higher permeability materials are exposed	Engineer and Environment Manager (or delegate)	Site Inspections Progressive ESCPs
L6	Management of WHS risk to site workers and off-site impacts of leachate during site works.	Where sufficient volumes of water are found to be ponding across the former Tempe Landfill works extent (including within excavations), this surface water will be preferentially pumped into the Leachate Treatment Plant to minimise the potential for offsite migration). Dewatering options are detailed in Section 6.1.2 above. A Dewatering Permit must be completed.	Construction	Engineer	Progressive ESCPs Dewatering Permit
L7	Management of WHS risk to site workers and off-site impacts of leachate during site works.	Implement a program of regular inspection of the full former Tempe Landfill works extent and all open excavations to identify any surface seepage of leachate during the project. Leachate in excavations will be preferentially pumped to the LTP for treatment and disposal as soon as practicable to avoid the potential for odour generation from the leachate. The method of monitoring and contingencies for management of surface seepage are presented in Appendix A.	Weekly throughout earthworks	Engineer	Weekly inspection form (refer Appendix D) Daily review process in Appendix E
L8	Management of WHS risk to site workers and off-site impacts of leachate during site works.	Ongoing review of data from the leachate collection and treatment system throughout the project to establish trends in leachate generation and discharge volumes over time as well as changes in leachate composition in order to adaptively manage leachate controls on the site if required.	Throughout earthworks and operation of the LTP for construction activities	Ongoing review is by Construction Manager, Environment Manager or their delegates	Reporting to EPA (under the EPL)
L9	Management of impacts associated with leachate generated during dewatering.	Groundwater generated from the dewatering of excavations and leachate from Tempe Landfill cannot be directly discharged to surface waters/stormwater/sewage unless an EPL or TWA is in force in regard to the discharge which permits the discharge.	Throughout construction	Construction Team/ Environment team	EPL or TWA and relevant monitoring data (e.g. TWA discharge monitoring reports or EPL annual returns)

6.2 Landfill Gas Management and Mitigation

Landfill gas management and mitigation measures has been prepared with reference to the following guidance documents:

- NSW EPA (2016), *Environmental Guidelines – Solid Waste Landfills*
- NSW EPA (2020), *Contaminated Land Guidelines – Assessment and Management of Hazardous Ground Gases*
- Safe Work Australia (2018), *Workplace Exposure Standards for Airborne Contaminants*
- Safe Work Australia (2020), *Confined Spaces – Code of Practice*

Table 6-2 below details the proposed landfill gas management measures to be implemented throughout construction with the former Tempe Landfill.

Table 6-2 Landfill Gas Management and Mitigation Measures

ID	Measure/Requirement	When to implement	Responsibility	Evidence
LG1	Service pits or open excavations will be considered potentially hazardous zones with respect to landfill gas (i.e. explosive and/or asphyxiant risk) until otherwise cleared by an appropriately qualified person. All staff involved in these works must be inducted prior to works commencing on site to ensure the potential risks are adequately known.	Prior to staff commencing works on-site	Project Manager, Supervisor/Foreman	Site diaries, incident management register and relevant WHS documentation
LG2	Any open excavations or service pits will be assessed for explosive gases prior to works commencing or following breaks. During works a hand-held landfill gas monitor will be used to alert staff if landfill gases are entering the work area. This monitoring will be undertaken in accordance with WHS requirements. Appropriate training will be undertaken for personnel responsible for monitoring.	Ongoing during earthworks	Project Manager, Supervisor/Foreman and WHS Manager (or delegate)	Site diaries, incident management register and relevant WHS documentation
LG3	Ignition sources across the work site will be kept to a minimum. A blanket smoking ban will be applied to the full extent of the former Tempe Landfill area during the duration of works (both within and outside of excavation areas).	Ongoing during earthworks	Project Manager, Supervisor/Foreman	Site diaries, incident management register and relevant WHS documentation
LG4	Implement the monitoring program outlined in the Appendix B.	Throughout the Works	Engineer	Piling monitoring form (see form in Appendix D) and gas monitoring report

ID	Measure/Requirement	When to implement	Responsibility	Evidence
LG5	In the event that monitoring of excavations indicates elevated landfill gas readings, excavation within the landfill area will cease until gas readings are back within tolerance. A review (monitoring) of air quality (odour) and landill gas will be undertaken at the source of the excavation and closest receivers (as detailed in Appendix B, Figure B-1)to determine any potential off-site impact. Measures to manage landfill gas levels may include: • Construction of a cut off trench along the boundary of the JHSW site using approximately 600mm pipe with gravel fill to allow for passive venting; • Construction of a series of boreholes in locations around the area of gas build up to allow for venting of gas; or • Use of a temporary flare (noting that any additional approvals required will need to be in place prior to implementation of this measure). The above measures will be determined on consultation with the landfill gas specialist and the NSW EPA.	In the event of elevated landfill gas readings	Project Manager/ Environment Manager	Landfill gas monitoring form (refer Appendix D)

6.3 Landfill Odour Management and Mitigation

This discussion of landfill odour management and mitigation measures has been prepared with reference to the following guidance documents:

- *Protection of the Environment Operations Act 1997*
- NSW DEC (2006), *Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW*
- NSW EPA (2016), *Environmental Guidelines – Solid Waste Landfills*

JHSW has designed the Project to minimise excavation and has chosen construction methods(such as concrete modular columns (CMC) in the landfill area which displaces the waste and soil material rather than removes it) in order to minimise the extent of excavation that potentially exposes waste to the surface and thereby minimising the potential for odour generation. The measures outlined in Table 6-3 below will be implemented throughout the works in order to manage odour.

Table 6-3 Landfill Odour Management and Mitigation Measures

ID	Measure/Requirement	When to implement	Responsibility	Evidence
O1	Prior to the completion of each days works during excavation in the landfill waste, review and document the site conditions to determine if any mitigation is required. This may include addition of deodoriser directly to the excavation area or use of an air curtain along the edge of the work area to minimise odour. The steps outlined in Appendix E will be documented on a daily basis.	Daily when odorous or landfill waste is exposed	Ongoing review and modification with Supervisor/Foreman	Site diaries
O2	Keep area of waste exposure to as small as practicable in order to minimise odour emitting surface area. Where this cannot be achieved, use of mitigation such as spray systems (portable/manual) or direct application to work areas, deodorising /misting systems, odour suppressant and odour curtains will be implemented if odour is an issue. The appropriate method will be implemented as applicable to the work area and extent of odour. An air curtain will be on site and placed along the edge of the work area. This will be used if odour is evident from the excavation.	Daily/ Additional measures as required.	Project Manager and Supervisor/Foreman	Site diaries Environmental inspection checklists
O3	• To reduce the potential for odour issues (relating to daylighting leachate), the following will be done: Regular review of areas to identify any leachate seeps from exposed waste surfaces.	Incident or activity-based	Project Manager and Supervisor/Foreman	Site diaries, pre-start check documentation and leachate seep

ID	Measure/Requirement	When to implement	Responsibility	Evidence
	• If leachate seep is identified- review the most effective method with the Site Foreman to remove the seep (note- the management of individual seeps will be necessary to review on a case by case basis after assessing risk to human health and the environment). Measures could include installation of earth bund, sandbags, temporary sump/tank, and pumping to LTP.			inspection form (Appendix D)
O4	Where feasible adaptively modify works on-site appropriately when the wind is blowing towards sensitive receptors and odour emitting materials are likely to be exposed. Adjacent identified sensitive receptors include (but are not limited to): • Commercial/industrial properties to the north-west. • Residential properties to the west. • Publicly accessible parklands to the south-west. This assessment will be made prior to the commencement of a daily work shift and involve review of predicted daily weather conditions in coordination with planned works during the shift. In addition, the weekly forecast will be reviewed by the Site Supervisor and the Environment team to allow for preparation for any expected weather conditions (eg high winds). Any changes to the works for the week and/or day will depend on the weather expected (eg rain or high winds), the active excavation areas, and the stage of the works. The changes to works will need to be considered on a case by case basis.	Prior to start of each shift	Project Manager and Supervisor/Foreman. Engage odour specialist for advice as required	Site diaries and pre-start check documentation
O5	Where sufficient volumes of water are found to be ponding across the former Tempe Landfill works extent (including within excavations), this surface water will be preferentially pumped into the Leachate Treatment Plant to reduce the potential for odour	Construction	Engineer	Site inspections Progressive ESCPs Dewatering Permit
O6	Further modelling is currently being carried out to demonstrate that the excavation methodology for works in the former Tempe Landfill can comply with the 2 OU criterion at sensitive receivers. This model will be used to ensure that the size of open excavations in specific areas is managed to ensure compliance with the 2 Odour Units at sensitive receivers.	Construction	Project Manager, Supervisor/Foreman	Odour Model/ Predictions
O7	Implement the monitoring program outlined in Appendix C.	See sections below	Project Manager, Supervisor/Foreman and odour specialist	Site diaries, complaints and incident registers, monitoring reports

ID	Measure/Requirement	When to implement	Responsibility	Evidence
O8	Odour complaints are to be managed in accordance with the JHSW complaints management system presented in the CEMP. Odour monitoring will be conducted following receipt of any odour complaints as detailed in Appendix C, Section C.3 (ie within 2 to 4 hours if the complaint is received during work hours, or as soon as practicable within 24hours when the complaint is received out of hours).	Incident/ complaint based	Community & Stakeholder Manager / Environment Team/ Supervisor/Foreman.	Site diaries, complaints register, incident register
O9	An overview of upcoming works within the former landfill area will be included in routine notifications to the community and will include the details of the 24hour community contact line. This will ensure the local community are kept up to date on the works and contact details in the event of odour concerns.		Community & Stakeholder Manager / Environment Team/ Supervisor/Foreman.	Complaints Register Community Notifications

7 Compliance Management

7.1 Roles and Responsibilities

The JHSWJV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.3 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of this Plan.

7.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to overall environmental management. The induction training will address elements related to landfill leachate, gas and odour management including:

- Requirements of this Plan.
- Applicable and relevant legislative requirements.
- Roles and responsibilities for landfill leachate, gas and odour management.
- Typical construction activities that may impact landfill leachate, gas and odour and associated environmental mitigation and management measures.

Targeted training in the form of toolbox talks or specific training may also be provided to personnel with a key role in landfill leachate, gas and odour management. Examples of training topics could include:

- Potential sources of landfill leachate, gas and odour impacts.
- Impacts to the environment and surrounding community.
- Mitigation measures to minimise landfill leachate, gas and odour impacts.

Further details about staff induction and training are outlined in Section 3.6 of the CEMP.

7.3 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this sub plan, CoA and other relevant approvals, licenses and guidelines. Audit requirements are detailed in Section 3.10 of the CEMP.

7.4 Reporting

Project reporting requirements specifically relevant to the management of landfill leachate, gas and odour impacts are detailed in the Landfill Leachate, Gas and Odour Monitoring Program in Section 6 of this Plan. Other general reporting requirements are further detailed in Section 3.10 of the CEMP.

All reports and data collected as per the monitoring requirements presented in this Plan will be provided to the JHSWJV Construction Manager or their delegate (e.g. the JHSW Environment, Approvals and Sustainability Manager).

During construction, the monitoring data (from the programs detailed in Appendices A, B and C of this Plan) will be collected, tabulated and assessed against the baseline conditions and performance criteria. In accordance with CoA C24, the results of the monitoring program will be submitted to DPIE (and to Inner West Council as required under the Third Party Agreement), for information, in the form of a Construction Monitoring Report.

The Construction Monitoring Report for landfill leachate, gas and odour monitoring will be developed and distributed on a quarterly basis during construction within the former Tempe landfill. These reports will be provided to the EPA accredited Site Auditor as required.

In addition, reporting as required under the EPL (to be finalised) will be provided to the EPA. These reports can also be provided to DPIE for information if required.

Exceedance of the performance criteria will instigate reporting requirements in line with Section 3.11, 3.12 and 4.14 of the CEMP. In addition and, as require by the EPA accredited Site Auditor Interim Audit Advice, the EPA accredited Site Auditor will be notified in the event of any non-conformance with regards to leachate, gas and odour during implementation of this Plan.

8 Review and Improvement

8.1 Continuous Improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies and adaptively amend the plan accordingly.
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement.
- Make comparisons with objectives and targets.

8.2 Plan Update and Amendment

The processes described in Section 3.10 to Section 3.14 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 3.12 of the CEMP.

Note that any variations to the Landfill Leachate, Gas and Odour CEMP Sub-plan must be approved in writing by the EPA accredited Site Auditor and evidence of the approval submitted to the Planning Secretary for information with the amended Sub-plan in accordance with CoA C9.

The LLGOMP document has been prepared to assist JHSWJV to manage odour, leachate and landfill gas risks which may arise during their works on the site (as listed in Section 1.3.3 of this report). Therefore, this document is valid only for the extent of the Project works.

Appendix A Landfill Leachate Monitoring Program

This Appendix contains the Monitoring Program for landfill leachate and has been developed to meet the requirements of CoA C15(b), C16, C17 and C20. Consultation on this Monitoring Program is detailed in Section 3.4 of the Landfill Leachate, Gas and Odour Management Plan.

The following sections discuss the leachate monitoring program to be implemented during construction.

A.1 Site Inspection and Targeted Leachate Seep Sampling Protocol

Regular inspections will be carried out across the construction site and including the landfill face. The purpose of the inspection is to identify any visible evidence of leachate seepage from caps and batters or at the bentonite wall where there is potential for leachate to leave the site boundary. The inspections are to be undertaken by the relevant JHSW Project Manager, Environment Manager or their delegate. The inspections will commence following site establishment of the C3 Compound and the frequency of the inspections is expected to be daily during excavation works within the landfill waste excavation areas. At other times ie before excavation commences, then these inspections are expected to be weekly.

Each site inspection will be documented and the results retained on file. An example form is presented in Appendix D of this Plan.

Where a leachate seep or discharge is identified with the potential to leave the site, and there is sufficient volume being generated that has the potential to migrate off site and the location is safe to access (and there is not an immediate risk to human health or the environment), it is to be sampled by an appropriately qualified person and that sample submitted under chain of custody documentation to a NATA accredited laboratory for analysis of the following parameters:

- Nutrients (ammonia, phosphorus as P, nitrate, nitrite).
- Heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn).
- Total recoverable hydrocarbons (TRH).
- Benzene, toluene, ethylbenzene and xylenes (BTEX).
- Polycyclic aromatic hydrocarbons (PAH).
- Organochlorine pesticides (OCP).
- Polychlorinated biphenyls (PCB).
- Per and poly fluoro alkyl substances (PFAS).

The results are to be compared to relevant human health and ecological criteria based upon the anticipated exposure pathways. Key sources of action criteria can be derived from the following sources:

- National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).
- PFAS National Environmental Management Plan 2020 (NEMP 2.0).

- ANZAST Water Quality Guidelines.

Based upon the field and analytical monitoring results and the comparison against relevant criteria a report shall be prepared. The report will be made available to the Environment Manager and relevant Construction Manager(s). Each report will provide the following:

- The nature of the identified discharge along with date of identification, any external circumstances (such as development works or weather events) which may have resulted in the discharge.
- Details of the sampling along with date, observations of the liquid sampled and method of sampling.
- Discussion of analytical results and comparison to relevant criteria.
- Conclusions and recommendations around management.

Note that where an immediate risk to human health or the environment is identified, the above monitoring and reporting protocol will be superseded by immediate management and mitigation. This is discussed further in the Contingency and Corrective Actions section below.

A.2 Monitoring Well Program

The leachate and groundwater monitoring will be undertaken to compare levels and contaminant concentrations of targeted monitoring wells within the landfill extent, against monitoring wells outside of existing leachate controls (which should have lower contaminant concentrations and groundwater levels closer to surrounding natural conditions).

Baseline monitoring data has been obtained as part of the EIS/MDP development as well as additional monitoring that TfNSW has undertaken up until JHSW was contracted by TfNSW for the Project. In addition, leachate quality data was provided by Inner West Council from the existing LTP to assist in determining the appropriate LTP system upgrade and for negotiations with SWC on the Trade Waste Agreement. Further monitoring has been completed (refer Coffey Report 2021) which, together with the baseline monitoring, shows that the background chemical concentrations outside the bentonite wall are as detailed in Table A-1 below. Trigger levels for monitoring have been established by WSP based on being 10% above the background levels.

Table A-1 Leachate background levels and criteria for trigger levels

Analyte	Background Level (outside bentonite wall)	Trigger Level (outside bentonite wall)
Ammonia	85.5 mg/L	95 mg/L
Phosphorus as P	2.88 mg/L	3.2 mg/L
Nitrate	4.86 mg/L	5.4 mg/L
Nitrite	0.27 mg/L	0.3 mg/L
Total recoverable hydrocarbons	2.16 mg/L	2.4 mg/L
Benzene, toluene, ethylbenzene and xylenes (BTEX).		Not detected – defer to ANZG 2018

Analyte	Background Level (outside bentonite wall)	Trigger Level (outside bentonite wall)
Polycyclic aromatic hydrocarbons (PAH). total	0.01386 mg/L	0.0154 mg/L
Per and poly fluoro alkyl substances (PFAS) (PFOS, PFOA, PFHxS and FTSA only	1.44 ug/L	1.6 ug/L
Dissolved methane.	12.87 mg/L	14.3 mg/L

Groundwater/leachate monitoring events will commence within the first month of bulk earthworks in the contaminated layer and then be undertaken every month until completion of construction. Monitoring each month will include field parameters and lab analysis as detailed below. After construction works are complete, a final closeout groundwater/leachate monitoring event will take place.

During each monitoring event the following field parameters will be collected from each monitoring well by calibrated equipment:

- Groundwater level and free-phase product (with an interface probe).
- pH.
- Electrical conductivity (EC).
- Turbidity.
- Dissolve oxygen (DO).
- Redox potential.
- Temperature.

The wells to be included in the monitoring network include GW7 and GW8 located within the landfill waste mass (and least likely to be impacted by works) and MPE_2, MPE_4, MPE_5, MPE_5A, MPE_7, MPE_11 and MPE_21 located to the south of the bentonite cut-off wall. Refer to Figure A-1 below for the leachate monitoring location plan.

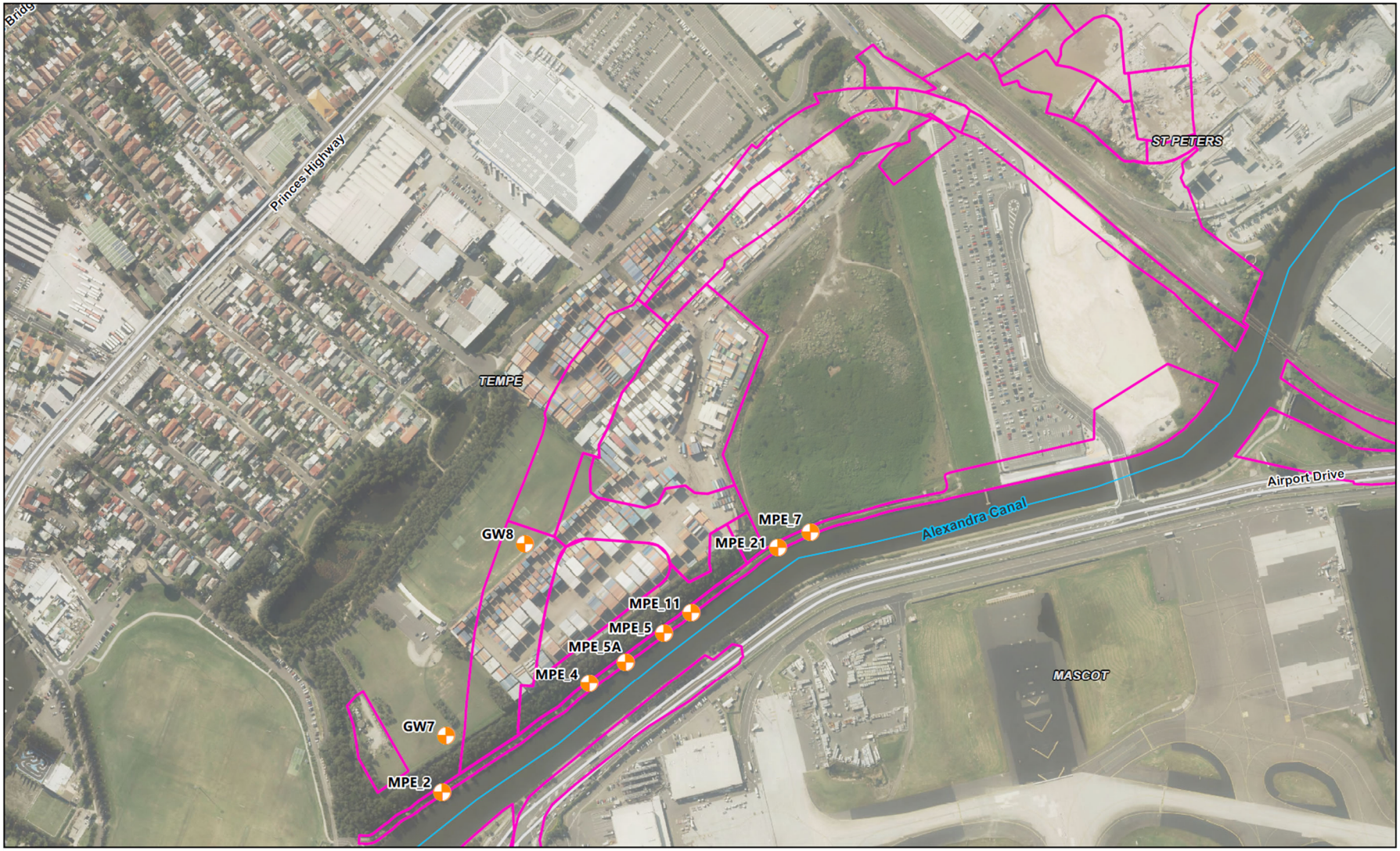


Figure A-1: Leachate Monitoring Locations

Samples will be collected using a low disturbance sampling technique approved prior to commencement by the Site Auditor. Primary and quality control samples will be analysed at a NATA accredited laboratory for the following analytes (full suite):

- Anions and cations.
- Nutrients (ammonia, phosphorus as P, nitrate, nitrite).
- Heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn).
- Total recoverable hydrocarbons (TRH).
- Benzene, toluene, ethylbenzene and xylenes (BTEX).
- Polycyclic aromatic hydrocarbons (PAH).
- Per and poly fluoro alkyl substances (PFAS) (PFOS, PFOA, PFHxS and FTSA only).
- Dissolved methane.

The Action Levels to be applied to the monitoring wells outside of the bentonite cut-off wall are the trigger levels detailed in Table A-1. The groundwater and leachate monitoring report will present a comparison of field and analytical results for monitoring wells within the footprint of the former Tempe Landfill with wells to the south of the bentonite cut-off wall. Each report will provide the following:

  - Summary of relevant regulations and guidance relating to leachate monitoring and management
  - Discussion of site conditions at the time of monitoring along with activities taking place on-site.
  - Discussion of field data collected during sampling.
  - Presentation of analytical monitoring data in a tabular format as well as a discussion in the body of the text and a comparison of the results to relevant criteria.
  - A brief comparison to results from previous monitoring rounds.
  - Conclusions and recommendations (if required) based on the results of the monitoring works.

A.3 Landfill Leachate Contingency and Corrective Action

JHSWJV is responsible for ensuring the management of leachate including treatment and disposal throughout the Work as well as measures for preventing leachate resulting from Work migrating from the landfill off site.

JHSW will measure variance in concentration during the earthworks program against the existing pre-works chemical concentration ranges (background ranges) derived from the monitoring well network to be utilised for the monitoring program. Concentrations exceeding the background ranges by more than 10% will constitute a non-conformance. Non-conformance will be detected through verification processes such as monitoring, inspections and close supervision of activities. All non-conformances will be managed in accordance with Section 3.11 of the CEMP. Any incidents will also be managed in accordance with Section 3.9 of the CEMP.

The corrective actions documented in Table A-2 will be adopted by JHSW (see following page).

Table A-2: Landfill Leachate Corrective/Contingency Measures

EVENT / TRIGGER	CORRECTIVE ACTION / CONTINGENCY PLAN
A leachate seep is identified **outside of excavations and open pits which does not require immediate management** to control odours and or limit risk to human and ecological receptors	Upon identification, isolate the location to prevent seepage from leaving the area undertake targeted repairs of capping, batters and other surface areas to block off leachate seepage. Repairs will vary based upon the surface being repaired (e.g. compacted clay on unsealed surfaces or concrete capping on paved surfaces). Undertake inspections in the days and weeks following the repair works to ensure that the repairs have been successful. If controls require amendment, undertake the works.
A leachate seep or discharge is identified **outside of excavations and open pits which requires immediate management** to control odours and or limit risk to human and ecological receptors potential offsite migration	Upon identification, isolate the location and divert seeping leachate away from sensitive receptors and into temporary holding areas and issue an incident notification. Notify relevant parties within the project team. Based upon advice from civil engineers and contaminated sites specialists, undertake targeted repairs of capping, batters and other surface areas to block off leachate seepage. Repairs will vary based upon the surface being repaired (e.g. compacted clay on unsealed surfaces or concrete capping on paved surfaces). Undertake inspections in the days and weeks following the repair works to ensure that the repairs have been successful. If controls require amendment, undertake the works.
A leachate seep or discharge is identified **within excavations and open pits which requires immediate management** to control odours or limit risk to human and ecological receptors potential offsite migration	Upon identification, isolate the location and divert seeping leachate away from sensitive receptors and into temporary holding areas and update the incident register. Notify relevant parties within the project team. Review construction works occurring. Establish the dewatering procedure for extracting leachate from excavations or reduce inflow into excavations sufficiently for works to be able to continue safely. Review the leachate collection system pumping rates to remove and lower leachate levels, and, if necessary the discharge rates from the LTP to determine if an increase is required. Seek advice from relevant civil engineers, hydrogeologists and WHS and contaminated sites professionals to establish if works can continue safely.

EVENT / TRIGGER	CORRECTIVE ACTION / CONTINGENCY PLAN
	Undertake inspections in the days and weeks following the repair works to ensure that the repairs have been successful. If controls require amendment, undertake the works.
Groundwater and leachate monitoring results identify a potential link between leachate in the former Tempe Landfill and groundwater to the south of the bentonite cut-off wall which did not exist prior to commencement of earthworks and exceedances of the adopted criteria are identified.	Undertake two additional weekly rounds of monitoring at the affected location(s). If initial contaminant exceedances are repeated by the third round of monitoring, the results will be notified to relevant agencies (including EPA under the EPL) and a contaminated site specialist will be consulted to provide adequate characterisation of risk. Undertake proposed further risk characterisation works and establish likely pathways for leachate migration. Based upon the findings of the risk characterisation works, undertake rectification works to reduce or eliminate the contamination risk. This may include increased pumping to the LTP. Continue monitoring of groundwater to track the effectiveness of the implemented controls and based upon the results of the monitoring, undertake further actions (if required).

Appendix B Landfill Gas Monitoring Program

This Appendix contains the Monitoring Program for landfill gas and has been developed to meet the requirements of CoA C15(b), C16, C17 and C20. Consultation on this Monitoring Program is detailed in Section 3.4 of the Landfill Leachate, Gas and Odour Management Plan.

The following section discusses the landfill gas monitoring program to be implemented during construction.

Two forms of monitoring will be undertaken during the works on the site to review potential impacts from landfill has generation.. These will include the following:

- Daily/regular monitoring of pits, excavations and boring/piling operations.
- Monthly sub-surface and structure/enclosed space monitoring.

The intent of these monitoring works is to identify risks to site workers from potential landfill gas migration, meet regulatory requirements for the Project and assess changes to sub-surface conditions which may result from the development works and cause or exacerbate offsite migration of landfill gases. Details of these monitoring works are presented in the following sections.

B.1 Daily/Regular Landfill Gas Monitoring

This monitoring will take place while ground breaking, excavation, boring or piling works are taking place across the works area within the former Tempe Landfill. The works will involve regular monitoring (daily at a minimum but potentially more regularly depending upon works activities) of all open excavations, pits, basins, bores or piling holes to ensure that dangerous atmospheres are not developing within these voids.

Monitoring will be undertaken with a gas meter which can detect oxygen (%v/v), methane (in %v/v), carbon dioxide (in %v/v), carbon monoxide (in ppm) and hydrogen sulfide (in ppm). A photoionisation detector (PID) will also be used to assess for inflow of potential volatile gases and vapours into open excavations. The meters will be kept in full working order for the duration of the Project and also be appropriately calibrated as per the specification of the specific model. Calibration and service documentation will be retained for the meters for reference by relevant parties (e.g. validation consultants or the appointed Site Auditor).

As a minimum, monitoring will take place at the start of a shift each day but may require ongoing monitoring depending on works being undertaken. Monitoring shall be undertaken by individuals who have been trained in the use of the equipment and assessing risk associated with dangerous atmospheres.

B.1.1 Open Excavations , Pits and Basins

During the construction phase the following will be implemented to manage risk to workers from vapours and hazardous ground gases:

- A records sheet (refer Appendix D of this Plan) is to be set up and completed for each area of excavation, date(s) of excavation, gas readings (PID and ground gas), and actions.
- Gas readings will be taken using a gas meter and PID at the surface of the excavation progressively through the entire bulk excavation process. And at the start of every day for existing open excavations.

- If any readings exceed the Action Levels for excavation, excavations will cease until the readings fall below the Action Levels. Refer to Section B.4 contingency tables for further information around managing ongoing exceedances. All identified exceedances and their subsequent management are to be recorded as per the environmental incident reporting procedure presented in the CEMP.

- The Action Levels are as follows:
  - Methane – equal to or more than 1%v/v (one fifth of the explosive limit of methane).
  - Carbon dioxide – equal to or more than 0.5%v/v (source: Time Weighted Average (TWA) for carbon dioxide – Safe Work Australia 2018).
  - Oxygen – equal to or less than 19.5%v/v (source: safe oxygen level - Safe Work Australia 2020).
  - Carbon monoxide – equal to or more than 30ppm (source: TWA for carbon monoxide - Safe Work Australia 2018).
  - Hydrogen sulfide – equal to or more than 10ppm (source: TWA for hydrogen sulfide - Safe Work Australia 2018).
  - Volatile organic compounds - PID reading equal to or more than 10ppm (source: TWA for naphthalene – Safe Work Australia 2018).

B.1.2 Piling or Boring Works

- Prior to moving the piling rig/establishing a new location, the following will be conducted:
  - Measure the LEL at the ground surface where the auger will make contact with the ground and at a height of 1.5 m above the ground surface.
  - Measure the LEL at the ground surface where the piling rig cabin and engine will be located and at a height of 1.5 m above the ground surface.
  - If any readings for gases exceed the Action Levels, then move to an alternative location or allow additional time for ventilation and remeasure the LEL. Once the reading is below the Action Levels then works in that area can commence.
- All intended operators of the gas detectors are to be trained in the use of the detector. A records sheet (refer Appendix D of this Plan) will be set up and completed for each bore, including the bore number, date(s) of boring, depths of gas measurements, gas readings, and actions.
- Whilst boring, gas measurements will be continually taken from the surface directly adjacent to the bore opening with the use of an appropriate gas detector.
- The Action Levels for piling and other boring works are as follows:
  - Methane – equal to or more than 1%v/v (one fifth of the explosive limit of methane).
  - Carbon dioxide – equal to or more than 0.5%v/v (source: TWA for carbon dioxide – Safe Work Australia 2018).
  - Oxygen – equal to or less than 19.5%v/v (source: safe oxygen level - Safe Work Australia 2020).
  - Carbon monoxide – equal to or more than 30ppm (source: TWA for carbon monoxide - Safe Work Australia 2018).
  - Hydrogen sulfide – equal to or more than 10ppm (source: TWA for hydrogen sulfide - Safe Work Australia 2018).

- Volatile organic compounds - PID reading equal to or more than 10ppm (source: TWA for naphthalene – Safe Work Australia 2018).

- If any readings for gases exceed the Action Levels for boring and piling the boring will cease until the reading falls below the Action Levels. Refer to Section B.4 contingency tables for further information around managing ongoing exceedances. All identified exceedances and their subsequent management are to be recorded as per the environmental incident reporting procedure presented in the CEMP.

B.2 Monthly Landfill Gas Monitoring

A program of monthly gas monitoring of the sub-surface and on-site structures will be undertaken in accordance with this monitoring program. The timing of each event will be roughly around the same day every month with one week variation on either side of the day so that preferred atmospheric conditions can be targeted for the sub-surface gas monitoring. The protocol for undertaking these works is presented in the following sections.

B.2.1 Sub-surface Landfill Gas Monitoring

The sub-surface gas monitoring will be undertaken to compare targeted monitoring wells within the landfill extent (and known to contain elevated gas concentrations), against monitoring wells outside of existing gas controls (which should have lower gas concentrations). The procedure for works is as follows:

- Monthly monitoring will be undertaken during the period of concrete modular column installation and bulk earthworks within the former Tempe landfill. Throughout the remainder of construction (ie at all other times) monitoring will be quarterly. (This is subject to confirmation in the EPL).
- During each monthly monitoring event a targeted sub-surface landfill gas monitoring round will be undertaken. Where possible within the required timeframe for each event, the fieldwork will be undertaken during a period of low or falling barometric pressure. .
- Prior to commencing the monitoring wells, each of the selected locations within the network are to be inspected to ensure that they have been fitted with appropriate gas monitoring caps.
- The wells to be included in the monitoring network are included in Figure B-1 below. This is based on available information at the time of preparing this Plan and investigations completed by JHSW. In the event that further monitoring locations are identified, JHSW will consider adding these wells to the monitoring network in consultation with the Site Auditor. It should be noted that according to Uminex gas monitoring reports “A” series locations were replacements for destroyed or lost wells (e.g. GW9A is a replacement for the GW9 gas monitoring well).
- The monitoring equipment will include a landfill gas meter (GA5000 or similar) which can monitor methane (%v/v), carbon dioxide (%v/v), oxygen (%v/v), carbon monoxide (ppm), hydrogen sulfide (ppm) and flow rate (L/hr) and an oil/water interface probe. The equipment will be kept in full working order for the duration of the Project and also be appropriately calibrated as per the specification of the specific model. Calibration and service documentation will be retained for the meters for reference by relevant parties (e.g. validation consultants or the appointed Site Auditor).
- A field monitoring sheet for sub-surface gas monitoring is presented in Appendix D of this Plan and will be filled out with all relevant information during each event. It should be noted that the gas concentrations within monitoring wells within the landfill boundary are anticipated to exceed the criteria and will unlikely require further management. Exceedances of the criteria in wells outside the landfill boundary would be indicative of issues with the existing gas controls and therefore require further investigation and characterisation. Therefore, only these wells outside the landfill boundary will be compared to Sub-surface Action Levels.

- The Sub-surface Action Levels to be applied to wells outside the bentonite wall are as follows:
  - Methane – more than 1%v/v (source: NSW EPA 2020).
  - Carbon dioxide – more than 5%v/v (source: NSW EPA 2020).
  - Carbon monoxide – equal to or more than 30ppm (source: TWA for carbon monoxide - Safe Work Australia 2018).
  - Hydrogen sulfide – equal to or more than 10ppm (source: TWA for hydrogen sulfide - Safe Work Australia 2018).
- In addition to the above, separate gas screening values for wells on the landfill side and wells located outside the interception trench (to be treated as separate datasets) will be calculated. These are to be derived from methane and carbon dioxide concentrations and flow rates as per NSW EPA 2020 and compared to the following table (Table B-1).
- If landfill side wells are identified as having a CS of 3 or more and wells located outside the interception trench are identified as having a CS of 2 or more a landfill gas specialist will be engaged to further characterise risk and if required, propose specific management protocols. A week of daily monitoring should be undertaken to assess gas variability and undertake off-site building internal monitoring to assess receptor risk (using a PID or similar and subject to access being provided by the landowner/occupier). The locations of the off-site building monitoring are identified in Figure B-1 below. Based on the data, a quantitative risk assessment will be prepared which will assess risks and provide recommendations for further action. If further mitigation systems are required to be implemented, these may include increasing the ventilation capacity of the existing mitigation system beneath the roadway or targeting the sub-surface pathway with a ventilation trench or other structure. The location of these gas monitoring wells is shown in the Figure B-1 below.

Table B-1: Modified Wilson and Card Classification (NSW EPA 2012)

Gas Screening Value Threshold (L/hr)	Characteristic Gas Situation	Risk Classification	Additional Factors	Typical Sources
<0.07	1	Very low risk	Typically methane <1%v/v and/or carbon dioxide <5%v/v, otherwise consider increase to CS2	Natural soils with low organic content. Typical fill

Gas Screening Value Threshold (L/hr)	Characteristic Gas Situation	Risk Classification	Additional Factors	Typical Sources
<0.7	2	Low risk	Borehole flow rate not to exceed 70L/hr, otherwise consider increase to CS3	Natural soils with high organic content. Fill
<3.5	3	Moderate risk		Old inert waste landfill Flooded mine workings
<15	4	Moderate to high risk	Consider need for Level 3 risk assessment	Mine workings susceptible to flooding Closed putrescible waste landfill
<70	5	High risk	Level 3 risk assessment required	Shallow, un-flooded abandoned mine workings
>70	6	Very high risk		Recent putrescible waste landfill

Figure B-1: Landfill gas monitoring locations

B.2.2 Surface Structure Monitoring

The monitoring protocol for indoor areas of surface structures is to be undertaken monthly. The procedure for the works is as follows:

- Indoor and enclosed space monitoring is to be undertaken within all temporary site structures during the event (e.g. site offices, amenities buildings, storage sheds, etc.).
- When undertaking indoor air monitoring the inlet will be kept as close as possible to the ground surface (i.e. within 200 mm) to pick up small fluctuations in gas venting from the subsurface. The field sampler will also focus on areas where gas can accumulate including enclosed spaces, ceiling spaces, etc.
- Monitoring will be undertaken using the calibrated flame ionisation detector or similar which measures flammable gases in parts per million (monitoring device will be selected that is capable of detecting methane gas at 20 parts per million). A PID or similar will also be used to assess potential volatile vapours. Note that the main items to be assessed during this monitoring event are flammable gases (such as methane), volatile compounds, carbon dioxide (%v/v), hydrogen sulfide (ppm), carbon monoxide (ppm) and oxygen (%v/v). A field sheet for monitoring these parameters is presented in Appendix D of this Plan.
- The Surface structure Action Levels for the monitoring events are as follows:
    - Methane – equal to or more than 500ppm (source: NSW EPA 2016).
    - Carbon dioxide – equal to or more than 0.5%v/v (source: TWA for carbon dioxide – Safe Work Australia 2018).
    - Oxygen – equal to or less than 19.5%v/v (source: safe oxygen level - Safe Work Australia 2020).
    - Carbon monoxide – equal to or more than 30ppm (source: TWA for carbon monoxide - Safe Work Australia 2018).
    - Hydrogen sulfide – equal to or more than 10ppm (source: TWA for hydrogen sulfide - Safe Work Australia 2018).
    - Volatile organic compounds - PID reading equal to or more than 10ppm (source: TWA for naphthalene – Safe Work Australia 2018).
- Atmospheric data collected from the nearest Bureau of Meteorology weather station for the monitoring period and the week prior will be collected for comparison against monitoring results. Relevant atmospheric parameters include temperature, humidity, rainfall, barometric pressure and wind speed/direction.
- The time of monitoring (start and finish time) will be recorded for comparison against atmospheric data (where required).
- If any readings for gases exceed the Surface structure Action Levels the buildings are to be evacuated immediately and remain so until the reading falls below the Action Levels. At this point a review of potential entry points to these structures will be investigated and a daily monitoring protocol will be implemented to ensure that levels do not continue to exceed Surface structure Action Levels. This will include off-site monitoring of permanent structures at nearest receivers using a PID or similar subject to access being provided by the landowner/occupier. All identified exceedances and their subsequent management are to be recorded in as per the environmental incident reporting procedure in the CEMP.

In addition to the above, routine off site building monitoring will be completed on a quarterly basis at the locations identified in Figure B-1 (subject to access being provided by the landowner/occupier).

B.2.3 Reporting

The monthly report will combine both the surface structure and sub-surface monitoring results. The document will be made available to the Environment Manager and relevant Construction Manager(s). Each letter report will provide the following:

- Summary of relevant regulations and guidance relating to landfill gas monitoring and management
- Discussion of site conditions at the time of monitoring along with activities taking place on-site.
- Discussion of atmospheric conditions (barometric pressure, temperature, humidity,rainfall derived from BoM weather station) on the day of and week preceding the monitoring event and a discussion of how the conditions may have affected data collection.
- Presentation of monitoring data in a tabular format as well as a discussion in the body of the text and a comparison of the results to relevant criteria.
- A brief comparison to results from previous monitoring rounds.
- Conclusions and recommendations (if required) based on the results of the monitoring works.

B.3 Interpretation of Landfill Gas Monitoring Exceedances

Exceedances are measured air emission or air quality levels above the goals. Recurring exceedances are defined as more than two of a similar type within a 12-month period.

All exceedances are to be interpreted in the context of potential risk to human receptors and on-site and off-site infrastructure. Refer to the contingency section below for potential management and mitigation options for exceedances.

B.4 Landfill Gas Contingency and Corrective Action

JHSWJV is responsible for ensuring the ongoing safe condition of the site and surrounds with regards to potential landfill gas hazards on the site and their interaction with construction works, as well as potential for off-site impacts.

Non-conformance will be detected through verification processes such as monitoring, inspections and close supervision of subcontractor activities. All non-conformances will be managed in accordance with Section 3.11 of the CEMP. Any incidents will also be managed in accordance with Section 3.9 of the CEMP.

Contingency and corrective actions for landfill gas hazards detailed in table B-2 below are to be implemented where exceedances are identified during routine monitoring. All exceedances (including one off exceedances) are to be assessed in the context of the exceedance in relation to potential immediate receptors. Section 6.2 of this Plan outlines the additional measures that may be practically implemented in the event of elevated landfill gas levels outside of the landfill. This includes construction of a cut-off trench, use of boreholes for venting, and/or use of a temporary flare.

Table B-2: Landfill Gas Corrective/Contingency Measures

EVENT / TRIGGER	CORRECTIVE ACTION / CONTINGENCY PLAN
Methane detected above 500ppm in internal ambient conditions (enclosed buildings)	If potentially explosive conditions 500ppm are detected or measured in ambient air or readings are increasing such that explosive conditions could develop, then ignition sources will be switched off, the site be evacuated (e.g. using fire evacuation procedures) and emergency services contacted. Note: the NSW EPA will also be informed if levels are detected above 1%v/v in the indoor air environment within 24 hours. Otherwise, conduct intensive monitoring of the surface in the vicinity of the exceedances to identify (if possible) where the methane is coming from. Expand the testing of confined spaces, such as wall cavities, cupboards, etc. Increase routine monitoring frequency to daily until levels decrease to background. Implement additional controls such as cut off trench, placement of boreholes or use a temporary flare to reduce landfill gas. The key project staff listed in the CEMP would be notified and informed of subsequent developments. In addition, TfNSW, Inner West Council, EPA and DPIE will be notified in the event of material environmental harm. In the event explosive conditions are detected in off-site locations (as per the locations identified in Figure B-1), emergency services will be contacted it is considered likely an evacuation procedure will be implemented (noting that emergency services would take over control of the site). In this event, a specific Communications Strategy will be implemented to notify key stakeholders, residents and relevant environmental and safety Authorities and directions implemented in accordance with the JHSW Incident and Emergency Response Plan or as otherwise directed by Emergency Services.
Concentrations of gases or vapours above Action Levels in open excavations, pits or piling bores	If potentially explosive conditions are detected then the pit will be isolated and considered a confined space until cleared by a confined space expert. Notify relevant parties within the project team. If levels remain high, a water spray or fan will be used ahead of the excavator to minimise the opportunity for sparks to develop. Continue monitoring to assess whether the controls are working. If the gas reading persists at greater than the Action Levels, works in the area will cease and a review of construction methodology in consultation with the landfill gas specialist will be undertaken to assess the significance and determine further actions. This may include implementation of additional controls such as placement of boreholes or use a temporary flare to reduce landfill gas. The key project staff listed in the CEMP would be notified and informed of subsequent developments.
Other Landfill gas concentrations above adopted guidelines are recorded within site structures	If landfill gas concentrations within site structures exceed the guideline values presented in this document then access to those areas of the buildings would be controlled and / or temporarily evacuated until ventilation or other measures to address the landfill gas build up had been implemented. Notify relevant parties within the project team. If the gas reading persists at greater than the Action Levels the structure will remain evacuated, and the landfill gas specialist will be contacted to assess the significance and advise on further actions.

Appendix C Landfill Odour Monitoring Program

This Appendix contains the Monitoring Program for landfill odour and has been developed to meet the requirements of CoA C15(b), C16, C17 and C20. Consultation on this Monitoring Program is detailed in Section 3.4 of the Landfill Leachate, Gas and Odour Management Plan.

This section outlines a monitoring program for ongoing assessment of odour throughout construction.

C.1 Odour Monitoring Equipment

A Nasal Ranger will be utilised for odour monitoring across the construction works associated with the former Tempe landfill area. The Nasal Ranger a portable, handheld instrument that can be used anywhere for real-time accurate odour measurement. The odour units (OU) are determined through the use of the aperture of nasal ranger and the gauge on the monitor.

The odour monitoring is conducted as follows:

1. Review of the surrounding receivers via a site walk to determine any noticeable odour;
2. If no odour is detected, go to the active work front and use olfactory senses to determine if there is a noticeable odour.
3. If there is no odour detected at the active work front then no further monitoring is required.
4. If there is odour detected at the active work front then use the Nasal Ranger to record the reading (starting at the highest aperture). Gradually move away from the work front recording the OUs at regular intervals until no odour is detected.

The results must be documented in an Odour Monitoring Form on saved onto SharePoint.

C.2 Staff Training in Odour Assessment

All staff undertaking formal odour monitoring are required to be trained and calibrated for odour assessment in accordance with the requirements for olfactory testing in Australian Standard AS 4323.3:2001 Stationary Source Emissions – Determination of Odour Concentration by Dynamic Olfactometry.

Records of training will be maintained in the 3D Safety Training Module.

C.3 Day to Day Monitoring

During ground disturbance works within the former Tempe landfill daily odour monitoring will be undertaken for one hour when works commence and prior to works completing for the day at downwind receptors. The approximate location of downwind receptors is shown on Figure C-1 below. These locations are indicative only as the location of monitoring will depend on the location of the work front(s) and the wind direction/speed at the time of the works.

Additional odour monitoring will also be undertaken during the day when wind gusts drop below three metres per second (10.8 km/h) for three consecutive hours or in the event of an odour complaint being received. Once a complaint is received, JHSW will review the activities and conduct odour monitoring at the excavation and at the nearest downwind receptor to determine the odour level (against compliance with <2 OU). This monitoring will be completed as soon as practicable after the complaint is received ie within 2 to 4 hour of a complaint within construction hours, and within 24 hours for complaints received out of hours.

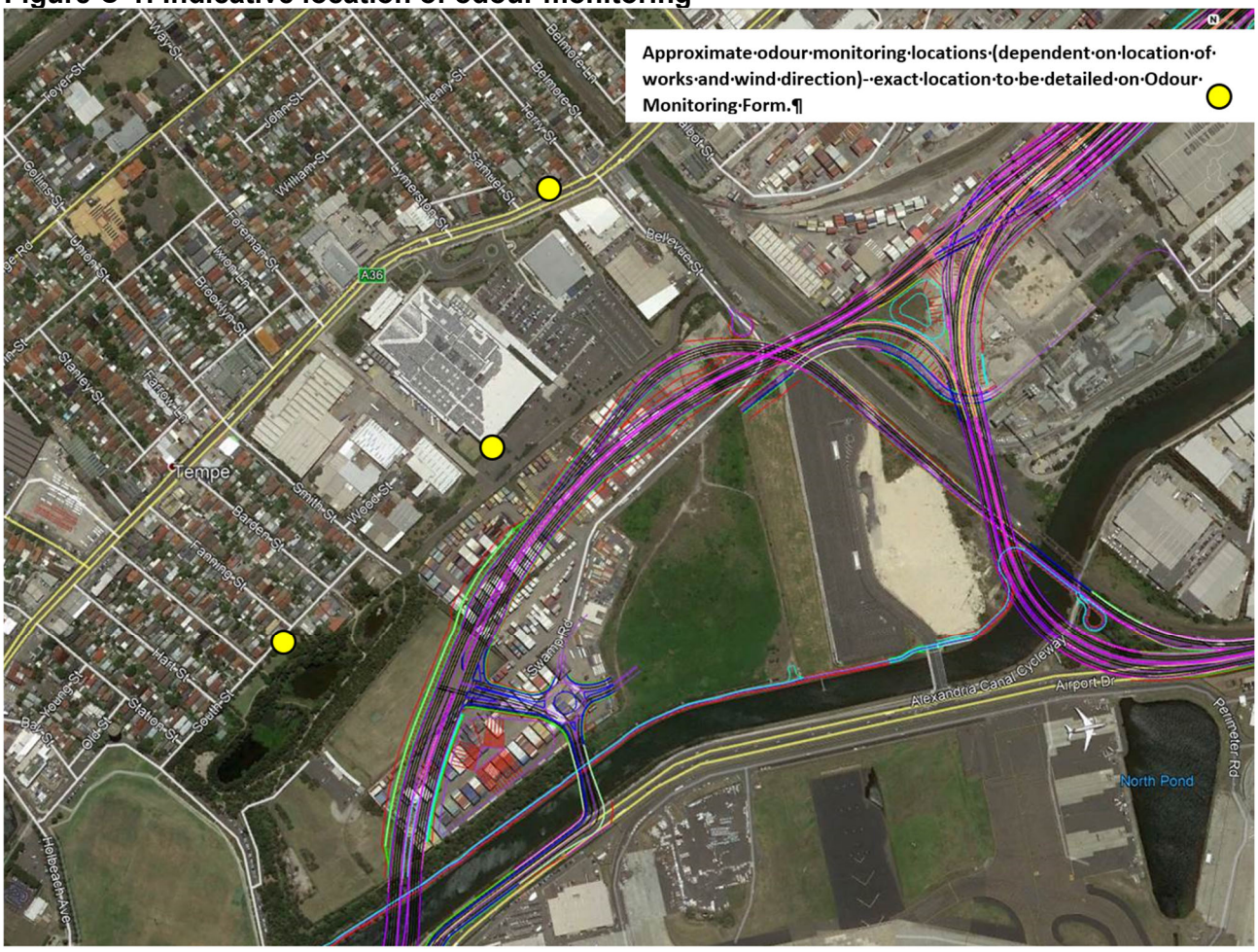
Monitoring will ensure that any odour generation as a result of the construction works does not exceed 2 OUs at downwind sensitive receptors as required by UMM AQ4.

Further, in the event that odour is observed from the leachate treatment plant (either the storage tanks or the SBR) then monitoring will be undertaken downwind of the area when wind is blowing towards sensitive receptors.

Should odour associated with Project works be detected at greater than 2 OU (as determined by the Nasal Ranger monitoring) at downwind sensitive receptors, the source of the odour would be identified and rectification works or additional odour suppressant would be undertaken to reduce odour emanating from the identified source to less than 2 OU. This monitoring is generally in accordance with Determination of odorants in ambient air by field inspection (VDI 3940, 1993) as required by UMM AQ5.

In addition, prior to the completion of each days activities, a review of potential odour from the excavation area will be undertaken to determine any additional mitigation measures that may be required (eg mobile air curtain, application of deodoriser etc) to ensure there adequate mitigation in place to ensure compliance with prescribed odour levels outside of working hours.

Figure C-1: Indicative location of odour monitoring



C.4 Three-Monthly Monitoring

A three-monthly odour monitoring program will be implemented during earthworks within the former Tempe Landfill area. As discussed above, the field personnel undertaking the works will be trained and calibrated in accordance with AS 4323.3:2001. Field olfactory measurements will be undertaken by a trained operator using a Nasal Ranger.

Prior to commencement of earthworks a single monitoring round will be undertaken to establish a background prior to commencement of site activities (particularly related to ground breaking activities). This monitoring will be done using a 50 meter grid of monitoring will be used across the landfill. If odour is detected at any point, then a localised review of odour monitoring will be completed at that point to determine the extent of the odour generation source(s).

Each monitoring event will target potential odour generating sources and the site boundary with a particular emphasis on site boundaries where identified off-site sensitive receptors are located.

Each odour monitoring report will present the following information (as a minimum):

- Scope of work, including locations, date and time of the monitoring.
- Details of the staff undertaking the monitoring and their training/calibration certification.
- Atmospheric data on the day of monitoring (including temperature and humidity) and three days leading up to the event.
- Information on the works taking place on-site during the monitoring event.
- Results of the monitoring works and comparison to previous results (if relevant).
- Any conclusions or recommendations around ongoing management of odour on the site during Project works.

C.5 Targeted Complaint-triggered Monitoring

NSW DEC (2006), *Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW* presents a framework by which confirmed complaints may act as a trigger for targeted monitoring events:

> *Odour impacts are notoriously difficult and impractical to measure. Confirmed complaints, in many cases, are the only means available for verifying whether there is an odour impact occurring that may need to be addressed.*
>
> *In general, confirmed complaints that may warrant further action are from individuals who:*
>
> - *Reside in the affected area.*
> - *Work in the affected area.*
> - *Are present in the affected area, which is normally open to members of the public.*
>
> *A confirmed complaint means that an EPA officer, council officer or operator has been able to confirm that a particular operation or combination of operations is the source of the odour. Confirmation may be accomplished through:*
>
> - *Interviewing the complainant.*
> - *Tracing the odour from the complainant's residence or place of business to the alleged source (if an odour is detected at the complainant's property, the wind direction can be determined for the purpose of tracing the odour to its source).*
> - *Identifying an operation as the source by correlating meteorological data with the time of the complaint.*

If the specific complaint in question falls within the definition of a "confirmed complaint" as presented above, JHSWJV will undertake a targeted odour assessment. The assessment will be undertaken to identify the location or activity that is the source of the odour and provide recommendations for resolution of the confirmed complaint which can be fed back to the EPA. As defined in C.3 above, once a complaint is received, monitoring will be completed as soon as practicable ie within 2 to 4 hours of a complaint within construction hours, and within 24 hours for complaints received out of hours.

C.6 Interpretation of Odour Monitoring Exceedances

In the applicable NSW guidance (NSW DEC 2006), odour exceedances are measured air emission or air quality levels above the goals of 2 odour units when measured at sensitive receptors. Recurring exceedances are defined as more than two of a similar type within a 12 month period.

In addition to the above NSW guidance, the Project is required to comply with the consent condition (CoA C7) which stipulates that no offensive odour associated with the works be detected beyond the boundary of the construction footprint.

All exceedances are to be interpreted in the context of potential nuisance to off-site human receptors. Refer to the contingency section below for potential management and mitigation options for exceedances.

C. 7 Landfill Odour Contingency and Corrective Action

JHSWJV is responsible for ensuring odour generated by the works does not impact the ongoing amenity of human receptors both on and adjacent to the site.

Non-conformance will be detected through the monitoring system presented above and the complaints management system presented in the CEMP. Non-conformance will be detected through verification processes such as monitoring, inspections and close supervision of subcontractor activities. All non-conformances will be managed in accordance with Section 3.11 of the CEMP. Any incidents will also be managed in accordance with Section 3.9 of the CEMP.

With respect to routine identified odour issues, the corrective actions documented in Table C-1 will be adopted by JHSW.

Table C-1: Landfill Odour Corrective/Contingency Measures

EVENT / TRIGGER	CORRECTIVE ACTION / CONTINGENCY PLAN
"Confirmed complaint" that is short term or a one-off event.	Undertake complaints protocol (as per SectionC-5 above) and based on results implement a targeted complaint-triggered monitoring event. If the results of the investigations and monitoring demonstrate that the event was a one-off short-term event that is unlikely to occur again, consider closing out.
"Confirmed complaint" that is not a short term or a one-off event.	Undertake complaints protocol (as per SectionC-5 above) and based on results implement a targeted complaint-triggered monitoring event. Based upon the outcomes of the initial investigation and the monitoring event, implement mitigation measures to limit odour emission potentially including (but not limited to): • Targeted increase of day cover thickness of odour source. • Review the location of air curtains or potential additional mobile units may be deployed • Temporarily altering works so that odour causing activities are undertaken only when prevailing wind conditions are blowing away from the sensitive receptor. • Targeted application of odour masking agents (based on prior expert advice). • Any other recommendations provided by the external odour specialist during the targeted complaint-triggered monitoring event. • Aeration of leachate storage (if leachate storage is the odour source). • Review of pumping to LTP to avoid extended periods of ponding.

Receptor complaint directly to the JHSWJV team that is not a short term or one-off event.	Undertake complaints protocol (as per SectionC-5 above). At the discretion of the JHSWJV environment team (and if deemed necessary) implement a targeted complaint-triggered monitoring event. Based upon the outcomes of the initial investigation and/or the monitoring event, implement mitigation measures to limit odour emission potentially including (but not limited to): • Targeted increase of day cover thickness of odour source. • Review the location of air curtains or potential additional mobile units may be deployed • Temporarily altering works so that odour causing activities are undertaken only when prevailing wind conditions are blowing away from the sensitive receptor. • Targeted application of odour masking agents (based on prior expert advice). • Any other recommendations provided by the external odour specialist during the targeted complaint-triggered monitoring event (if undertaken). • Aeration of leachate storage (if leachate storage is the odour source).

Appendix D Monitoring Forms and Field Records

LEACHATE INSPECTION FORM: FORMER TEMPE TIP	
Date and Time of Inspection:	Inspector:
All open excavations inspected (Yes/No):	
Evidence of leachate seepage within excavations (including surface staining, inflow of water, discolouration of surface water, etc. Describe number of seeps, estimated volume of liquid and rate of inflow. Also take photographs):	
Seep 1 Easting:	Seep 1 Northing
Seep 2 Easting:	Seep 2 Northing
All other exposed surfaces across works area (Yes/No):	
Evidence of leachate seepage within excavations (including surface staining, stressed vegetation, inflow of water, discolouration of surface water, etc. Describe number of seeps, estimated volume of liquid and rate of inflow. Also take photographs):	
Seep 1 Easting:	Seep 1 Northing
Seep 2 Easting:	Seep 2 Northing

Example Landfill Gas Field Sheet- monitoring in buildings

Sampler:	
Date:	
Gas Meter:	
Weather Conditions/General Comments:	

Monitoring Time	Location Description	CH4/ Flammable Gases	PID	CO2	CO	H2S	Comment
		ppm	ppm	%v/v	ppm	ppm	

Example Sub-surface Landfill Gas Monitoring Form

Location	Time	Pressure	Flow Rate (L/hr)					CH4 (%V/V)		CO2 (%V/V)		O2 (%V/V)		CO (ppm)		H2S (ppm)		GW Level (mbTOC)
		mBar	0 sec	30 sec	60 sec	90 sec	120 sec	Max.	Stable	Max.	Stable	Min.	Stable	Max.	Stable	Max.	Stable	

Site Location:	Comments:
Project No:	
Sampler:	
Date:	
Gas Meter:	
Weather Conditions:	

ODOR MONITORING DATA SHEET

DATE:_____

TIME	LOCATION	60	30	15	7	4	2	<2	ND	DESCRIPTORS	COMMENTS

Weather Conditions

- ☐ Mostly Sunny
- ☐ Partly Cloudy
- ☐ Mostly Cloudy
- ☐ Overcast
- ☐ Hazy

Precipitation

- ☐ None
- ☐ Fog
- ☐ Rain
- ☐ Sleet
- ☐ Snow

Wind Direction (Blowing From)

N
NW NE
W ---------- E
SW SE
S

Wind Speed

- ☐ Calm
- ☐ Light Breeze (1- 5 mph)
- ☐ Moderate Wind (5 – 15 mph)
- ☐ Strong Winds (15 mph or higher)

Temperature: _____ F Relative Humidity: _____ % Barometric Pressure _____

Notes: _____

_____

_____

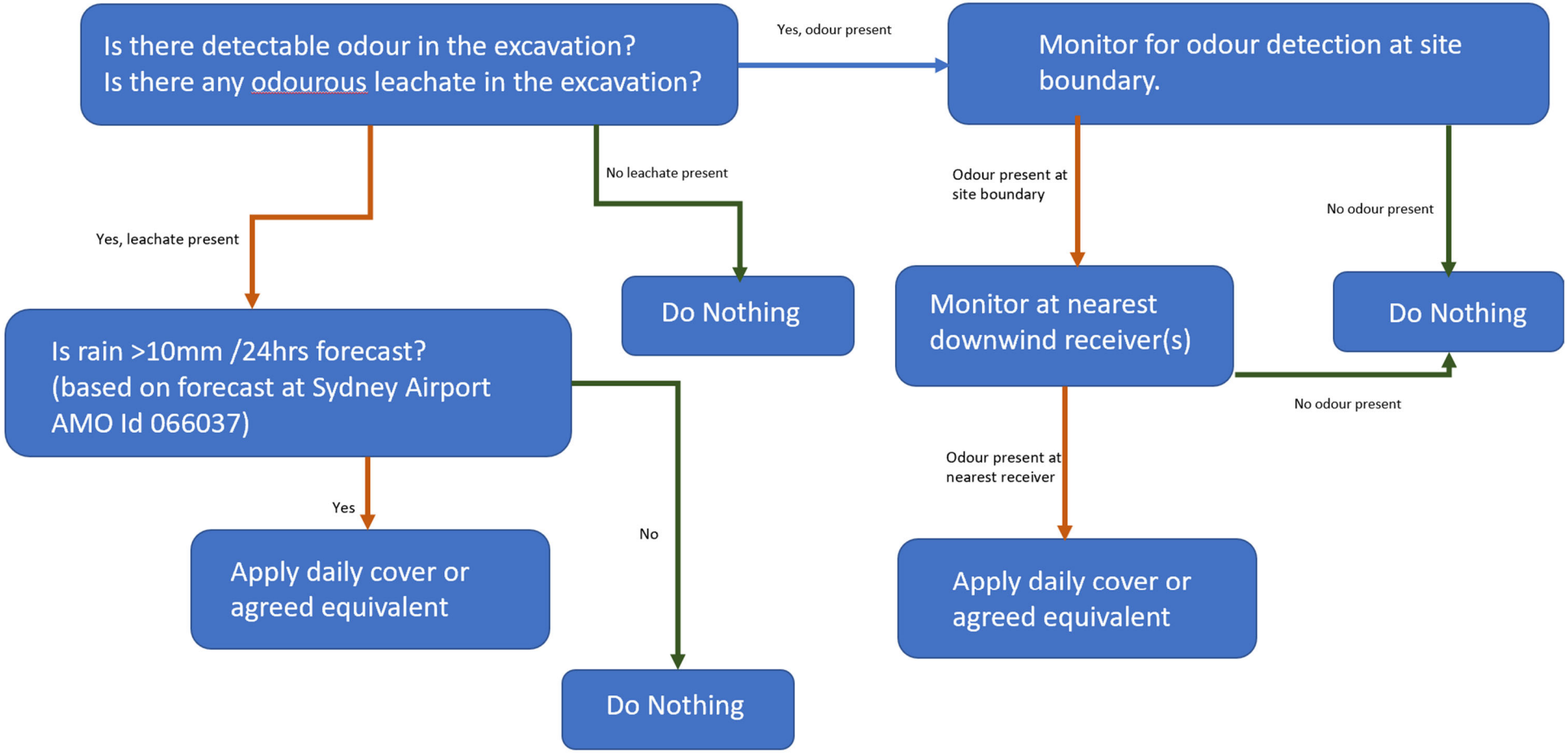
_____

_____

_____ _____ _____

Date Name Signature

Appendix E Daily Assessment of Site Conditions



Appendix F Site Auditor Interim Audit Advice

ZOIC
A Geosyntec Company

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20051 IA16 LLGOMP 16Jul21 Approve

16 July 2021

Mark Turner
John Holland Seymour Whyte Joint Venture
Level 3, 65 Pirrama Road
Pyrmont, NSW 2009

Via email: Mark.Turner@jhg.com.au
cc: Robert.Muir@jhsw.com.au

Dear Mark,

Re: Interim Advice 14 – Endorsement of Landfill leachate, Gas and Odour Management Plan, Sydney Gateway Project, NSW

1 Introduction

John Holland Seymour Whyte Joint Venture (JHSW JV) has appointed Kylie Lloyd of Zoic Environmental Pty Ltd (Zoic), a NSW EPA Auditor accredited (No. 0302) under the Contaminated Land Management (CLM) Act 1997, to conduct an Audit at the Sydney Gateway Project, NSW ("the site").

The aim of the engagement is to enable a site audit statement (SAS) and associated site audit report (SAR) to be prepared that confirms the suitability of the site for proposed redevelopment as a road network, a new waste mound (cell) and leachate treatment plant, in accordance with the NSW EPA (2017) Contaminated Land Management Guidelines for the NSW Site Auditor Scheme (3rd edition).

2 Scope of Audit and Nature of Interim Advice

NSW EPA (2017) describes the site assessment and audit process as:

1. *Consultant is commissioned to assess contamination.* The contaminated site consultant designs and undertakes the site assessment and, where required, all remediation and validation activities to achieve the objectives specified by the owner or developer; and
2. *Site auditor reviews the consultant's work.* The site owner or developer commissions the Auditor to review the consultant's work. The Auditor then prepares a SAR and SAS at the conclusion of the review, which are given to the owner or developer.

Therefore, the contaminated land consultant and other relevant parties should be satisfied that the work to be conducted conforms to all appropriate regulations, standards and guidelines and is suitable based on the site history and the proposed land use.

This Audit is statutory in nature and makes reference to requirements contained within Conditions C7, C8, C9, E46, E47 and E90 of the State Significant Infrastructure SSI) 9737 dated 27 August 2020. Of specific relevance to this interim advice includes conditions C7 and C9 which state:

C7 The **Landfill Leachate, Gas and Odour CEMP Sub-plan** must include:

(a) measures to manage landfill gas emissions and limit odours generated during construction so as not to cause offensive odour beyond the boundary of the construction footprint, including site specific action criteria and notification procedures for receivers potentially affected by odour generation;
(b) measures to monitor and manage landfill gases accumulating in buildings, basins and subsurface trenches and pits associated with the CSSI;
(c) details of the closure and stabilisation of the impacted area of landfill so it is suitable for its intended uses;
(d) methods for the management of leachate including treatment and disposal as well as measures for preventing leachate resulting from Work migrating from the landfill off site;
(e) reporting triggers and contingency actions in the event that unacceptable levels of odours, and landfill gases are reached or reported above safe thresholds at the boundary of the construction footprint;
(f) reporting triggers and contingency actions should leachate migrate offsite from the landfill or if there is any environmental or health problems caused by leachate;
(g) community engagement processes to be undertaken if nuisance odours move beyond the construction boundary;
(h) evidence that an EPA accredited Site Auditor has reviewed the Landfill Leachate, Gas and Odour CEMP Sub-plan and has issued an interim audit advice or a Section B Site Audit Statement regarding the appropriateness of the Sub-plan; and

() evidence that the Landfill Leachate, Gas and Odour CEMP Sub-plan and the interim audit advice or a Section B Site Audit Statement regarding the appropriateness of the Sub-plan issued by the accredited Site Auditor has been submitted to the relevant council and the EPA and they have no further concern.

A copy of any advice or recommendations required by this condition must be submitted to the Planning Secretary for information with the Sub-plan.

The Sub-plan must be developed in accordance with the objectives of the existing Voluntary Remediation Proposal (Ref. 26050) approved by the EPA.

C9 Any variations to the **Landfill Leachate, Gas and Odour CEMP Sub-plan** and **Contaminated Aquatic Sediments in Alexandra Canal CEMP Sub-plan** must be approved in writing by the EPA accredited Site Auditor and evidence of the approval submitted to the Planning Secretary for information with the amended Sub-plan.

3 Current Interim Advice

In preparing this interim audit advice, the Auditor has reviewed the following reports related to land contamination assessment:

- JHSWJV (1 June 2021) Landfill Leachate, Gas and Odour Management Plan – SSI 9737 Revision F (LLGOMP) (Ref: SGWPW-JHSW-NWW-PM-PLN-000518);

Additionally, the following documents were referred to confirm references made in the LLGOMP above were included:

- JHSWJV (10 May 2021) Construction Environment Management Plan – SSI 9737 (LLGOMP) (Ref: SGWPW-JHSW-NWW-PM-PLN-000508);
- JHSWJV (15 February 2021) Air Quality Management Plan – SSI 9737 (LLGOMP) (Ref: SGWPW-JHSW-NWW-PM-PLN-000509);

The purpose of the current IA is to Endorse an updated version of the LLGOMP to address auditor comments provided in IA4 dated 22 April 2021 and to confirm compliance with Conditions C7 and C9 of CSSI 9737.

4 Summary of Landfill Leachate, Gas and Odour Management Plan

The purpose of the LLGOMP is to describe how JHSWJV intends to manage leachate, gas and odours during construction so as to not cause offensive odour beyond the boundary of the construction footprint and to satisfy other requirements in accordance with Conditions C7 and

C9 of the project approvals. The LLGOMP scope is limited to development interactions with former Tempe Landfill only with the objective of the plan to ensure requirements of the following documents are captured:

- The combined Environmental Impact Statement (EIS) / Major Development Plan (MDP) prepared for the Sydney Gateway Project – Stages 1 & 3.
- Conditions of Approval for SSI 9737 issued by the Minister for Planning and Public Spaces (NSW), on 27 August 2020.
- Updated Management Measures (UMM) detailed in the Response to Submissions Report.
- Roads and Maritime specifications G36, G38 and G40.
- The Project's Environmental Protection Licence (EPL).
- Relevant legislation and other requirements described in Section 3.1 of this Plan.
- The objectives of the Voluntary Remediation Agreement (VRA) (Ref. 26050), EMP and any RAPs prepared for the project.

Environmental control measures presented include the following:

- Landfill leachate Management and Mitigation adopts three central objectives
    i. Diversion of upgradient flow to prevent runoff into open excavations and reduce infiltration into underlying waste.
    ii. Capture of rainfall and other surface water sources and reduce potential of infiltration into underlying waste.
    iii. Identification, monitoring and management of leachate seeps across the site extent (including within excavations, on caps, batters and other permeable and semi-permeable areas).
- Implementation of a Landfill leachate monitoring and inspection program inclusive of:
    - Regular inspections across the construction site and landfill face. Frequency to be initially daily during excavation works within the landfill waste areas likely reverting to weekly at other times. Where a seep is identified in sufficient volume to potentially migrate off site sampling and analysis will be conducted, and report prepared.
    - Monitoring of targeted wells within and outside existing leachate controls commencing the first month of bulk excavation then be conducted monthly until completion of Construction. Following construction a final closeout groundwater/leachate monitoring event will take place.
    - Background levels were established on the basis of baseline monitoring with trigger levels set 10 % above the background. Concentrations exceeding the trigger levels will constitute a non-conformance and be managed in accordance with section 3.11 of the CEMP.
    - Contingences for leachate seeps will require either immediate or non-immediate action, within or outside excavations/open pits. Remedies consisted of isolation, appropriate leachate disposal and follow up inspections. Should groundwater monitoring identifying a link between on-site offsite leachate in the former Tempe Landfill and groundwater to the south of the bentonite cut-off wall which did not exist prior to commencement of earthworks and exceedances of the adopted criteria are identified, further monitoring and notification to the EPA (required under the EPL will be required.
- Landfill Gas Management and Mitigation
    - Two forms of landfill gas monitoring are proposed including:

i. Daily/regular monitoring of pits, excavations, and boring/piling operations.

ii. Monthly sub-surface and surface structure monitoring.

- Identified exceedances and management are recorded per CEMP incident reporting procedures. For subsurface monitoring should GSV exceed CS2 outside the interception trench and CS3 within the landfill, weekly monitoring, offsite monitoring and further characterisation of the risk to develop specific management protocols will be conducted.
- Contingencies are presented for methane detected in ambient air, concentration of gases above action levels in open excavations pits or piling bores and other landfill gas concentrations within structures. Remedies consisted of evacuation/isolation, further monitoring, potential abandonment and notification of relevant stakeholders.

- Landfill Odour Management and Mitigation
  - Odour management measures include the following:
    i. Review and document site conditions daily
    ii. Minimise area of waste exposure
    iii. Manage odours from daylighting leachate via implementing leachate protocols as per the plan
    iv. Where feasible adaptively modify works
    v. Significant volumes of ponded surface will be preferentially pumped to the Leachate treatment plant
    vi. Odour model prediction to guide excavation methodologies to comply with the 2 odour unit criterion
    vii. Implement the monitoring program
    viii. Manage complaints as per requirements in the CEMP.
  - Landfill odour monitoring consists of day to day during former Tempe landfill disturbance at downwind receptors at the beginning and end of the work day. Additional monitoring will be conducted 3 hr period of low wind gusts or in the vent of an odour complaint. Three-month monitoring will also be completed during earthworks in the former Tempe landfill area until completion. Allowance has been made for targeted complaint triggered monitoring should specific location be of greater sensitivity.
  - Contingencies were presented for one off and longer term confirmed complaints and regular complaints directly to the JHSWJV team. Remedies consisted of enacting the complaints protocols and implementation odour masking agents where appropriate.
- Compliance management will consist of training, auditing and reporting noting reference in the CEMP. Monitoring data will be collected, tabulated and assessed against the baseline conditions and performance criteria in the form of a construction monitoring report. Th report will be developed on a six monthly basis and distributed to the site auditor as required.
- Allowance has been made for continuous improvement via potential update or revision of the plan. This may be conducted in response to requirements under section 3.12 of the CEMP. It was further noted that variations to the plan are required to be approved in writing by the NSW EPA Accredited Site Auditor.

5 Auditor Comments

The Auditor has reviewed the JHSW JV (1 June 2021) against relevant guidelines made or approved by NSW EPA and considers that the document is appropriate, subject to the following conditions:

1. In line with condition C9 should the LLGOMP be varied approval in writing must be sought from the Auditor.
2. To enable completion of the Audit under Condition E47, the Auditor should be notified for non-conformances or incidents of leachate, landfill gas and odour during implementation of the plan
3. Section B.2.1 Sub surface landfill gas monitoring – Landfill gas monitoring wells to the south west of GW9 as per Figure B1 must adopt a characteristic Gas situation of CS2 to trigger appropriate actions.

6 Closure

This interim advice does not constitute a SAS or a SAR, but rather is provided to assist the Client in the assessment and management of contamination issues at the site. The information provided herein should not be considered pre-emptive of the final Audit conclusions. It represents the Auditor's opinion based on the review of currently available information.

Should you have any queries or wish to discuss any points, please do not hesitate to contact Matthew Rendell or the undersigned.

Yours sincerely,

Kylie Lloyd
Site Auditor
Zoic Environmental Pty Ltd

Attachments: Attachment A - Review Comments (spreadsheet provided separately)

DOCUMENT/PACKAGE No.	Stage 1
DOCUMENT/PACKAGE TIT	Landfill Leacahte, Gas and Odour Management Plan (State) SGWPW-JHSW-NWW-PM-PLN-000518
PACKAGE ID & ISSUE DAT	Rev C 21-Apr-21

REVIEW STATUS
O Observation / Comment
D From info currently provided not able to determine whether document/design is compliant.
N Non-Compliant

COMPLIANCE STATUS
O Open
C Closed
CS Closed subject to additional action / information
(Status **L,H** are applicable to Design Documentation only)
L Certification Limitation

Comment No.	Stage	Document Title	Rev	Document Section ref.	Description	Reviewer Name	Reviewer Company	Review Date	Compliance Comment (if any)	REVIEW STATUS	Document Owner Response	Response Date	Compliance Status	Auditor comment	JHS comment (14/07/2021)	Auditor Comment (16/07/2021)
1	1	asdasd	C	SGWPW-JHSW-NWW-	1. Section 2.2 – objectives	K Lloyd	Zoic	22-Apr-21								
2	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. Please clarify which EMPs and/or RAPs are in place for the former Tempe Landfill?	K Lloyd	Zoic	22-Apr-21			As this section relates to objectives, this was stating any RAPs or EMPs which JHSW may prepare for the Project. Wording amended.		C	Addressed		
3	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. Does this objective intend to capture future EMPs and RAPs associated with the Gateway Project?;	K Lloyd	Zoic	22-Apr-21			No, it intends to capture construction related information.		C	Addressed		
4	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	2. Section 3.1.2 – Guidelines and standards	K Lloyd	Zoic	22-Apr-21								
5	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. The PFAS National Environmental Management Plan has been revised in January 2020 (Version 2.0). Please update.	K Lloyd	Zoic	22-Apr-21			Reference updated		C	Addressed		
6	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. Management of worker health and safety hazards are noted throughout the plan. Should NSW WHS legislation be referenced or included within the plan?	K Lloyd	Zoic	22-Apr-21			It is not proposed to include WHS legislation in this Plan however relevant elements (eg gas levels and ignition sources etc) have been included in the JHSW Incident and Emergency Response Plan (as an emergency action plan). The WRA and the AMS risk assessment will also be developed to identify these key risks.		C	Addressed		
7	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	3. Table 3.4 Other Requirements Relevant to this Plan	K Lloyd	Zoic	22-Apr-21								
8	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. Please provide a copy of the CEMP and AQMP when available	K Lloyd	Zoic	22-Apr-21			A copy of these Plans is provided as part of this response for information.		C	Addresssed. Plans have been received with references cross checked.		
9	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. TfNSW G36 Sct 4.4.1: Please provide a copy of the EPL when available	K Lloyd	Zoic	22-Apr-21			The EPL is not yet available. JHSW will advise once issued and provide a link to the public register.		C	Noted		
10	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. UMM-AQ1: Should Reference be made to EPA's agreement for Exhumation of waste prior to obtaining an EPL here or reference elsewhere in the Document?	K Lloyd	Zoic	22-Apr-21			This has been covered in the Waste Mgmt Plan.		C	Addressed		
11	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	4. Section 4.6.1 – Does the current leachate treatment system and current cut off wall provide an effective measure to minimise release of leachate to the canal.	K Lloyd	Zoic	22-Apr-21			The current landfill incfrastructure has been operation by IWC for a significant period of time and they have had surrendered EPL obligations on reporting to the EPA. In terms of the landfill infrastructure, the only changes to the existing system relates to the upgrade to the leachate treatment plant to manage the potential increase in leachate generation during construction of the works. All other landfill infrastructure (ie leachate pipework, gas pipework, collection and venting) remains unchanged and is not proposed to be modified by the JHSW Works. JHSW has committed to ongoing maintenance of the pit, pipe, and pump system in place, including upgrade or replacement of any pumps that falter during the works, rodding and flushing both inlet and outlet pipework, and general maintenance and monitoring of the system throughout the Project works period. EPA has recent provided acknowledgement that the existing system has deficiencies and that leachate has been consistently detected outside of the cut off wall, and that JHSW works will not worsen the situation. EPA has confirmed however that they consider the objectives of the VRA are met on the basis that there is no evidence that there is impact to the Alexandra Canal.		C	Addressed. The auditor notes EPA position		
12	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	5. Section 4.6.2 – Please include a copy of the results or confirm the title of the report that contains the data referenced.	K Lloyd	Zoic	22-Apr-21			This section has since changed (now Section 4.4.2)- reference has been updated to refere to the EIS/MDP and the various Technical Working Papers (TPW 16 covers the Landfill for example and includes the details for Coffey Environments. (2007). Groundwater Quality Monitoring, Tempe Lands, Tempe. Ref S21090.14. Anual		C	Addressed. References and summaries of data have been cross checked		
13	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	6. Section 4.7 – When is the ground gas assessment work proposed by Coffey anticipated to be completed and how will their results be incorporated within this document/approach?	K Lloyd	Zoic	22-Apr-21			This is now in Section 4.5 and relates to the Landfill Gas Monitoring Results Update, April 2021 – Gateway Project prepared by Coffey. As this now confirms the presence and available data from additional bores, these bores have been added to the monitoring network in Appendix B of the LLGOMP.		C	Addressed noting additional LFG wells have been added to the montoring regime (NW boundary between the landfill and residences). Please provide copy of the LFG Gas monitoring results update.	Please see attached pdf reports for April and June 2021.	Addressed
14	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	7. Section 5.1 – Construction Activities	K Lloyd	Zoic	22-Apr-21								
15	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. Will works disturb the cut off wall	K Lloyd	Zoic	22-Apr-21			There has been a recent design revision which means that the new drainage outlets to be installed as part of the road design which no longer penetrate the bentonite wall. There are no other works planned that will disturb the wall. This has been added to Sect 5.1		C	Addressed		
16	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. Will works disturb the leachate treatment system (lines and pumps)	K Lloyd	Zoic	22-Apr-21			As noted above, in terms of the landfill infrastructure, the only changes to the existing system relates to the upgrade to the leachate treatment plant to manage the potential increase in leachate generation during construction of the works. All other landfill infrastructure (ie leachate pipework, gas pipework, collection and venting) remains unchanged and is not proposed to be modified by the JHSW Works. JHSW has committed to ongoing maintenance of the pit, pipe, and pump system in place, including upgrade or replacement of any pumps that falter during the works, rodding and flushing both inlet and outlet pipework, and general maintenance and monitoring of the system throughout the Project works period.		C	Addressed		
17	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. Please include when the construction of a new leachate treatment system is planned respect to the construction activities.	K Lloyd	Zoic	22-Apr-21			The upgrade to the existing LTP is currently underway and will be completed and operational prior to constrction works commencing within the landfill area (excl site establishment). Reference has been included in Section 6.1.1 to state that this upgraded LTP will be operational prior to commencing works within the former Tempe Landfill area.		C	Addressed		
21	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	8. Section 5.2 – Factors Affecting Leachate, Landfill Gas and Odour – Please consider the following factors	K Lloyd	Zoic	22-Apr-21			(Note- now Section 5.3)					
22	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. Groundwater level.	K Lloyd	Zoic	22-Apr-21			Sectyion 5.3 has been amended to make reference to the various factors that can impact LLGO. JHSW consider that this is sufficient to close out these items (a) to (e)		C	Addressed		
23	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. Increased development in the surrounding area.	K Lloyd	Zoic	22-Apr-21			Sectyion 5.3 has been amended to make reference to the various factors that can impact LLGO. JHSW consider that this is sufficient to close out these items (a) to (e)		C	Addressed		
24	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. Placement of services a potential factor likely to impact	K Lloyd	Zoic	22-Apr-21			Sectyion 5.3 has been amended to make reference to the various factors that can impact LLGO. JHSW consider that this is sufficient to close out these items (a) to (e)		C	Addressed		

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25	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	d. Method of construction	K Lloyd	Zoic	22-Apr-21			Sectyion 5.3 has been amended to make reference to the various factors that can impact LLGO. JHSW consider that this is sufficient to close out these items (a) to (e)		C	Addressed		
26	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	e. Sealing works	K Lloyd	Zoic	22-Apr-21			Sectyion 5.3 has been amended to make reference to the various factors that can impact LLGO. JHSW consider that this is sufficient to close out these items (a) to (e)		C	Addressed		
27	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	9. Section 5.3 – Impacts	K Lloyd	Zoic	22-Apr-21			(Note- now Section 5.2)					
28	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. Please clarify is the intent of the grouping 'landfill integrity' to cover physical aspects such as capping and subsidence?	K Lloyd	Zoic	22-Apr-21			This section has subsequently been re-worded. Reference to landfill integrity removed.		C	Addressed		
29	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. Are ecological considerations included within the list of potential impacts attributable to construction?	K Lloyd	Zoic	22-Apr-21			There is a potential for ecological impacts if leachate as a result of construction works is not managed and discharges to the Canal. Impacts to Canal water quality already captured so text has been updated to include ecological considerations.		C	Addressed		
30	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. Should potential dermal / ingestion / inhalation of leachate and hazardous ground gas by construction workers be included here?	K Lloyd	Zoic	22-Apr-21			It is not considered relevant to include WHS requirements here- covered by WHS Management Plan (Refer to comment 6 above)		C	Addressed		
31	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	10. Figure 6-1 - It is noted the Auditor is required to review the Activity method statement and Environmental Works Method Statement please provide.	K Lloyd	Zoic	22-Apr-21			AMS and EWMS can be provided once available- this will be closer to the commencement of construction.		C	Addressed		
32	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	11. Section 6.1 – It is acknowledged the plan refers to the downgradient cut-off wall and leachate extraction and treatment system as a primary means of leachate management for the project, please clarify whether this system is to be upgraded prior to construction?	K Lloyd	Zoic	22-Apr-21			The LTP is upgraded and will be operational prior to the commencement of excavation work in the former landfill area but not the other pipework etc- refer to response to Comment 11 above.		C	Addressed		
33	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	12. Section 6.2.1 –	K Lloyd	Zoic	22-Apr-21			(Note- now the Leachate Monitoring Program in the Appendices- now Appendix A)					
34	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. Please specifically nominate the criteria to be used and the locations when they will apply	K Lloyd	Zoic	22-Apr-21			Section A.1 (of Appendix A) has been updated to confirm that during excavation in the waste areas, daily seepage inspections will be undertaken (higher risk/concern). Inspections will be undertaken on a weekly basis prior to commencement of excavation.		C	a. How do the action levels (Critiera) relate to the trigger levels (background plus 10%)	They are the same- just incorrect use of words. Section A.2 amended to remove bullet points and change the sentence to read "The Action Levels to be applied to the monitoring wells outside of the bentonite cut-off wall are the trigger levels detailed in Table A-1".	Addressed.
35	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. Please nominate when the inspections will commence.	K Lloyd	Zoic	22-Apr-21			Inspections will commence following the establishment of the site (C3 Compound). This has also been included in Section A.1 of Appendix A.		C	Addressed		
36	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. Please confirm what constitutes sufficient volume.	K Lloyd	Zoic	22-Apr-21			This section has been amended to refer to sufficient volume being when there is a potential for off site migration to occur.		C	Addressed		
37	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	d. Please include provision of summary of results to the auditor at regular intervals during the audit – monthly, quarterly etc.	K Lloyd	Zoic	22-Apr-21			This has actually been included in Section 7.4 of the Plan on the basis that the Auditior will want visibility of all LLGO monirtoring information.		C	Section 7.4 commits to provsion of 6 monthly construction Monitoring report. Exceedance of the performance criteria will instigate reporting requirements in line with Section		
38	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	13. Section 6.2.2 – Monitoring Well Program	K Lloyd	Zoic	22-Apr-21			(Note- now the Leachate Monitoring Program in the Appendices- now Appendix A)					
39	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. WSP nominates GW7, GW8, MPE_4, MPE_5 and MPE_21 as the well network. It is requested additional monitoring wells be added. At a minimum but not limited to MPE2, MPE5A MPE11 and MPE7 should be considered.	K Lloyd	Zoic	22-Apr-21			Monitoring well program has been amended to include these additional wells and a location map included.		C	Addressed		
40	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. When will the baseline data compilation be completed and when will it be provided to the Auditor?	K Lloyd	Zoic	22-Apr-21			The baseline data has been compiled and the Plan has now been updated to include the baseline levels and criteria for leachate monitoring. This data can be made available to the Auditor. JHSW will measure variance in concentration during the earthworks program against the existing pre-works chemical concentration ranges (background ranges) derived from the monitoring well network to be utilised for the monitoring program. Concentrations exceeding the background ranges by more than 10% will constitute a non-conformance.		C	b.Could you provide further information around the adoption of background plus 10% as the trigger level? Is this consistent with the Sediment plan? c.Please provide baseline data report to confirm calcaultion of backgorund levels. It's unclear how this works.	Historic monitoring indicates that the barrier wall is mitigating leachate migration is to Alexandra Canal (as required by the VRA), however full hydraulic containment of leachate from the landfill is not being achieved. The purpose of the construction monitoring is to ensure that the historic performance standards for the barrier wall are maintained during construction. A 10% increase in the historic concentrations is unlikely to directly correlate with an increase in the surface water quality however, 10% is considered a conservative indicator that the barrier wall performance is deteriorating and warrants further investigation/action. The Aquatic Sods plan relates to the background monitoring data from within the Alexandra Canal as opposed to leachate within the subsurface groundwater wells adjacent to the Canal. These background levels are criteria which relate specifically to groundwater and are not intended to represent target concentrations within the surface water. The only time the surface water quality data would be used in conjunction with the leachate monitoring data would be if the levels of contaminants increase in the Canal and we needed to establish if there is any correlation to the barrier performance. In addition, the former landfill operates under the VRA with Inner West Council and EPA, where as the bed sediments in the Canal operates under a Remediation Order with Sydney Water and EPA.	Addressed given the purpose of trigger levels are to ensure the barrier wall is maintained as currently functioning and compliant with EPA project licence requirements
41	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. Please justify the exclusion of VOCs from analytical schedule for the groundwater monitoring program	K Lloyd	Zoic	22-Apr-21			The available SVOC monitoring data that has been captured since 2011 shows no levels of VOC being recorded/measurable in groundwater. As such, it is not considered relevant to monitor moving forward. JHSW is happy to discuss further with the Auditor as required.		C	Addressed	**(linked to above)** (-c) Please see attached (note- separate email) the baseline data used to calculate the background levels. The methodology used the maximum concentration over the monitoring period plus 10%.	Noted
42	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	d. Should agreed monitoring regime be altered, please notify the auditor with supporting justification as noting this forms a deviation and will require approval.	K Lloyd	Zoic	22-Apr-21			Noted and agreed. Any variations to the Plan, including the Monitoring Program must be approved by the Site Auditor per CoA C9 (and approval of updates must then be provided to DPIE). This is covered in Section 3.4 of the Plan.		C	Addressed		
43	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	e. What notification requirements are there should	K Lloyd	Zoic	23-Apr-21			Does this comment relate to notifcation in the event of non conformance with monitoring? This has now been added to the Table in Section A-2 for notification to EPA under the EPL in the event of monitoring showing an increase in leachate outside the bentonite wall (ie >10% above background)		C	Addressed		
44	1	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	14. Figure 6-2 – The image used is not clear such that the reader cannot identify which monitoring wells are to be sampled, please amend.	K Lloyd	Zoic	24-Apr-21			Figures have now been updated to be clearer and additional wells added.		C	Addressed		
45	2	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	15. Section 6.3 – What change in leachate constitutes a non-conformance? Please consider volume and concentrations above a nominated criteria/value, noting the objectives of the document are, among others, to meet the objectives of the VRP which are in turn to protect waters in Alexandra Canal.	K Lloyd	Zoic	25-Apr-21			WSP will measure variance in concentration during the earthworks program against the existing pre-works chemical concentration ranges (background ranges) derived from the monitoring well network to be utilised for the monitoring program. Concentrations exceeding the background ranges by more than 10% will constitute a non-conformance.		C	d.It is noted the sediment plan states standard statistical methods for a comparisons of non-parametric data will be used in assessing the statistical variance, should this approach be replicated in the LLGOMP for consistency? If not could justification please be provided?	The surface water monitoring results represent concentrations within the surface water resource. The historic groundwater monitoring trends do not show a direct correlation between groundwater quality and surface water impact as demonstrated in the CSM presented in the Tempe DSI. Groundwater quality is not considered to be the primary indicator of surface water impact.	Accepted
46	3	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	16. Section 6.5.1- Daily/Regular Landfill Gas Monitoring	K Lloyd	Zoic	26-Apr-21			(Note- now Appendix B- LF Gas Monitoring Program is in the Appendices)					
47	4	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. Please clarify the action level for methane noting one fifth of the explosive level of methane is 1%v/v not 1% LEL?	K Lloyd	Zoic	27-Apr-21			This has been updated.		C	Addressed		

Comment No.	Stage	Document Title	Rev	Document Section ref.	Description	Reviewer Name	Reviewer Company	Review Date	Compliance Comment (if any)	REVIEW STATUS	Document Owner Response	Response Date	Compliance Status	Auditor comment	JHS comment (14/07/2021)	Auditor Comment (16/07/2021)
48	5	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. Please advise /clarify the reporting protocols for daily/regular landfill gas monitoring? This is now included in all sections within this Appendix.	K Lloyd	Zoic	28-Apr-21			In the event of elevated levels of landfill gas, excavations will cease until the readings fall below the Action Levels. Refer to Section B.4 contingency tables for further information around managing ongoing exceedances. All identified exceedances and their subsequent management are to be recorded as per the environmental incident reporting procedure presented in the CEMP		C	Addressed		
49	6	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	17. Section 6.5.2 – Surface and Sub surface landfill gas monitoring	K Lloyd	Zoic	29-Apr-21			Continued in Appendix B of the Plan (new Appendix ref)					
50	7	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. The proposed Sub-surface landfill gas monitoring locations should be clearly indicated on a figure.	K Lloyd	Zoic	30-Apr-21			A figure has now been included to identify locations of gas monitoring		C	Addressed		
51	8	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. Please clarify the terminology Temporary and Permanent surface structures? Does this refer to structures residing on the site during construction only noting permanent structures should have landfill gas mitigation measures	K Lloyd	Zoic	01-May-21			Heading B.2.2 has been amended to avoid confusion and the Plan has been updated to more clearly word that temporary site structures will be monitoring, and in the event those strutures have elevtaed levels of surface gas hen off site monitoring will be undertaken (in permanent structures-houses etc). I think this is clearer but please advise if any residual concerns.		C	Addressed		
52	9	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. Please confirm whether the structures and services associated with the project (e.g. site sheds) be raised off the ground?	K Lloyd	Zoic	02-May-21			The site estbalishment of te C3 compound has been done such that there was no excavation for services (they are above ground) and the site sheds are on foundations (albeit that the sheds do remain at ground level). These works were approved under the Site Establishment Management Plan approved by DPIE. No other works within the landfill area can commence until such time as the CEMP and Subplans are approved.		C	Addressed		
53	10	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	d. Please advise for surface monitoring what unit will be used to measure Carbon dioxide, Oxygen, Carbon monoxide, and Hydrogen sulfide?	K Lloyd	Zoic	03-May-21			Section B.2.2 details the units for these gases.			Addressed		
54	11	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	e. Monitoring device limits of detections should be stipulated to ensure appropriate equipment is used. For example, for surface gas monitoring NSW EPA 2016 Solid waste landfills states a device capable of measuring 20 ppm should be used.	K Lloyd	Zoic	04-May-21			Section B.2.2 has been updated to confirm that a monitoring device will be used that is capable of testing methane at 20ppm per the NSW EPA guideline.		C	Addressed		
55	12	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	18. Table 6.6 – Landfill Gas Corrective action/Contingency plan	K Lloyd	Zoic	05-May-21			This is now Section B.4 in Appendix B			Please confirm which locations are inside vs outside the LFG venting trench	Please refer to the table below (beside this column). The trench doesn't extend all the way to the west - it stops at 9A (so there is no trench near 1-6 and 22). We note that there does not seem to be available information where the trench is documented/shown on a diagram. JHSW will continue to locate and will update this Figure (B-1) in the event it becomes available.	Section B.2.1 Sub surface landfill gas monitoring – Landfill gas monitoring wells to the south west of GW9 as per Figure B1 must adopt a characteristic Gas situation of CS2 to trigger appropriate actions.
56	13	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. As per NSW EPA 2016, Solid waste landfills, the EPA should be notified within 24 hrs should methane concentrations exceed 1%v/v methane in enclosed structures not 1.25%, please amend.	K Lloyd	Zoic	06-May-21			Table B-2 has been amended to refer to the 24hour notification.		C	b.Please confirm processes should action levels be exceeded in external subsuface wells? Does this include notification to the EPA in line with NSW EPA 2016 for subsurface monitoring? It is noted the subsurface action levels (1%v/v methane) have been exceeded historically (refer to table 4-1).	risk profile associated with sub-surface migration and a causative link between the construction and the elevated results is identified a week of daily monitoring should be undertaken to assess gas variability and undertake building internal monitoring (if possible) to assess receptor risk. Based on this data prepare a quantitative risk assessment which will assess risks and provide recommendations for further action. If further mitigation systems are required to be implemented, these may include increasing the ventilation capacity of the existing mitigation system beneath the roadway or targeting the sub-surface pathway with a ventilation trench or other structure. Update to Section B.2.1 has been made (just above table B-1)	Addressed
57	14	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. It is noted Piling bores represent a risk for landfill gas exposure for the project. In light of this should specific procedures be detailed where ignition sources are introduced for construction purposes e.g. trimming of piles ?	K Lloyd	Zoic	07-May-21			Yes, as per comment 6, relevant elements (eg gas levels and ignition sources etc) have been included in the JHSW Incident and Emergency Response Plan (as an emergency action plan). The WRA and the AMS risk assessment will also be developed to identify these key risks.		C	Addressed		
58	15	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. Please nominate contingency actions for subsurface monitoring should significant changes in the hazardous ground gas regime occur as a result of construction.	K Lloyd	Zoic	08-May-21			Contingency actions are detailed in the paragraph above Table B-1 and the thresholds are detailed in Table B-1. We have included further information around the increase to subsurface montioring as well as off site monitoring.		C	Addressed		
59	16	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	19. Section 6.8 Odour Monitoring:	K Lloyd	Zoic	09-May-21			(now Appendix C)					
60	17	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	a. Please confirm locations for baseline monitoring (background) and detail method for monitoring.	K Lloyd	Zoic	10-May-21			This information has now been included in the Plan along with a location map		C	Addressed		
61	18	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	b. What odour thresholds will be used?	K Lloyd	Zoic	11-May-21			2 odour units. This has now been updated in the Plan		C	Addressed		
62	19	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	c. Please confirm sensitive receptors and locations and methodology for quarterly monitoring	K Lloyd	Zoic	12-May-21			This information has now been included in the Plan along with a location map		C	Addressed Quarterlty monitoring only occuring within former Landfill area		
63	20	JHSW JV (21 March 2021) LLGOMP	C	SGWPW-JHSW-NWW-	d. Given the timeframe of the project please justify the minimal odour monitoring (currently nominated as quarterly) to be implemented during earthworks?	K Lloyd	Zoic	13-May-21			Daily monitoring proposed as per CoA. The quarterly monitoring links to mapping of odour 'plumes'.		C	Addressed. Note day to day monitoring at downwind receptors occurs during disturbance works in Tempe Landfill		

Monitoring Results

Table 1: Gas Monitoring Results

Well Number	Location	LEL	CH_4	CO_2	O_2	H_2S
		%	%	%	%	ppm
GW9A	Inside[1]	OS[3]	21.4	8.7	0	0
GW10A	Inside[1]	OS[3]	54.7	22	0	0
GW11A	Outside[2]	Covered – Not Accessible[4]				
GW14	Inside[1]	93	5	14	0.4	0
GW15	Outside[2]	16	0.6	0.1	21	0
GW19A	Outside[2]	15	1	0.1	20	0

Notes:
1. Inside the passive interception and venting trench.
2. Outside the passive interception and venting trench.
3. Off Scale concentration greater than 100% LEL.
4. Covered by a parked vehicle.