
# POST CLOSURE MANAGEMENT PLAN

## CLEANAWAY SOLID WASTE PTY LTD
## TULLAMARINE
## CLOSED LANDFILL

## SURFACE WATER, GROUNDWATER and LEACHATE MANAGEMENT PLAN

**16 DECEMBER 2016**

**REVISION 001**

## TABLE OF CONTENTS

## ABBREVIATIONS

**COI** - Contaminant of Interest (as per the 2014 TRAR. Formerly 'Chemical of interest' in Revision 6 of the GQMP).

**EPA** - Environment Protection Authority (Victoria)

**ERA** - Ecological Risk Assessment

**GQMP** - Groundwater Quality Management Plan (superseded by this document)

**HCM** - Hydrogeological Conceptual Model

**LNAPL** Light Non-Aqueous Phase Liquid

**NATA** - National Association of Testing Laboratories

**PAN** - Pollution Abatement Notice

**PRA** - Preliminary Risk Assessment as documented in Golder report titled "Groundwater Risk Assessment, Cleanaway Landfill, Tullamarine." Golder Associates Pty Ltd, Reference Number 02613641/050, dated March 2004.

**PCMP** - Post Closure Management Plan

**SEPP** - State Environment Protection Policy

**SRA** - Secondary Risk Assessment as documented in Golder report titled "Secondary Risk Assessment, Cleanaway Landfill, Tullamarine", Golder Associates Pty Ltd, Reference Number 04613711/600, dated September 2007.

**SRW** Southern Rural Water

**SW, GW and L MP** - Surface Water, Groundwater and Leachate Management Plan (this document).

**2011 TRAR** - 2011 Technical Report for Auditor Review as documented in Golder report titled "2011 Technical Report for Auditor Review – Tullamarine Landfill", Golder Associates Pty Ltd, Reference Number 077613139-081-R-Rev0, dated September 2011.

**2014 TRAR** - 2014 Technical Report for Auditor Review as documented in the Kleinfelder report titled "2014 Technical Report for Auditor Review – Tullamarine Closed Landfill, Western Avenue, Westmeadows, VIC, 3043", Kleinfelder Australia Pty Ltd, Reference Number MLB14R05230, dated June 2016.

## GLOSSARY

**Contaminant of Interest** - Formerly 'Chemicals of Interest' in Golder (2007a), then referred to as 'Contaminants of Interest' in Golder (2011) and 'Chemical of Interest' in Revision 6 of the GQMP. COIs are defined here as site-related constituents, likely to have originated from the site and which have been identified to potentially pose a risk to receptors and / or are of particular value to future assessments. COI lists have been refined through successive assessments for the site and have most recently been updated in the recommendations section of the 2014 TRAR. They are not all of the analytes that were tested for as part of the monitoring program.

**DNAPL -** Dense Non Aqueous Phase Liquid. Chemicals that are not readily soluble in, and are denser than water. These chemicals typically sink in water. These have not been identified via solubility assessment at the landfill however will be voluntarily assessed during each monitoring round as per community requests.

**Environmental Auditor -** Independent individual appointed pursuant to Section 53S of the Environment Protection Act. Responsible for evaluation of compliance of procedures and practices implemented during the investigation, assessment and remediation works, if required, at the site.

**Environmental Consultant** – Responsible for advising Cleanaway in the development of specific procedures to achieve environmental compliance with legislation.

**Groundwater** - Any water contained in or occurring in a geological structure or formation or an artificial landfill (This does not include leachate within the landfill cells).

**Landfill** – The area of land within the EPA licensed boundary of the site including the landfill cells.

**Landfill Cell** – The space into which the waste has been placed as per the EPA licence.

**Leachate** – Water (aqueous phase liquid) that has come in to contact with waste, and with respect to the Tullamarine Landfill, also includes liquid waste disposed at the site before 1987.

**Liquid Waste –** Leachate and light non aqueous phase liquid (LNAPL) within the landfill cells.

**NAPL** – Non -aqueous phase liquid. Liquid which is not miscible with water.

**LNAPL** – Light non-aqueous phase liquid. With respect to the Tullamarine Landfill, LNAPL has been found within the landfill floating on the leachate water table / unsaturated waste interface. LNAPL testing in 2014/2015 found that LNAPL at the landfill is 'functionally immobile' (EHS Support 2015).

**PCBs** – Polychlorinated biphenyls, PCBs are present within LNAPL at the landfill, however have not been found to be present in groundwater.

**Tullamarine Closed Landfill Manager** – Cleanaway representative (or site delegate) responsible for the development and implementation of specific procedures to achieve environmental compliance with legislation.

# 1. THE OVERALL PURPOSE AND AIM OF THIS DOCUMENT

## 1.1 Overall Purpose

This version, Revision 1, of the Surface Water, Groundwater and Leachate Management Plan (SW, GW and LMP), formally the Groundwater Quality Management Plan (GQMP) incorporates and updates Revision 6 of the GQMP (Transpacific 2011a) and liquid waste management plan, Revision 2 (LWMP) (Transpacific 2011b) for the Tullamarine closed landfill, located on Western Avenue, Westmeadows, Victoria (the site).

Following the closure of the site as an operating landfill, the Post Closure Management Plan (PCMP) was prepared in response to the Environment Protection Authority Victoria's (EPA) Pollution Abatement Notice (PAN) (dated 4 December 2009) requirements for the site. To manage groundwater quality in a more holistic way, the Liquid Waste Management Plan (LWMP - which includes leachate and LNAPL) and GQMP (which includes surface water and groundwater) have been combined into this single document (this SW, GW and LMP).

This SW, GW and LMP has been prepared to set out the procedures for the management of Surface Water, Groundwater and Leachate Given Light Non-Aqueous Phase Liquid (LNAPL) is 'functionally immobile' (EHS Support 2015), the management of Leachate will effectively enable the appropriate management of LNAPL.

For the purposes of this SW, GW and LMP, the site (also referred to as the "landfill", see Figure 2) is defined as the premises boundary from the EPA Post Closure PAN (PCPAN), dated 4 December 2009 (Appendix A).

Monitoring of groundwater on and around the site has occurred since the early 1970s and this SW, GW and LMP builds on the findings of the years of concerted work completed. This version of the SW, GW and LMP has modifications made according to 2014 Technical Report For Auditor Review (2014 TRAR). Details regarding the site history, site assessments and justification for monitoring schedules, are included within the following documents:

- Preliminary Risk Assessment for the site (Golder, 2004)
- Secondary Risk Assessment (SRA) for the site (Golder, 2007),
- 2011 Technical Report for Auditor Review, and most recently
- 2014 Technical Report for Auditor Review.

## 1.2 Overall Aim

The aim of the SW, GW and LMP is to:

- Comply with the requirements of the Environment Protection Act (1970), State Environment Protection Policy (SEPP) "Groundwaters of Victoria", SEPP "Waters of Victoria"; and
- Form the basis of on-going environmental management of the landfill (pertaining to groundwater impact).

This will be achieved by continued assessment and monitoring of the landfill and surrounding environment as detailed within this plan.

All relevant aspects of the management of leachate and LNAPL that were previously within a separate document titled "Liquid Waste Management Plan" (LWMP)[1], are now in this SW, GW and LMP following revocation of the LNAPL Trial and Hydrogeological Assessment PAN.

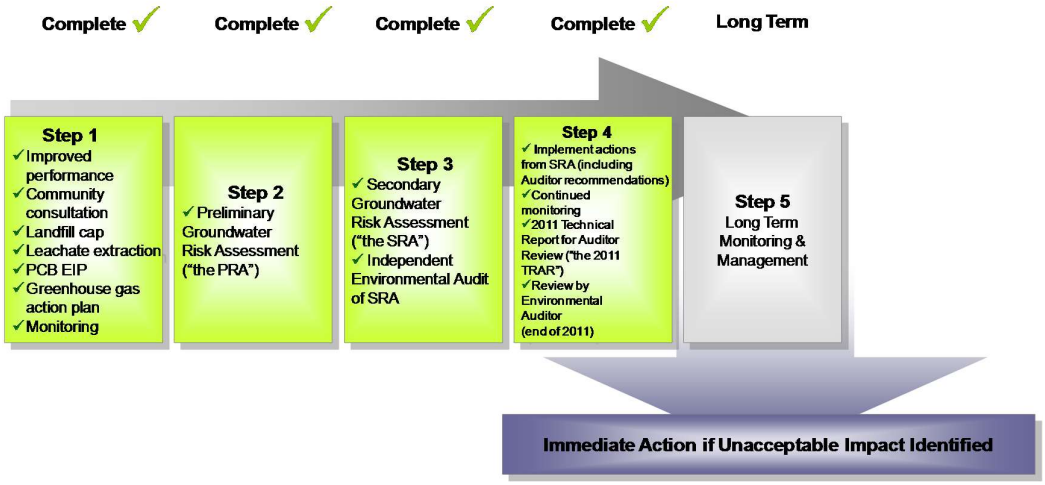
This revised SW, GW and LMP document forms part of the overall Post Closure Management Plan (PCMP), which integrates all aspects of site management post closure such as:

- Groundwater and surface water quality.
- Leachate, both aqueous and non-aqueous phases.
- The Moonee Ponds Creek environment adjacent to the site.
- Landfill gas
- Site rehabilitation
- Community relations
- Post closure maintenance

## 1.3 Overview of Approach

As part of the PCMP, Cleanaway recognises the importance of implementing practical management actions to continue to protect the beneficial uses of groundwater and surface waters through the revision of the SW, GW and LMP that has been developed for the site. Having completed the SRA and the 2011 TRAR, we are now at Step 5 in the 5 step process:

**A Progressive Approach to Long Term Management Actions**




Step 5 is focussed on a long term management plan that:

[1] Transpacific (2011b). Post Closure Management Plan, Tullamarine Prescribed Waste Landfill, Liquid Waste Management Plan, Transpacific, dated December 2011, Revision 002. Reference number 077613139/058.

1. Addresses and implements the actions and recommendations identified in the SRA, the 2011 TRAR, the 2014 TRAR and Environmental Auditor reviews.
2. Provide a program of continued monitoring of groundwater, surface water and biological parameters to confirm if there is a change in the extent of impact and level of risk to the environment. Contingency measures and implementation protocols have been developed to manage unacceptable impacts should they be identified in the future.
3. Encompass continual review and improvement through collection and reporting of data for review by an independent Environmental Auditor towards the end of 2017.

This approach is consistent with the requirements of the State Environment Protection Policy "Groundwaters of Victoria" and also consistent with the planning framework outlined in the original GQMP.

## 1.4 Structure of SW, GW AND LMP and how to use this document

This SW, GW and LMP is structured so that the main body of the document initially provides an introduction to the SW, GW and LMP stating its aims and overall approach to the ongoing management of groundwater at the site.

To facilitate implementation, four tasks are identified:

- **Task SW, GW AND LMP 001** – Leachate Management
- **Task SW, GW AND LMP 002** – Surface Water Management
- **Task SW, GW AND LMP 003** – Groundwater Management
- **Task SW, GW AND LMP 004** – Reporting

Various individual management actions have been allocated as appropriate to Tasks 001 (leachate); 002 (surface water); 003 (groundwater) and 004 (reporting). Details of the individual management actions are provided in the appendices attached to this SW, GW and LMP.

The main body of the SW, GW and LMP document provides:

- Some limited background information on the site (more detail is provided in the SRA, the 2011 TRAR and the 2014 TRAR)
- Statement reiterating regulators and key stakeholders
- Summary of the legislative setting of this SW, GW and LMP
- Management procedures for future revision of the SW, GW and LMP
- A list of deliverables arising from this GQMP, to provide clarity to key stakeholders such as the EPA and the community about reporting over the period to 2017.

It has been noted that procedure nomenclature within Revision 6 of the GQMP was confusing at times so, for clarity "Actions, Tasks, and Subtasks" are to be completed as part of SW, GW and LMP compliance for the site. Actions, tasks and sub-tasks are collectively be referred to as 'Items' in this document.

## 1.5 Cleanaway's Commitment

Consistent with our Environmental Policy, Cleanaway is committed to the implementation of this SW, GW and LMP.

Signed:

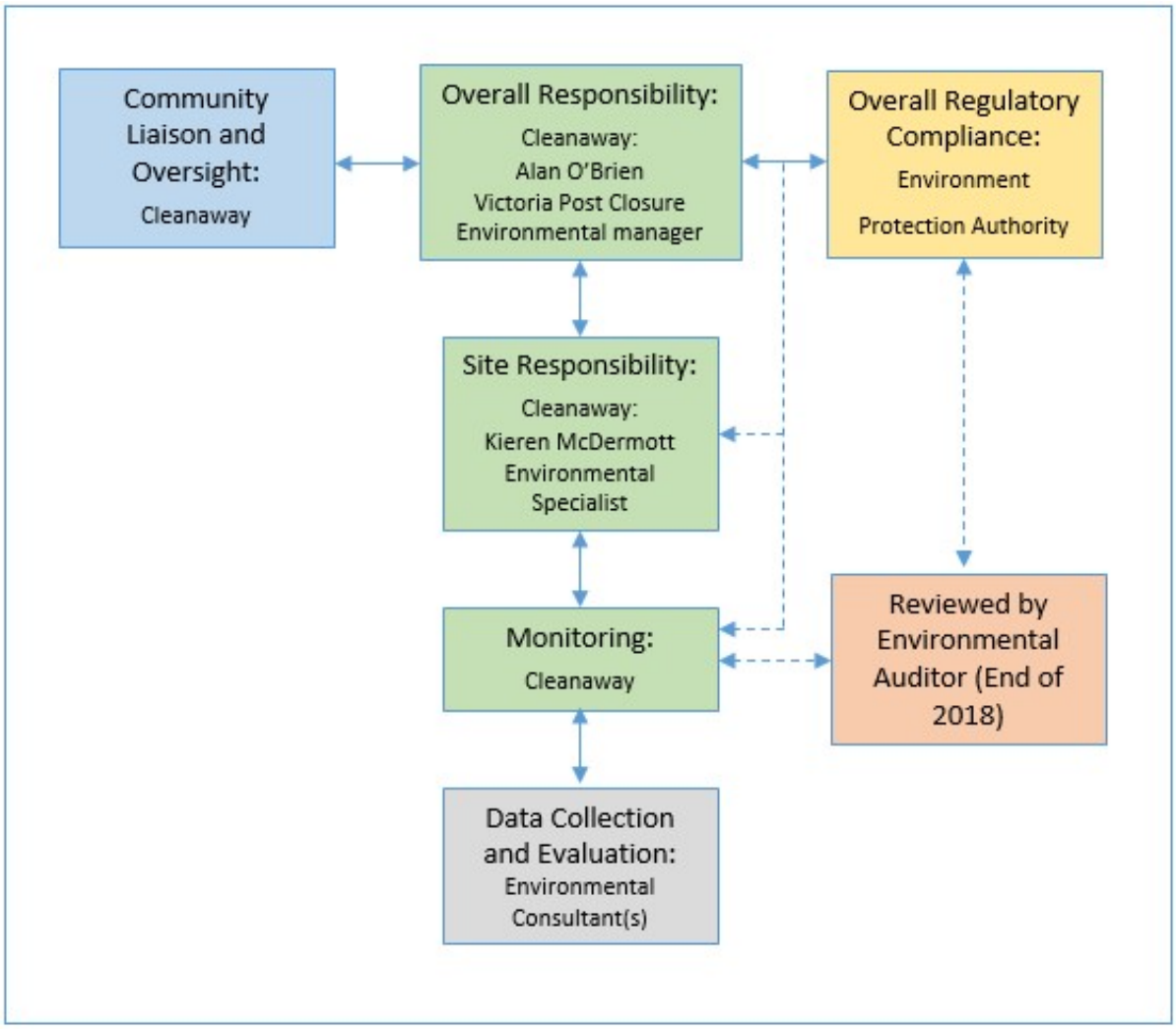
Alan O'Brien
Environment and Technical Manager of Post Collection, Victoria
Cleanaway

## 2. MANAGEMENT PLAN FRAMEWORK

The following sections outline the framework that will be used to manage, document and report on groundwater related environmental issues at the site to the regulators and key stakeholders.

### 2.1 Organisation

The following chart summarises the management structure as it relates to the implementation of this GQMP.



## 2.2 Stakeholders

Cleanaway and Environmental Professional's working on behalf of Cleanaway communicate regularly with the following key stakeholders.

Regulators:
- Environment Protection Authority (EPA)
- Hume City Council (Council)
- Southern Rural Water

Key stakeholders
- Tullamarine Landfill Community Groups
- Broader Community
- Contractors / subcontractors
- Melbourne Airport
- Other neighbouring sites

## 2.3 Community Relations

Cleanaway has been consulting with various community groups since 1997, and proposes to continue to work with regulators and key stakeholders to help engage and inform the broader community.

## 2.4 Auditing of the SW, GW AND LMP

The frequency of internal Cleanaway audits of the SW, GW and LMP will be as required by the Environmental Auditor.

The next review of the SW, GW and LMP by an Environmental Auditor is anticipated to commence in 2018.

The scope of the review of the SW, GW and LMP by an Environmental Auditor will likely involve:
- A review of the progress of the implementation of the SW, GW and LMP.
- Review of the data from the environmental monitoring program (September 2014 to late 2017) to assess whether there has been a discernible change to the previously assessed low risk to the environment and human health associated with movement of impacted groundwater from the site.
- Review of the adequacy of the environmental monitoring program.
- Provision of recommendations.

## 2.5 Timeframe for Implementation

The scope and indicative times for completion of each SW, GW and LMP sub task are provided in the appendices to this document. In addition, Section 5 of this document provides a summary list of deliverables and their indicative timing.

## 2.6 Document Revision

The following table outlines the history of development of this document:

| Management Plan | Version Number | Date | Nature of Revision | Editor |
|---|---|---|---|---|
| Groundwater and Surface Water Quality | 005 | March 2010 | The fifth revision of the GQMP was developed to align with the requirements of the PAN issued 4 December 2009. | Transpacific Golder |
| Liquid Waste | 001 | March 2010 | The first liquid waste management plan was developed to align with the requirements of the PAN issued 4 December 2009 | |
| Liquid Waste | 002 | December 2011 | A second liquid waste management plan was developed to align with the requirements of the 2011 TRAR. | |
| Groundwater and Surface Water Quality | 006 | December 2011 | Revision 6 of the GQMP (Rev6) was developed to incorporate the outcomes of the 2011 TRAR and the recommendations from the Environmental Auditor's review of the monitoring and reporting outcomes of the GQMP (Rev5). | Transpacific Golder |
| Surface Water, Groundwater and Leachate | 001 | December 2016 | Revision of the SW, GW and LMP (Revision 1) to incorporate the outcomes of the 2014 TRAR, and combine Revision 2 of the LWMP and Revision 7 of the GQMP. This version incorporated leachate and LNAPL management and so a standalone liquid waste management plan is no longer required. As this document is a more comprehensive standalone and holistic plan this is the first revision of the plan. | Cleanaway Kleinfelder |

# 3. LEGISLATION AND GUIDELINES

Activities at the site must conform with the relevant SEPPs for Land, Groundwater, Air, Noise, and Surface Waters, and the Waste Management Policies (WMPs) and relevant environmental regulations promulgated under the Environment Protection Act (1970). Further information on key policies and regulations applicable to the site is outlined below.

## 3.1 Relevant Legislation and Policies

**Table 1 Relevant Victorian legislation and policies**

| Legislation | Key SW, GW AND LMP aspects to consider |
|---|---|
| Environment Protection Act (1970) | • Sets overall principles of environment management.<br>• Defines Appointment and responsibilities for Environmental Auditors.<br>• Controls discharges to and pollution of waters. |
| SEPP (Groundwaters of Victoria) (1997) | • Establishes beneficial uses to be protected for groundwater.<br>• Sets indicators and objectives for groundwater for the various beneficial uses. |
| SEPP (Waters of Victoria) (2003) | • Establishes beneficial uses to be protected for surface waters including the Moonee Ponds Creek.<br>• Sets indicators and objectives for surface waters including the Moonee Ponds Creek. |
| Water Act (1989) | • Regulates the construction and decommissioning of bores.<br>• Regulates the use of bores for extractive purposes. |

## 3.2 Applicable Environmental Legislation & Guidelines

Relevant guidelines are identified in each management task.

# 4. ADDRESSING AND IMPLEMENTING IDENTIFIED ACTIONS AND RECOMMENDATIONS

The objective of this SW, GW and LMP is to address and implement actions and recommendations that were identified in the SRA, the 2011 TRAR, the independent Environmental Auditor reviews of the SRA and the 2011 TRAR and the 2014 TRAR (where practicable and relevant).

The 2014 TRAR identified outstanding and ongoing items as part of detailed compliance reviews of site environmental management activities. Those outstanding and ongoing items have been retained and those completed are considered ‘closed out’.

## 5. DELIVERABLES

The following table summarises the expected deliverables from this SW, GW and LMP for the period between Auditor acceptance of this SW, GW and LMP and near the end of 2017, and anticipated timelines.

**Task 001: Liquid Waste Management**

| Rep | Reporting | |
|---|---|---|
| **Rep. 1** | Cleanaway is to produce an Annual Groundwater Review which will document that the requirement of SW, GW and LMP have been completed. | **Ongoing (annually) post 2018 TRAR** (i.e. first review due in 2019) |

**Task 002: Surface Water Management**

| Rep | Reporting | |
|---|---|---|
| **Rep. 2** | High spatial salinity monitoring technical report to be completed following the monitoring event. | **By end of 2017** |

**Task 003: Groundwater management**

| Rep | Reporting | |
|---|---|---|
| **Rep. 3** | A monitoring well installation report is to be completed following the installation of groundwater monitoring wells: MB87U, MB87L, MB88U, MB88L, MB89U, MB89L, MB90U and MB90L. The installation report is to document the location and construction details of each of the wells as well as present the geological data collected during drilling. | **30 June 2017** |

# FIGURES

PLOTTED: 16-Dec-2016, 12:21PM, Iziemelis

LAYOUT: 1

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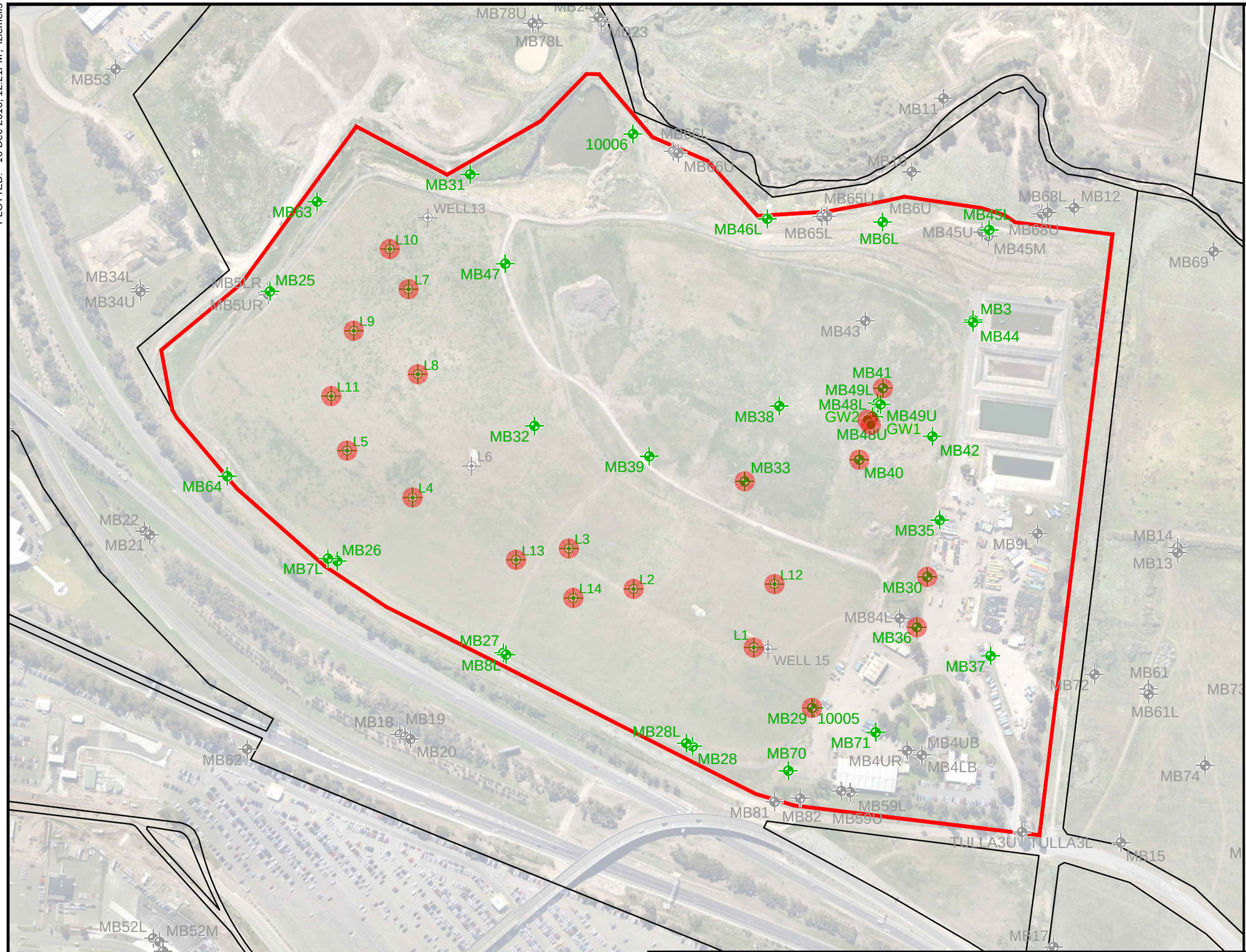


## LEGEND

- SITE BOUNDARY
- MONITORING WELL
- LEACHATE EXTRACTION WELL
- PUMP TRIAL WELLS
- BORES FOR QUARTERLY FIELD MONITORING
- LNAPL PRESENT IN WELL

N

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

SCALE 0 35 70 105 140 175 METRES
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| CHECKED BY: | MW |
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# LNAPL DISTRIBUTION AND MONTHLY MONITORING BORES

TULLAMARINE CLOSED LANDFILL
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE
1

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MOUND 1
MOUND 2
MOUND 3
BUFFER LAND
WESTERN AVENUE
WRIGHT STREET

## LEGEND

- SITE BOUNDARY
- 140-202 WESTERN AVE. BOUNDARY
- LANDFILL CAP BOUNDARY
- MONITORING WELL
- LEACHATE EXTRACTION WELL
- 2016 INSTALLED GROUNDWATER MONITORING WELL
- MONITORED QUARTERLY
- MONITORED SIX MONTHLY

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

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SCALE 1:6000 (A3) METRES



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# MOONEE PONDS CREEK - SALINITY MONITORING NETWORK

TCL TULLAMARINE
MONITORING WELL INSTALLATION
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE
2

PLOTTED: 16-Dec-2016, 12:21PM, Iziemelis

LAYOUT: 3

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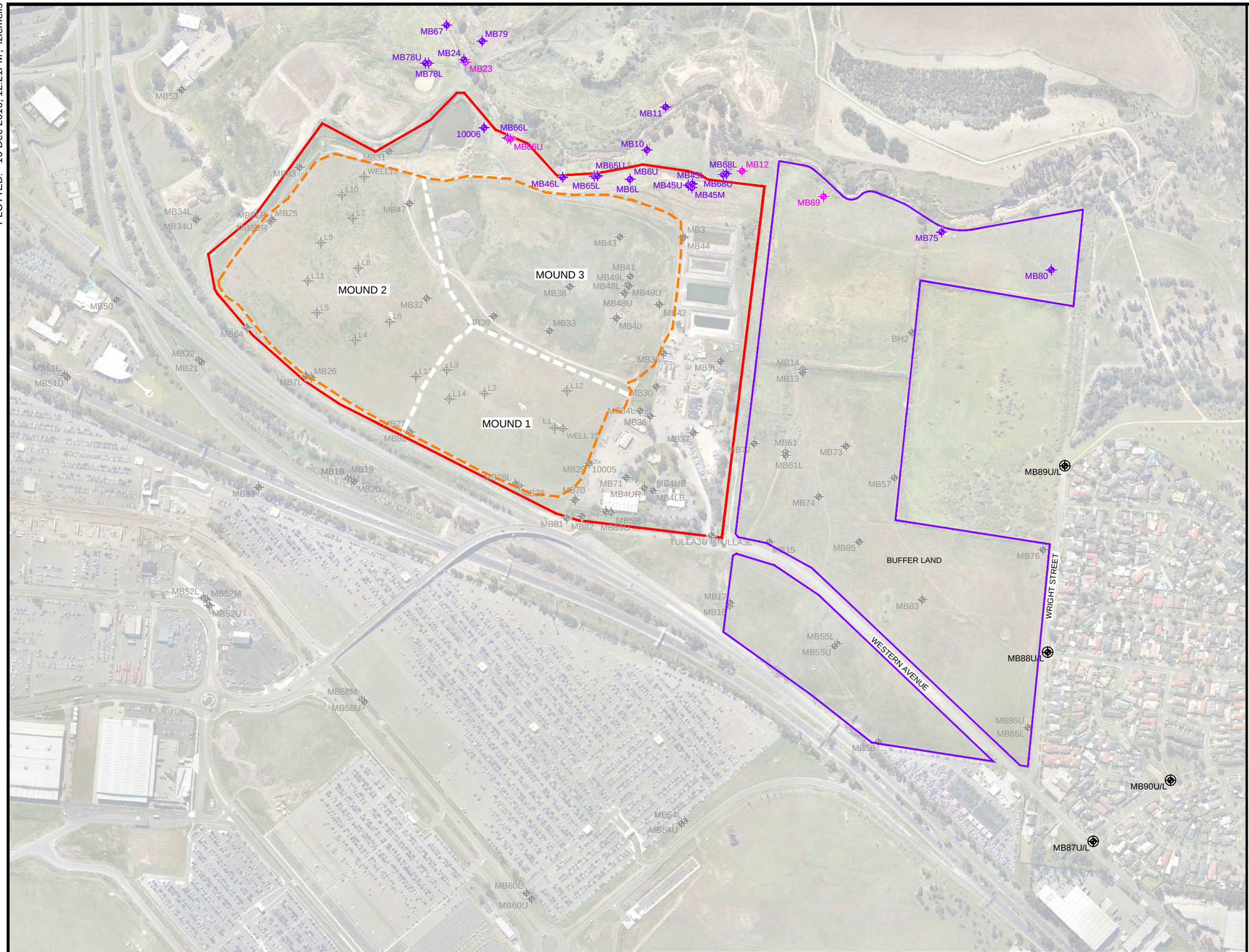


## LEGEND

- SITE BOUNDARY
- 140-202 WESTERN AVE. BOUNDARY
- LANDFILL CAP BOUNDARY
- MONITORING WELL
- LEACHATE EXTRACTION WELL
- 2016 INSTALLED GROUNDWATER MONITORING WELL
- MONITORED YEARLY
- MONITORED EVERY 2 YEARS

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

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SCALE 1:6000 (A3) METRES



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# MOONEE PONDS CREEK - VICINITY MONITORING NETWORK

TCL TULLAMARINE
MONITORING WELL INSTALLATION
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE 3

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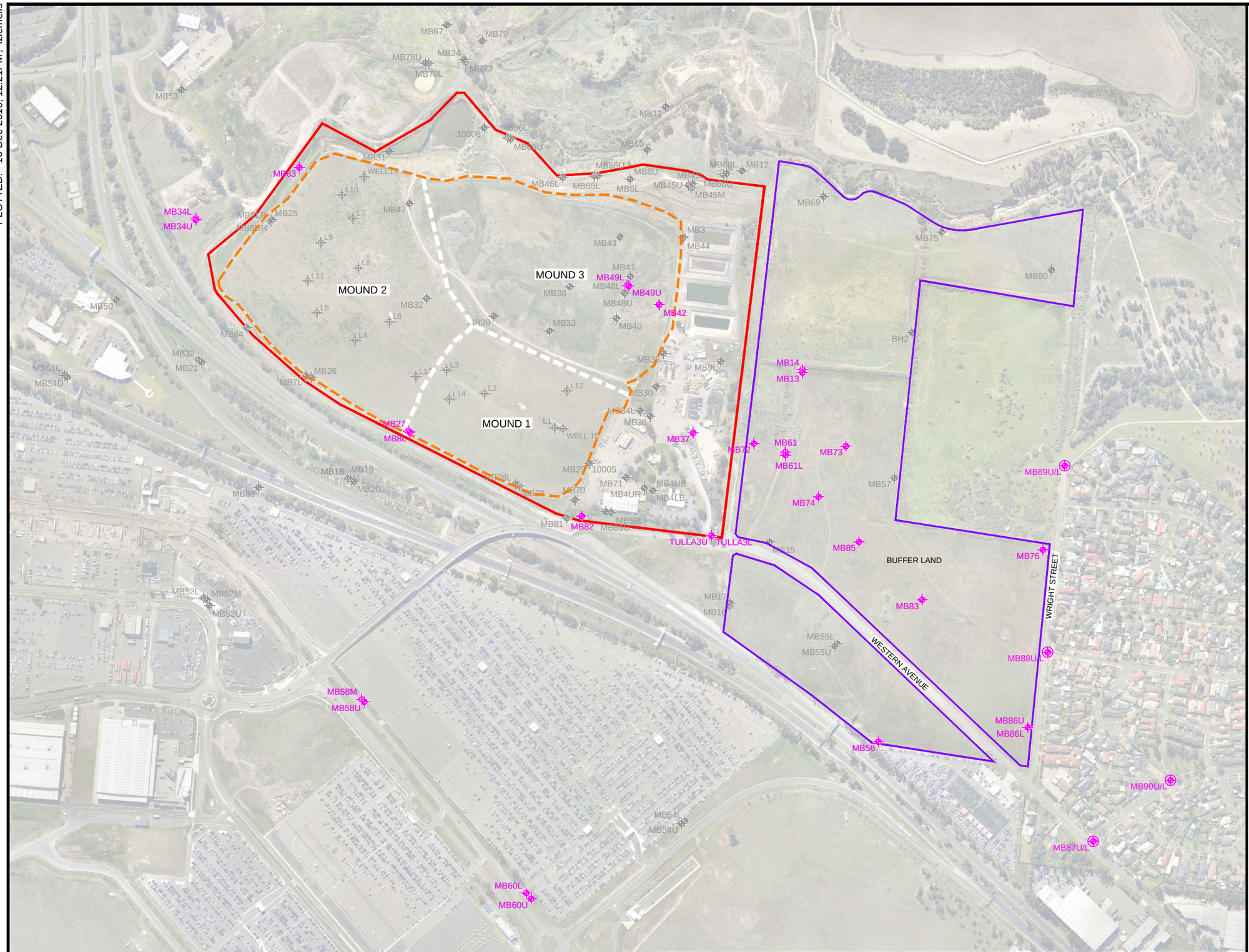


## LEGEND

- SITE BOUNDARY
- 140-202 WESTERN AVE. BOUNDARY
- LANDFILL CAP BOUNDARY
- MONITORING WELL
- LEACHATE EXTRACTION WELL
- 2016 INSTALLED GROUNDWATER MONITORING WELL
- MONITORED YEARLY

N

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DIMENSIONS IN METRES (m).

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SCALE 1:6000 (A3) METRES



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# MONITORED NATURAL ATTENUATION MONITORING NETWORK

TCL TULLAMARINE
MONITORING WELL INSTALLATION
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE
4

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MB67 MB79 MB78U MB24 MB23 MB78L MB53 MB11 10006 MB66L MB66U MB10 MB31 WELL13 MB63 MB65U MB68L MB12 MB46L MB65L MB6U MB6L MB45U MB68U MB45M MB69 L10 MB47 L7 MB34L MB34U MB50R MB25 MB50R L9 MB43 MB3 MB44 MB75 L8 MB41 MOUND 3 MB49L MB48L MB49U L11 MOUND 2 MB38 MB48U MB42 MB80 MB50 L5 MB32 L6 MB39 MB33 MB40 BH2 MB64 L4 MB22 MB21 MB35 MB9L MB14 MB51L MB51U MB26 MB7L L12 L3 MB13 L14 L2 L12 MB30 MB34L MB27 MB8L MOUND 1 L1 WELL 15 MB36 MB37 MB72 MB61 MB73 MB61L MB89U/L MB18 MB19 MB29 10005 MB28L MB28 MB70 MB71 MB4UB MB4UR MB4LB MB57 MB62 MB20 MB74 MB81 MB82 MB59L MB59U TULLA3U TULLA3L MB15 MB85 BUFFER LAND MB76 MB52L MB52M MB52U MB17 MB16 MB83 WRIGHT STREET MB55L MB55U WESTERN AVENUE MB88U/L MB58M MB58U MB86U MB86L MB56 MB90U/L MB54L MB54U MB87U/L MB60L MB60U

## LEGEND

- SITE BOUNDARY
- 140-202 WESTERN AVE. BOUNDARY
- LANDFILL CAP BOUNDARY
- MONITORING WELL
- LEACHATE EXTRACTION WELL
- 2016 INSTALLED GROUNDWATER MONITORING WELL
- MONITORED EVERY2 YEARS

N

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DIMENSIONS IN METRES (m).

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# HYDRAULIC FLOW LINES MONITORING NETWORK

TCL TULLAMARINE
MONITORING WELL INSTALLATION
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE

5

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LAYOUT: 6

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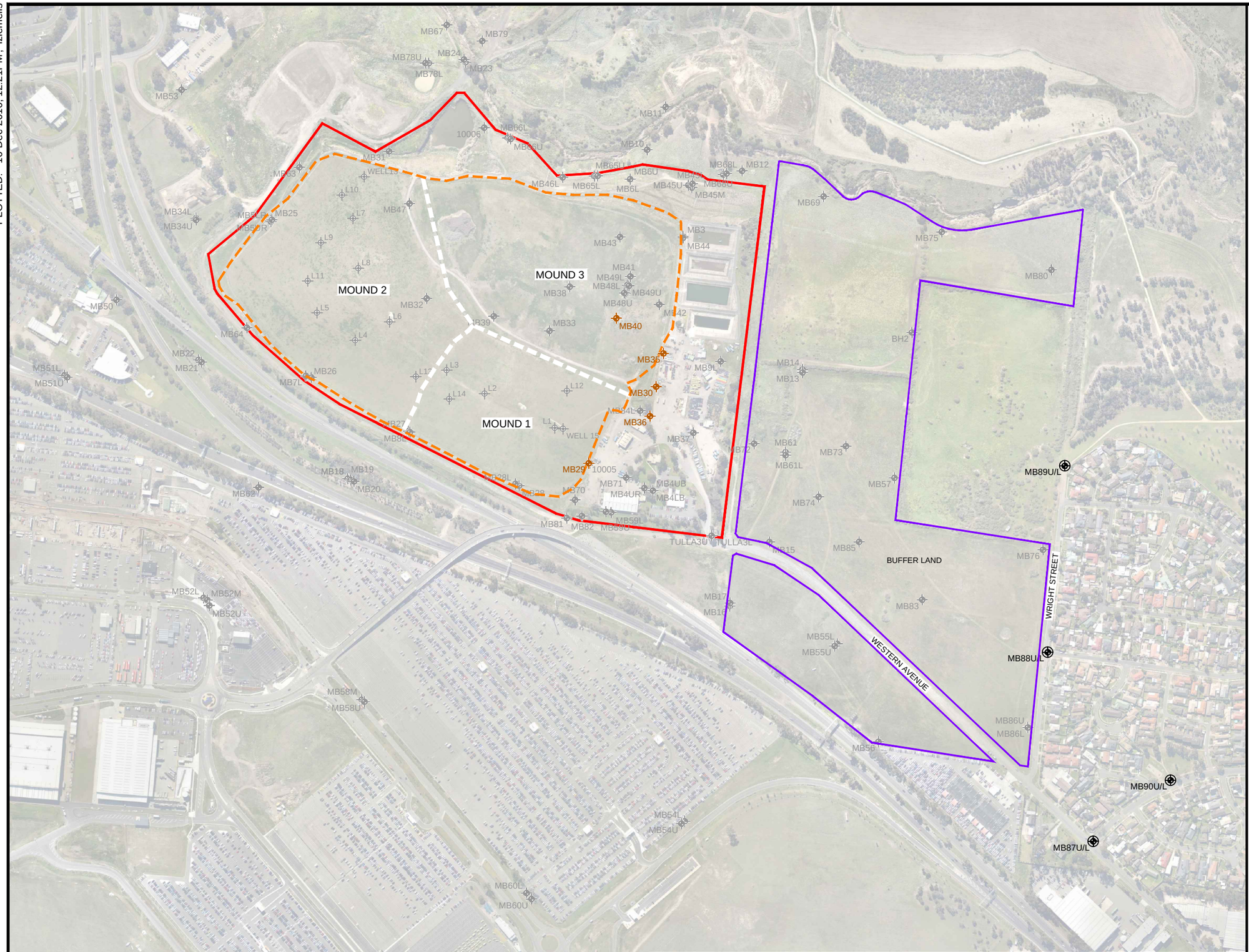


## LEGEND

- SITE BOUNDARY
- 140-202 WESTERN AVE. BOUNDARY
- LANDFILL CAP BOUNDARY
- MONITORING WELL
- LEACHATE EXTRACTION WELL
- 2016 INSTALLED GROUNDWATER MONITORING WELL
- MONITORED EVERY 3 YEARS

N

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

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SCALE 1:6000 (A3) METRES



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# LNAPL MONITORING NETWORK

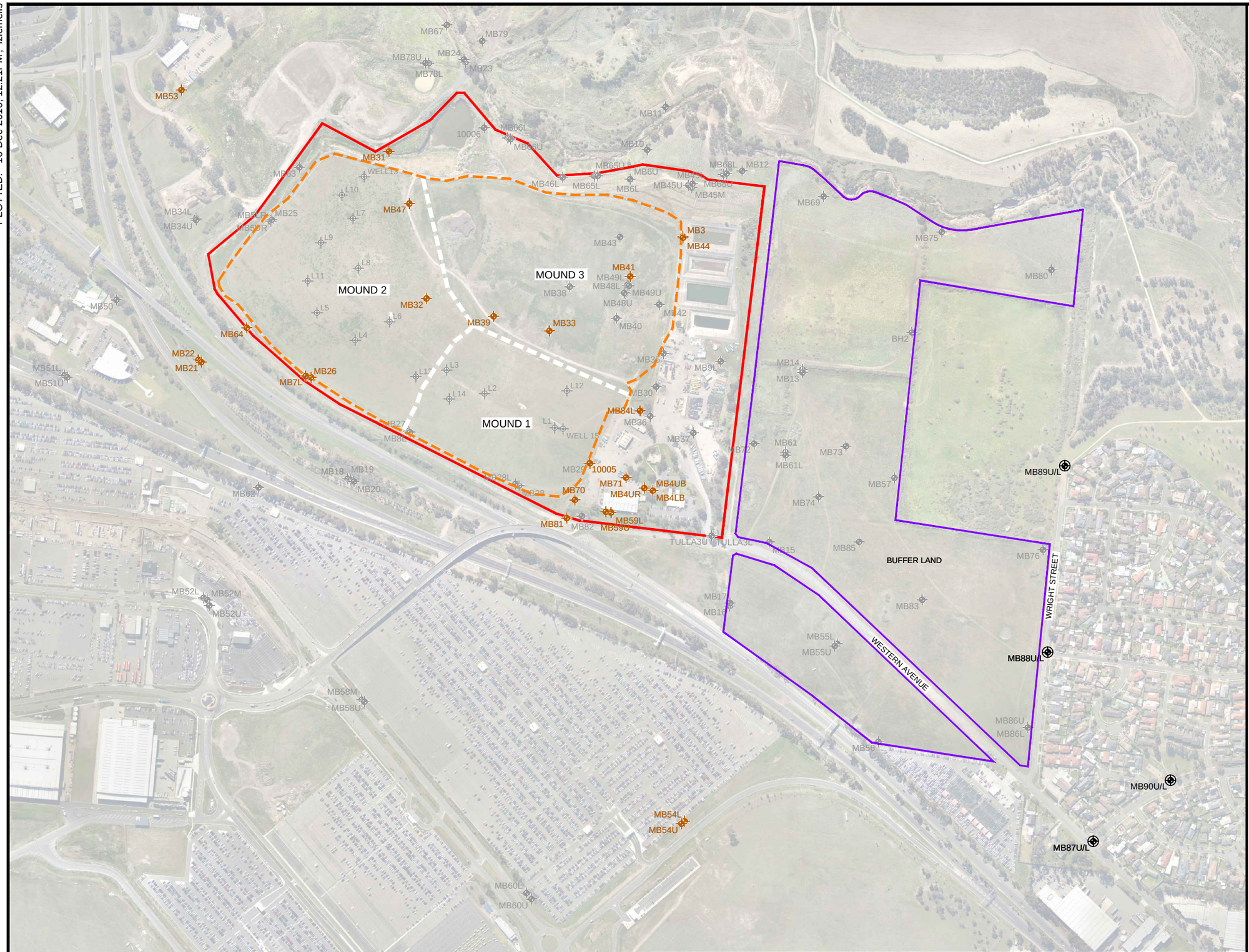
TCL TULLAMARINE
MONITORING WELL INSTALLATION
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE
6

PLOTTED: 16-Dec-2016, 12:21PM , Iziemelis

LAYOUT: 7

ATTACHED IMAGES: "1-1.jpg" "golder base.jpg" "north.jpg" "site2.jpg"
CAD FILE: \\melbourne.kleinfelder.com\Melbourne-Data\Data\09_Projects\DELTEK Projects\Regular\20172\20143795.001A Cleanaway Tulla Landfill\GQMP\Draft\GQMP Figures
MELBOURNE, AU




## LEGEND

- SITE BOUNDARY
- 140-202 WESTERN AVE. BOUNDARY
- LANDFILL CAP BOUNDARY
- MONITORING WELL
- LEACHATE EXTRACTION WELL
- 2016 INSTALLED GROUNDWATER MONITORING WELL
- MONITORED EVERY 3 YEARS

N

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

0 60 120 180 240 300
SCALE 1:6000 (A3) METRES



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| | |
|---|---|
| PROJECT: | 20162414.001A |
| DATE DRAWN: | 13.09.16 |
| DRAWN BY: | LZ |
| CHECKED BY: | MW |
| FILE NAME: | 20162414.001A.dwg |

# REMAINING MONITORING NETWORK

TCL TULLAMARINE
MONITORING WELL INSTALLATION
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE
7

PLOTTED: 16-Dec-2016, 12:21PM , Iziemelis

LAYOUT: 8

ATTACHED IMAGES: "1-1.jpg" "golder base.jpg" "north.jpg" "site2.jpg"

CAD FILE: \\melbourne.kleinfelder.com\Melbourne-Data\Data\09_Projects\DELTEK Projects\Regular\20172014379 5.001A Cleanaway Tulla Landfill\GQMP\Draft\GQMP Figures

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MB67 MB79 MB78U MB24 MB23 MB78L MB53 MB11 10006 MB66L MB66U MB10 MB31 MB63 WELL13 MB65U MB6U MB68L MB12 MB46L MB65L MB6L MB45U MB68U MB45M MB45L MB69 MB34L MB34U MB52R MB50R MB25 MB47 L10 L7 L9 L8 L11 MB3 MB44 MB43 MB75 MB41 MB49L MB48L MB49U MB48U MB42 MB80 MOUND 3 MOUND 2 MB38 MB32 MB50 L5 L6 MB39 MB33 MB40 MB64 L4 BH2 MB22 MB21 MB35 MB9L MB14 MB13 MB51L MB51U MB26 MB7L L12 L3 L14 L2 L12 MB30 MB84L MB36 MB27 MB8L MOUND 1 L1 WELL 15 MB37 MB72 MB61 MB73 MB61L MB89U/L MB18 MB19 MB29 10005 MB28L MB71 MB4UB MB62 MB20 MB28 MB70 MB4UR MB4LB MB57 MB74 MB81 MB82 MB59L MB59U TULLA3U TULLA3L MB15 MB85 BUFFER LAND MB76 WRIGHT STREET MB17 MB16 MB83 MB52L MB52M MB52U MB55L MB55U WESTERN AVENUE MB88U/L MB58M MB58U MB86U MB86L MB56 MB90U/L MB54L MB54U MB87U/L MB60L MB60U

## LEGEND

- SITE BOUNDARY
- 140-202 WESTERN AVE. BOUNDARY
- LANDFILL CAP BOUNDARY
- MONITORING WELL
- LEACHATE EXTRACTION WELL
- 2016 INSTALLED GROUNDWATER MONITORING WELL
- MONITORED QUARTERLY
- MONITORED SIX MONTHLY
- MONITORED YEARLY
- MONITORED EVERY 2 YEARS
- MONITORED EVERY 3 YEARS

N

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

0 60 120 180 240 300

SCALE 1:6000 (A3) METRES



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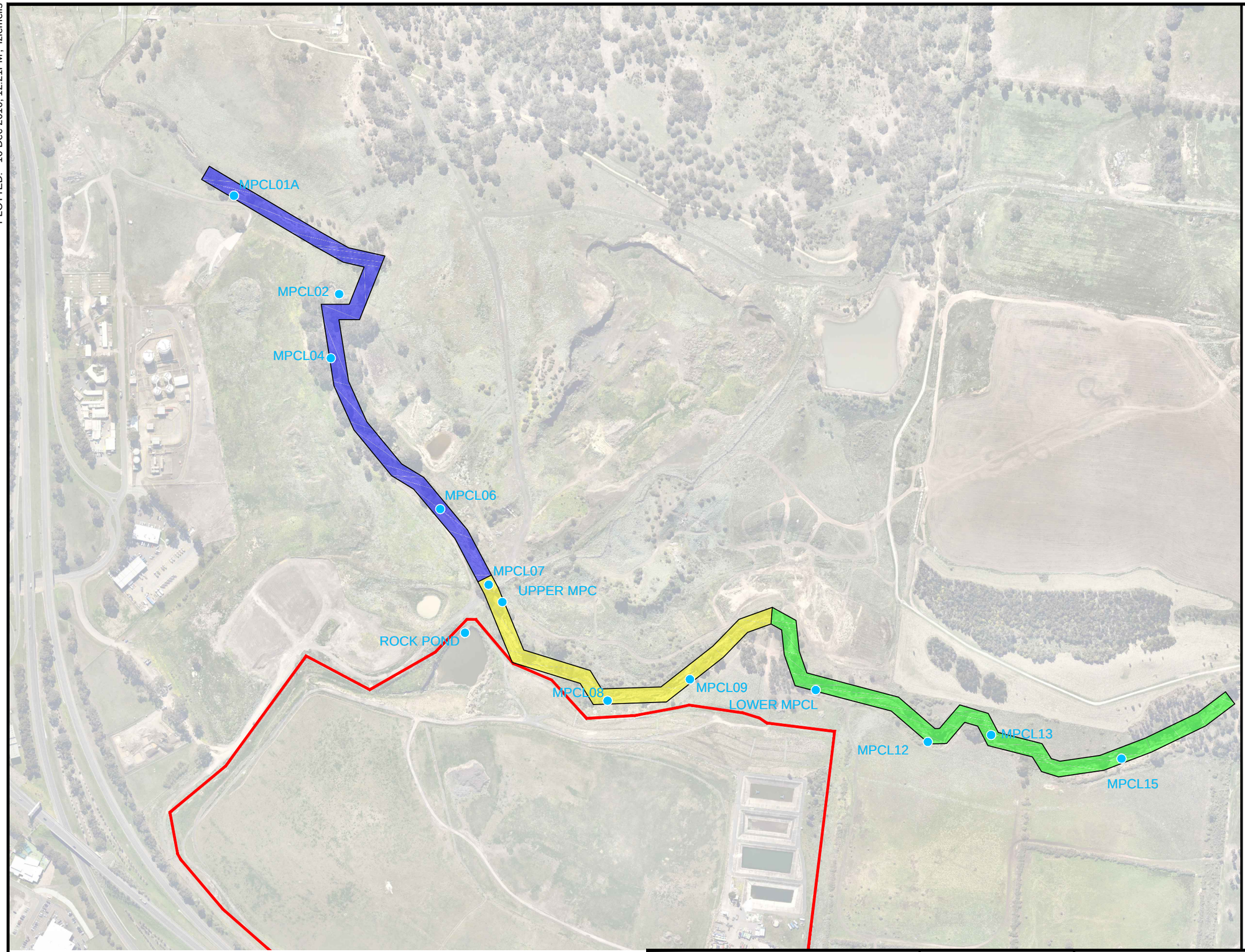
# MINIMUM SAMPLING INTERVAL

TCL TULLAMARINE
MONITORING WELL INSTALLATION
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE 8




## LEGEND

- SITE BOUNDARY
- SURFACE WATER SAMPLING LOCATIONS
- ZONE 1
- ZONE 2
- ZONE 3
- MONITORED QUARTERLY

N

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

0 50 100 150 200 250
SCALE 1:5000 (A3) METRES



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| FILE NAME: | 20162414.001A.dwg |

# SURFACE WATER FIELD PARAMETERS

2014 TECHNICAL REPORT FOR AUDITOR REVIEW
TULLAMARINE CLOSED LANDFILL
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE
9

PLOTTED: 16-Dec-2016, 12:21PM, Iziemelis LAYOUT: 10

ATTACHED IMAGES: "1-1.jpg" "golder base.jpg" "north.jpg" "site2.jpg"
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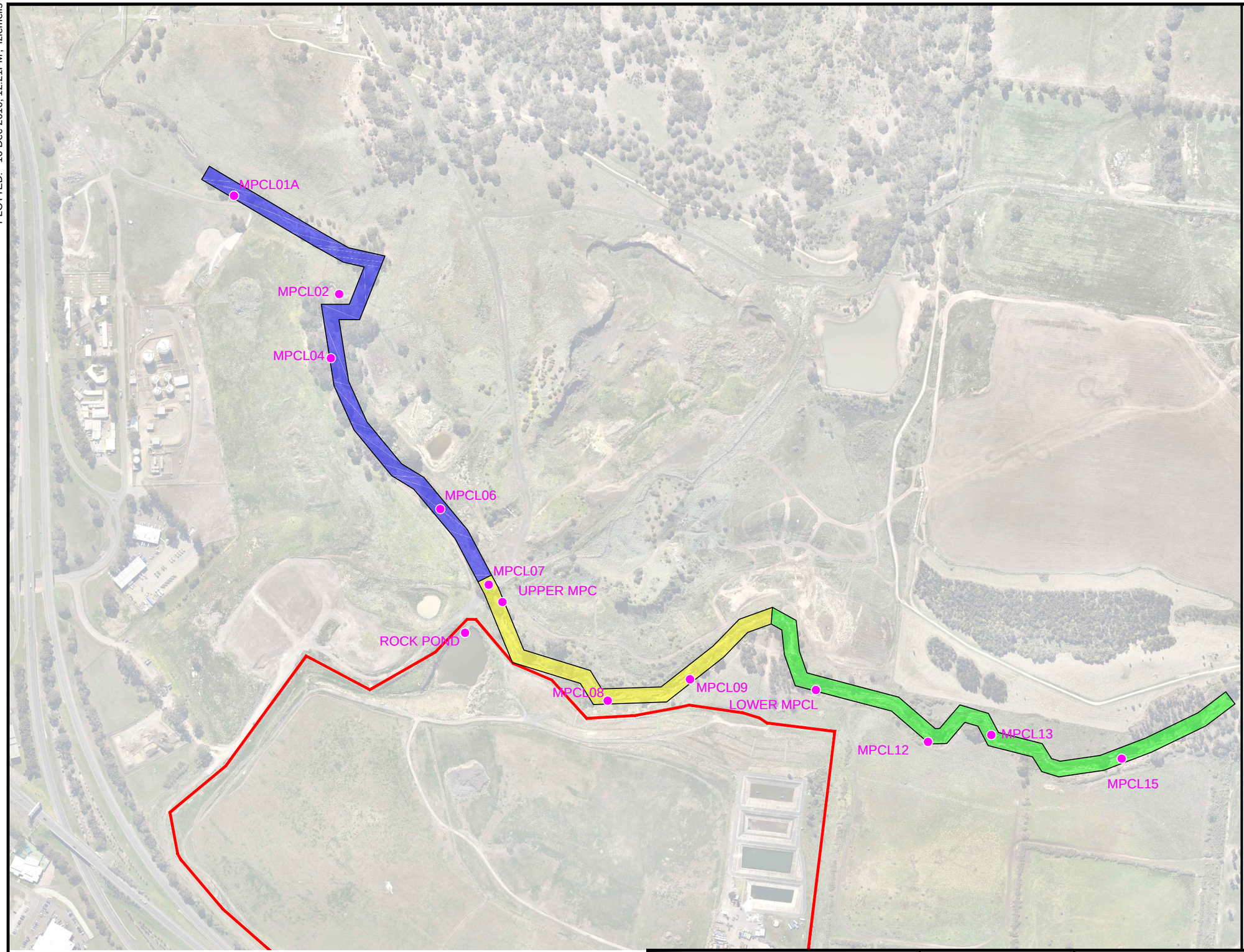


## LEGEND

- SITE BOUNDARY
- SURFACE WATER SAMPLING LOCATIONS
- ZONE 1
- ZONE 2
- ZONE 3
- MONITORED YEARLY

N

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

0 50 100 150 200 250
SCALE 1:5000 (A3) METRES



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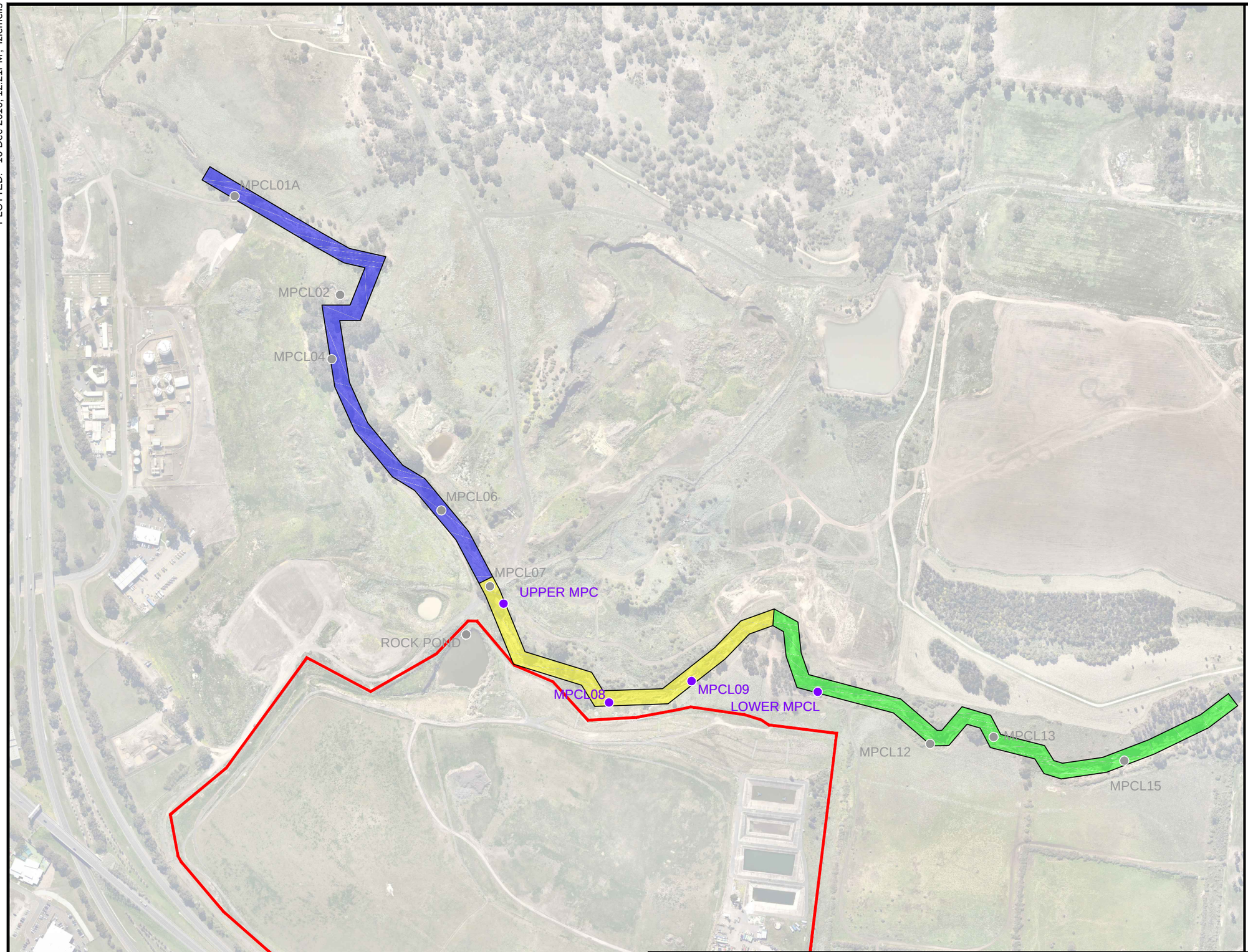
| DRAWN BY: | LZ |
| CHECKED BY: | MW |
| FILE NAME: | 20162414.001A.dwg |

# SURFACE WATER LABORATORY ANALYSIS (LAB EC)

2014 TECHNICAL REPORT FOR AUDITOR REVIEW
TULLAMARINE CLOSED LANDFILL
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE
10




## LEGEND

- SITE BOUNDARY
- SURFACE WATER SAMPLING LOCATIONS
- ZONE 1
- ZONE 2
- ZONE 3
- MONITORED EVERY 2 YEARS

N

NOTE: ALL LOCATIONS ARE APPROXIMATE.
DIMENSIONS IN METRES (m).

0 50 100 150 200 250
SCALE 1:5000 (A3) METRES



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| PROJECT: | 20142414.001A |
| DATE DRAWN: | 13.09.16 |
| DRAWN BY: | LZ |
| CHECKED BY: | MW |
| FILE NAME: | 20162414.001A.dwg |

SURFACE WATER
LABORATORY ANALYSIS
(COI)

2014 TECHNICAL REPORT FOR AUDITOR REVIEW
TULLAMARINE CLOSED LANDFILL
WESTERN AVENUE
WESTMEADOWS, VICTORIA

FIGURE
11

PLOTTED: 16-Dec-2016, 12:21PM, lziemelis LAYOUT: 11
ATTACHED IMAGES: "1-1.jpg" "golder base.jpg" "north.jpg" "site2.jpg"
CAD FILE: \\melbourne.kleinfelder.com\Melbourne-Data\Data\09_Projects\DELTEK Projects\Regular\2017\20143795.001A Cleanaway Tulla Landfill\GQMP\Draft\GQMP Figures
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# SW, GW and LMP TASKS

## SW,GW&LMP-001-1. OBJECTIVES OF THE LEACHATE MANAGEMENT PROCEDURE

The objectives and actions for liquid waste management at the site were previously documented within a separate Liquid Waste Management Plan based on requirement set out in the site EPA license since 2002 and then updated, following the closure of the site as a landfill, with a Post Closure Pollution Abatement Notice (PC PAN), dated 4 December 2009. In order to ensure the ongoing management of liquid waste at the site, this section serves to replace the now redundant LWMP.

In preparing the Leachate Management Task Procedure**,** consideration was given to the following:

- The contents of the LWMP (Rev 2) that remain relevant following the revocation of the associated LNAPL and HA PAN. These remain as regulatory requirements.
- Concerns and expectations the community have expressed regarding the removal and safe treatment/handling of LNAPL. These are considered voluntary or non-regulatory requirements.

Further information about the derivation of, and background for, this GQMP, as well as details regarding the history of the site, the extent of COIs and further discussion of risk are included within the Secondary Risk Assessment (SRA) for the site (Golder, 2007), Revision 6 of the GQMP, Revision 2 of the LWMP, the 2011 TRAR, and most recently the 2014 TRAR.

### Aim of the Leachate Management Procedure

To address the above considerations, the overall aim of future liquid waste management at the landfill is to adopt a voluntary precautionary approach by further reducing, as far as practicable, the low risk currently posed by leachate and LNAPL to people and the environment.

Details relating to the objectives and proposed actions for future liquid waste management at the landfill are presented below.

## SW,GW&LMP-001-2. APPLICABLE ENVIRONMENTAL LEGISLATION & GUIDELINES

Activities at the site must conform to the relevant State Environment Protection Policies (SEPPs) for Land, Groundwater, Air, Noise, and Surface Waters, and relevant environmental regulations (such for prescribed industrial wastes (PIW) and polychlorinated biphenyls (PCBs), amongst others) promulgated under the Environment Protection Act (1970).

## SW,GW&LMP-001-3. PROCEDURES FOR LEACHATE MANAGEMENT

| Item | Management Procedure | When By |
|---|---|---|
| **1** | **Item 1: LNAPL Contingency Protocol** | |
| **1.1** | The Existing LNAPL Contingency Protocol has been updated to reflect the improving conceptual understanding of LNAPL as presented in the 2014 TRAR.<br><br>The site has remained with LNAPL outside the landfill cell, but within the site boundary throughout the monitoring period covered by the 2014 TRAR. As such, the minimum monitoring requirements set out below (Items 2.1, 2.2 and 2.3) are to be adopted.<br><br>Given the updated understanding that LNAPL within the site boundaries is 'functionally immobile', the previous LNAPL contingency procedure is not considered applicable any longer. If a change in LNAPL distribution is detected at the site (during LNAPL gauging of boreholes on site) the following LNAPL contingency procedure is to be adopted for the site (as provided below): | **Implementation is ongoing** |

| Item | Management Procedure | When By |
|---|---|---|
| 1.2 | **A. LNAPL Contingency Procedure:** LNAPL / Sheen Found in New on-site Groundwater Monitoring Bore.<br><br>Should a sheen or LNAPL be observed in a new on-site monitoring bore, Cleanaway Management and the Environmental Auditor shall be notified within 48 hours to coordinate an appropriate response as part of the contingency protocol.<br><br>The following steps are to be undertaken as part of the initial response:<br><br>• A sample of the LNAPL is to be collected for fingerprinting analysis to ascertain LNAPL properties and potential sources.<br>• A 'baildown' or similar test is to be conducted to determine actual LNAPL thickness and transmissivity in accordance with ASTM E2856[1].<br><br>Following initial data collection, the following should be considered in developing an appropriate response:<br><br>If LNAPL transmissivity allows for feasible removal of LNAPL, an LNAPL removal program is to be implemented. This may include ongoing baildown, skimming or pumping (or other).<br><br>The Conceptual Site Model is to be reviewed to determine LNAPL source, and the lateral migration potential. If needed, additional groundwater wells / leachate wells are to be installed to: defined the extent of LNAPL; intercept LNAPL and/or aid in LNAPL removal.<br><br>**B. Appropriate Remedial Actions for LNAPL in Moonee Ponds Creek.**<br>Note that the LNAPL in the landfill is functionally immobile and so its detection in the creek is extremely unlikely. If a sheen is observed during quarterly creek monitoring its source is likely to be from a source other than the landfill. Fingerprinting will be undertaken as outlined above to determine the source. Given the source could likely be from a local surface spill, Cleanaway will investigate the source and notify the EPA and Melbourne Water immediately. An immediate investigation will be undertaken to confirm the source of the spill, who is responsible and actions required to achieve clean up.<br><br>If immediate response is required, the EPA, Melbourne Water and any other response agencies (such as the Metropolitan Fire Brigade) will be notified and involved as required. | **LNAPL Contingency Procedure only to be enacted upon if a change in LNAPL is detected during planned gauging.**<br><br>**Enactment is As Required (within 48 hours) / Determined in consultation with the Environmental Auditor** |

[1]Active Standard ASTM E2856-13 *Standard Guide for Estimation of LNAPL Transmissivity,* 2013.

| 2 | Item 2: LNAPL Monitoring Program | |
|---|---|---|
| **2.1** | LNAPL levels and thickness are to be collected quarterly within all Leachate Bores (L1 to L14). Any additional bores installed within Mounds 1, 2 or 3 with the intent for monitoring LNAPL and/or Leachate) within the mounds are to be included in Items 2.2 and 2.3 list.<br><br>Leachate bores to be monitored quarterly are shown on Figure 1 | **On-going (quarterly)** |
| **2.2** | Groundwater levels, LNAPL levels and thickness are to be collected quarterly within the following Groundwater Monitoring Bores:<br><br>10005, 10006, MB3, MB6L, MB7L, MB8L, MB25, MB26, MB27, MB28, MB28L, MB29, MB30, MB31, MB31, MB32, MB33, MB35, MB36, MB37, MB38, MB39, MB40, MB41, MB42, MB44, MB45L, MB46L, MB47, MB48L, MB48U, MB49L, MB49U, MB63, MB64, MB70, MB71, GW1 and GW2.<br><br>This list of bores shall be reviewed annually with any recommendations for adding or removing wells from this list included in the Annual Compliance Review.<br><br>Groundwater Monitoring bores to be monitored quarterly are shown on Figure 1 | **On-going (quarterly)** |
| **2.3** | Monee Ponds Creek is to be visually inspected quarterly to identify the presence of sheen as per normal sampling requirements at any site. Visual inspection is to be undertaken at three locations approximate to: the eastern site boundary, centrally along the northern site boundary and the wester site boundary. If a sheen is noted then refer to Item 1.2B (above) for the response required. | **On-going (quarterly)** |
| **2.4** | LNAPL Levels collected quarterly (as per Item 1.1 and Item 1.2) are to be held within an electronic file that can be accessed during Technical Reviews. Liquid Waste Management Database. | **Voluntary Activity** |
| **2.5** | DNAPL Monitoring is to be completed at the bores listed in Item 2.2 in response to community requests. | **Voluntary Activity** |

<table>
<tr><th>Item</th><th>Management Procedure</th><th>When By</th></tr>
<tr><td>3</td><td colspan="2">Item 3: LNAPL / Leachate Extraction</td></tr>
<tr><td>3.1</td><td>Leachate Level Contingency Protocol:<br>The Hydrogeological Assessment completed for the site in 2015 presented maximum allowable leachate levels within each of the Landfill mounds at the site and interim target levels:
<table>
<tr><th>Cell Identification</th><th>Interim Target Leachate Level (mAHD)</th><th>Leachate Level Achieved By</th></tr>
<tr><td rowspan="4">Mound 1</td><td>92.5</td><td>01-06-2018</td></tr>
<tr><td>91.5</td><td>01-06-2020</td></tr>
<tr><td>89.5</td><td>01-06-2025</td></tr>
<tr><td>87.0</td><td>01-06-2035</td></tr>
<tr><td rowspan="4">Mound 2</td><td>92.0</td><td>01-06-2018</td></tr>
<tr><td>91.0</td><td>01-06-2020</td></tr>
<tr><td>89.0</td><td>01-06-2025</td></tr>
<tr><td>87.0</td><td>01-06-2035</td></tr>
<tr><td rowspan="4">Mound 3</td><td>92.5</td><td>01-06-2018</td></tr>
<tr><td>91.5</td><td>01-06-2020</td></tr>
<tr><td>89.5</td><td>01-06-2025</td></tr>
<tr><td>87.0</td><td>01-06-2035</td></tr>
</table>
Interim target leachate levels should be achieved by the dates shown for each cell in the table above.</td><td>As required</td></tr>
<tr><td>3.2</td><td>Voluntary LNAPL Removal:<br>Since 2014, Cleanaway has undertaken two LNAPL bail down events of LNAPL within groundwater monitoring wells (outside waste mounds) as part of non-regulated voluntary activities (the results of which have yet to be reported).<br>Cleanaway are planning on continuing LNAPL bail down events based on specialist’s advice, the results of which are to be presented in the 2018 TRAR.</td><td>Voluntary Activity</td></tr>
</table>

## SW,GW&LMP-002-1. OBJECTIVES OF PROCEDURE

Further information about the derivation of, and background for, this SW, GW and LMP, as well as details regarding the history of the site, the extent of COIs and further discussion of risk are included within the Secondary Risk Assessment (SRA) for the site (Golder, 2007); the 2011 TRAR; and most recently, the 2014 TRAR.

The objectives of the Surface Water Management procedures of this SW, GW and LMP with respect to Moonee Ponds Creek is to:

- Identify through a monitoring program whether groundwater conditions are approaching those which may be associated with unacceptable risk before the beneficial uses of Moonee Ponds Creek are adversely impacted.
- Have in place a contingency protocol to verify the level of risk posed and implement a suitable remedial action in a timely manner to prevent unacceptable impact.

Details regarding the action items for groundwater management are provided in procedure SW, GW and LMP Task 003.

## SW,GW&LMP-002-2. APPLICABLE ENVIRONMENTAL LEGISLATION & GUIDELINES

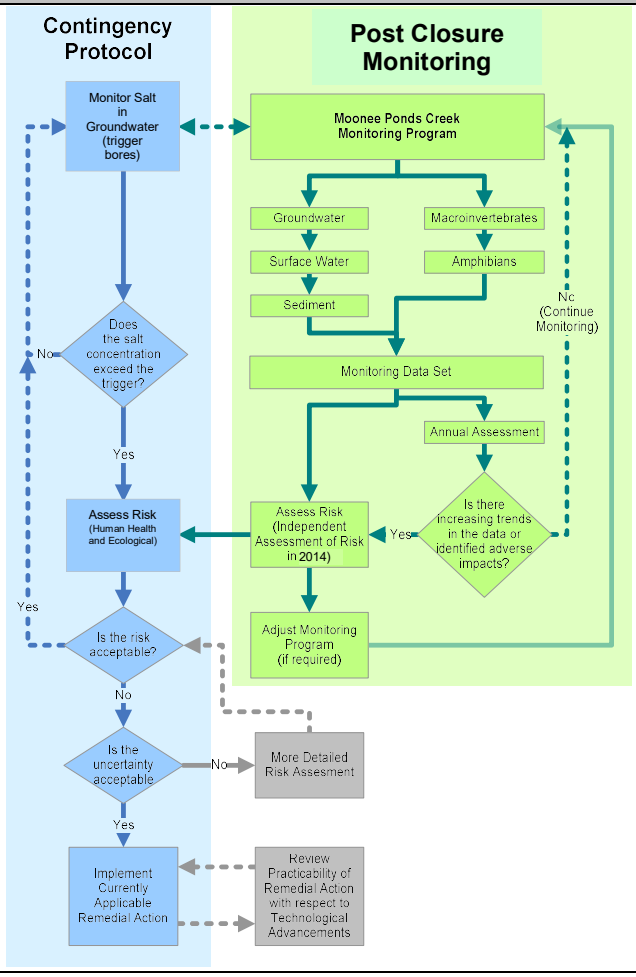
- Environment Protection Act (GoV 1970).
- SEPP – Waters of Victoria (GoV 2003).
- EPA Publication 441.7, “A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes”, dated March 2000.

## SW,GW&LMP-002-3. PROCEDURES FOR MANAGING THE MOONEE PONDS CREEK ECOSYSTEMS

| Item | Management Procedure | When By |
|---|---|---|
| **1** | **Action 1: Creek Monitoring Program** | |
| **1.1** | **General**<br><br>The creek monitoring program consists of the following elements:<br>• Groundwater quality (see SW, GW and LMP Item No. 003 – 4, Sub task 2)<br><br>Annual Surface Water Reviews are to identify if monitoring data collected for the corresponding year meet the requirements of this SW, GW and LMP. Should data-gaps be identified, monitoring to address those data-gaps should be carried out after consultation with the Environmental Auditor.<br><br>Technical reporting with respect to the monitoring program (such as fieldworks undertaken and field and laboratory results obtained for example) is to be completed in the 2018 TRAR. | Not applicable (defined elsewhere in the SW, GW and LMP, in the referenced items) |

| Item | Management Procedure | When By |
|---|---|---|
| 1.2 | **Moonee Ponds Creek Water Quality Monitoring Program**<br><br>The sample locations of the Moonee Ponds Creek monitoring program are outlined below.<br><br>The 13 surface water sampling locations are as follows:<br>MPCL01A, MPCL02, MPCL04, MPCL06, MPCL07, Upper MPC, MPCL08, MPCL09, Lower MPCL, MPCL12, MPCL13, MPCL15 and the Rock Pond.<br><br>*Quarterly (All surface water sampling locations)*<br>• Field Parameters (redox potential, electrical conductivity (EC), dissolved oxygen (DO), pH and temperature).<br><br>*Annually in Autumn:*<br>• Laboratory EC and TDS to be analysed annually from locations:<br>o MPCL01A, MPCL02, MPCL04, MPCL06, MPCL07, Upper MPC, MPCL08, MPCL09, Lower MPCL, MPCL12, MPCL13, MPCL15and the Rock Pond.<br><br>*Once Every Two Years in Autumn:*<br>• Analysis once every two years from Upper MPC, MPCL08, MPCL09 and Lower MPCL for the following:<br>o Metal (barium, cobalt, copper, manganese (total), nickel, and zinc.<br>• Total Dissolved Solids (TDS) and Electrical Conductivity (EC).<br>• Nitrogen species (including nitrate, ammonia, total Kjeldahl nitrogen and total nitrogen).<br>• Anions and cations (including calcium, magnesium, potassium, sodium, fluoride, chloride, sulphate, nitrate, carbonate, bicarbonate and hydroxide).<br><br>*Reconnaissance of stream water quality* in the creek (including downstream of the north end of Wright Street) is to be completed quarterly.<br><br>The data collected from the proposed monitoring program (field and laboratory results) are to be stored electronically such that the data can be retrieved during Technical Review.<br><br>The Moonee Ponds Creek water quality monitoring program is to be revised following independent review as part of the 2018 TRAR | **On-Going (minimum of quarterly)** |
| 1.3 | **Confirmatory Macroinvertebrate Monitoring**<br>Cleanaway are to develop a macroinvertebrate monitoring plan in consultation with specialists for review and endorsement by the Auditor. It is recommended that the monitoring plan be designed to complement the historic and ongoing groundwater and surface water monitoring conducted at the site and in the vicinity of MPC with consideration given to clearly defining the survey objectives, methodologies, frequency and duration of monitoring. | Future monitoring program to be agreed with the Environmental Auditor. |
| 1.4 | **Confirmatory Frog Monitoring**<br>Cleanaway are to develop a frog monitoring plan in consultation with specialists for review and endorsement by the Auditor. It is recommended that the monitoring plan be designed to complement the historic and ongoing groundwater and surface water monitoring conducted at the site and in the vicinity of MPC | Future monitoring program to be agreed with the Environmental Auditor. |

| Item | Management Procedure | When By |
|---|---|---|
| | with consideration given to clearly defining the survey objectives, methodologies, frequency and duration of monitoring. | |
| **1.5** | **High Spatial Resolution Surface Water Salinity Study**<br>One high spatial resolution surface water salinity study is to be carried out before the next (2018) TRAR as Kleinfelder (2014b) found evidence of salinity stratification within MPC and the study may provide a good indication for the presence or absence of ongoing groundwater discharge into the creek.<br>The scope of this study should be informed by Kleinfelder (2014b) and agreed upon with the Environmental Auditor.<br>Following completion of the monitoring event, a technical report is to be prepared and provided to the Environmental Auditor for verification (**REP.2**). | Fieldwork proposed to commence in Q1, 2017<br><br>Reporting in Q2, 2017 |
| **2** | **Action 2: Contingency Protocol to Protect the Moonee Ponds Creek Ecosystem** | |
| **2.1** | The contingency protocol describes a process to identify future changes in the groundwater or surface water quality and assess whether there is a potential for an unacceptable risk that requires intervention. Therefore, a contingency protocol must have the following components:<br><br>1. An advanced warning "**trigger**" which defines a value which can be regularly monitored. It is a point at which the risk is deemed potentially unacceptable at any time during the monitoring program.<br>2. A "**decision tree**" that sets out a cascade of events to be followed to verify that the trigger has been attained. This may include an evaluation of site information and/or additional investigations as necessary within a short timeframe to assess whether meeting this trigger is indicative of a potential for unacceptable risk.<br>3. A "**remedial response**" which is designed to the extent that is necessary to enable its implementation before the unacceptable risk can occur. The remedial response is the final outcome of the decision tree process once a trigger is met. Only then is the remedial response implemented through initiating contract specification and on the ground works. | The 2018 TRAR will cover the 2014-2017 period as part of the comprehensive 3 year assessment. |
| **2.2** | **Trigger Bores: Establishment of Trigger Values**<br>Key groundwater monitoring bores near Moonee Ponds Creek were identified in the SRA for regular measurement as an advance warning system to indicate potential unacceptable risk to the creek from impacted groundwater emanating from the site.<br><br>Groundwater laboratory electrical conductivity was selected as the parameter monitored to provide the advance warning system.<br><br>Two additional bores have been included in the MPC Salinity monitoring network (MB66U and MB69). Documentation of the trigger values for these bores is to be completed in the 2018 TRAR based on review of salinity trends in and adjacent to MPC.<br><br>The SRA's Moonee Ponds Creek contingency protocol was updated to reflect the post-closure monitoring status of the site and the monitoring of salt/salinity in trigger bores. This protocol is presented below. | 2018 Technical Report for Auditor Review. |

| Item | Management Procedure | When By |
|---|---|---|
| |  | |
| **2.3** | **Potential Enhancement of Riparian Vegetation**<br>The SRA identified that under the present conditions, the ecology of Moonee Ponds Creek is at low risk from impacted groundwater inputs from the site. This conclusion was retained in the 2014 TRAR.<br><br>Weed (including Box Thorn) removal and riparian improvements were completed along the creek collaboratively with Melbourne Water during the period 2009 – 2014.<br><br>Cleanaway is currently preparing plans to complete Stormwater Connection works and voluntary Landscaping associated with the sites northern boundary and creek embankment. Details have been provided to Melbourne Water, Hume City Council, the Melbourne Airport and the Environmental Auditor and Community Groups. | The 2018 TRAR will cover the 2014-2017 period as part of the comprehensive assessment / review. |

## SW,GW&LMP-003-1. OBJECTIVES OF THE GROUNDWATER MANAGEMENT PROCEDURE

The objectives of the groundwater program that are related to the surface water program are provided in procedure SW, GW and LMP Task - 002. Other groundwater management issues not directly related to the interaction between groundwater and Moonee Ponds Creek are discussed below.

The objectives of the Groundwater Management procedure of this SW, GW and LMP are:

- Continued groundwater monitoring to ensure effective groundwater management at the landfill.
- Continued voluntary monitoring of natural attenuation parameters and the eight groundwater monitoring wells (MB87U/L, MB88U/L, MB89U/L and MB90U/L) along Wright Street and beyond.

Further information about the derivation of, and background for, this SW, GW and LMP, as well as details regarding the history of the site, the extent of COIs and further discussion of risk are included within the Secondary Risk Assessment (SRA) for the site (Golder, 2007), the 2011 TRAR, and most recently the 2014 TRAR.

## SW,GW&LMP-003-2. APPLICABLE ENVIRONMENTAL LEGISLATION & GUIDELINES

Activities at the site must conform to relevant environmental legislation and guidelines including (but not limited to):

- Environment Protection Act (GoV 1970)
- SEPP – Groundwaters of Victoria (GoV 1997)
- SEPP – Waters of Victoria (GoV 2003)
- EPA Publication 840 “The Clean Up and Management of Polluted Groundwater”, dated April 2002
- EPA Publication 669, “Groundwater Sampling Guidelines”, dated April 2000
- EPA Publication 441.7, “A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes”, dated March 2000.

## SW,GW&LMP-003-3. PROCEDURES FOR MANAGING THE GROUNDWATER ENVIRONMENT

| Item | Management Procedure | When By |
|---|---|---|
| **1** | **Action 1: Further Investigations** | |
| **1.1** | **Deliverables**<br><br>The following deliverables are expected from this action item:<br>• Voluntary Review on monitoring well installation and completion (**REP.3).**<br><br>This report will be submitted to the Environmental Auditor for their information. | 30 June 2017 |

| Item | Management Procedure | When By |
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| 1.2 | **Investigation Area 3 (Extractive Uses of Groundwater)**<br>• Install monitoring wells MB77 and MB58L (as specified in the GQMP Revision 6).<br>Further details pertaining to this item can be found in Revision 6 of the GQMP. | Once access is arranged with the site owners and leaseholders. |
| 1.3 | Installation of Groundwater monitoring wells to the east of Wright Street:<br>ME87U, MB87L. MB88U, MB88L, MB89U, MB89L, MB90U and MB90L | Completed November 2016. |
| **2** | **Action 2: Groundwater Monitoring Program** | |
| 2.1 | **Deliverables**<br>The Annual Groundwater Reviews are to be completed prior to 30 June each year from 2019 (2018 TRAR Report to document 2016-2018 review) and identify compliance with and deviations from the actions stipulated within this SW, GW and LMP The compliance reviews are to be provided to the Environmental Auditor. | Annually by 30 June (from 2019). |
| 2.2 | **Rationalisation of Groundwater Monitoring Program**<br>The 2018 TRAR is to include a comprehensive review of the activities undertaken as part of this SW, GW and LMP. This will include review of analytical concentrations and/or trends and provide comment on the suitability of the adopted monitoring program to meet the monitoring objectives.<br><br>Following the completion of the 2018 TRAR, this document is to be reviewed and updated as required. Any amendments or revisions of the SW, GW and LMP are to be provided to the Community and Environmental Auditor for review. | 2018 TRAR |
| 2.3 | **Moonee Ponds Creek Salinity Monitoring Network (Figure 2)**<br>Groundwater Monitoring Wells:<br>MB6U, MB10, MB23, MB45U, MB45M MB65U, MB68U, MB66U, and MB69<br><br>Sampling Frequency:<br>• Sample:<br>  ○ Quarterly: Wells MB6U, MB10, MB23 and MB69<br>  ○ Six monthly: Wells MB45U/M, MB65U, MB66U and MB68U.<br><br>Analysis:<br>• Field Parameters (redox potential, electrical conductivity (EC), dissolved oxygen (DO), temperature and pH).<br>• Laboratory Parameters<br>  ○ Total dissolved solids (TDS) and electrical conductivity (EC).<br>  ○ Anions and Cations (calcium, magnesium, potassium, sodium, chloride, sulphate, bicarbonate, carbonate and hydroxide). | On-going (quarterly) |
| 2.4 | **Groundwater Wells in the Vicinity of Moonee Ponds Creek (Figure 3)**<br>Groundwater Monitoring Wells:<br>10006, MB6U, MB6L, MB10, MB11, MB12, MB23, MB24, MB45U, MB45M, MB45L, MB46L, MB65U, MB65L, MB66U, MB66L MB67, MB68U, MB68L, MB69, MB75 MB78U, MB78L, MB79 and MB80.<br><br>Sampling Frequency:<br>• Sampling every year for wells MB12, MB23, MB66U and MB69. | On-going (annually) |

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| | • Sampling once every two years for all other wells.<br><br>Analysis:<br>• Field Parameters (redox potential, electrical conductivity, dissolved oxygen, temperature and pH).<br>• Laboratory Parameters<br>  ○ Total dissolved solids (TDS), electrical conductivity (EC), total nitrogen, total Kjeldahl nitrogen (TKN), ammonia and nitrate (as nitrogen).<br>  ○ Metals (aluminium, arsenic barium, boron, chromium (total), chromium (VI), cobalt, copper, iron (total), lead, manganese, mercury, molybdenum, nickel, selenium and zinc).<br>  ○ Anions and Cations (calcium, magnesium, potassium, sodium, chloride, sulphate, bicarbonate, carbonate and hydroxide). | |
| **2.5** | **Continued Voluntary Natural Attenuation Monitoring (Figure 4)**<br>Groundwater Monitoring Wells:<br><br>Tulla3U, Tulla3L, MB8L, MB13, MB14, MB27, MB34U, MB34L, MB37, MB42, MB49U, MB49L, MB56, MB58U, MB58M, MB60U, MB60L, MB61, MB61L, MB63, MB72, MB73, MB74, MB76, MB82, MB83, MB85, MB86U, MB86L, MB87U* MB87L*, MB88U*, MB88L*, MB89U*, MB89L* MB90U* and MB90L*.<br><br>* New groundwater monitoring wells installed as per Item 1.3<br><br>Sampling Frequency:<br>All wells to be sampled annually.<br>Each bore is to be checked for LNAPL during monitoring using an interface probe.<br><br>Analysis:<br>• Field Parameters (redox potential, electrical conductivity (EC), dissolved oxygen (DO), temperature and pH).<br>• Laboratory Parameters:<br>  ○ VOCs (including, vinyl chloride, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, 1,2-dichloroethane, 1,2-dichlorobenzene, 1,2,4-trimethylbenzene, chloroform, 1,1,2-trichloroethane, chlorobenzene).<br>  ○ Total Recoverable Hydrocarbons (NEPM fractions) with and without silica gel clean-up.<br>  ○ Benzene, toluene, ethylbenzene, xylenes and naphthalene.<br>  ○ Methane, ethene and ethane.<br>  ○ Manganese, ferric iron and ferrous iron.<br>  ○ Nitrate, nitrite, sulphate. | On-going (annually) |
| **2.6** | **Hydraulic Flow lines (Figure 5)**<br>Groundwater Monitoring Wells:<br>• *North* (MB6U, MB38, MB42, MB43, MB48U, MB48L, MB49U and MB49L).<br>• *North East* (BH2, MB9L, MB13, MB14, MB30, MB75 and MB80).<br>• *East* (MB36, MB37, MB57, MB61, MB61L, MB72, MB73, MB74, MB76, MB83, MB89U* and MB89L*).<br>• *South East* (Tulla 3U, Tulla 3L, MB15, MB16, MB17, MB55U, MB55L, MB56, MB86U, MB86L, MB90U* and MB90L*).<br>• *South* (MB28, MB28L, MB60U and MB60L). | On-going (once per two years) |

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| | • *South West* (MB8L, MB18, MB19, MB20, MB27, MB52U, MB52M, MB52L, MB58U, MB58M, and MB62).<br>• *West* (MB5LR, MB5UR, MB25, MB34U, MB34L, MB50, MB51U and MB51L).<br><br>Sampling Frequency:<br>• All Hydraulic Flow Lines: once every two years.<br><br>Analysis:<br>• Field Parameters (redox potential, electrical conductivity, dissolved oxygen, temperature and pH).<br>• Laboratory Parameters<br>o Total dissolved solids (TDS), electrical conductivity (EC), total nitrogen, total Kjeldahl nitrogen (TKN), ammonia and nitrate.<br>o Metals (aluminium, arsenic barium, boron, chromium (total), chromium (VI), cobalt, copper, iron (total), lead, manganese, mercury, molybdenum, nickel, selenium and zinc).<br>o Anions and Cations (calcium, magnesium, potassium, sodium, chloride, sulphate, bicarbonate, carbonate and hydroxide). | |
| **2.7** | **LNAPL Monitoring Network (Figure 6)**<br>Groundwater Monitoring Wells:<br>MB29, MB30, MB35, MB36 and MB40.<br><br>Sampling Frequency:<br>For wells with LNAPL present, water levels and LNAPL thickness is to be measured quarterly in accordance with the SW, GW and LMP Task – 001, Item 2.2.<br><br>Sampling for laboratory analysis to be completed once per every three years.<br><br>Analysis:<br>Compositional analysis for VOCs (including, vinyl chloride, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, 1,2-dichloroethane, 1,2,4-trimethylbenzene, chloroform, 1,1,2-trichloroethane, chlorobenzene). Also obtain dissolved phase samples from select wells using discrete sampling methods and analyse for VOCs (as above). Sampling methodology to be agreed in consultation with the Environmental Auditor. | On-going (once per three years) |
| **2.8** | **Remaining Wells Monitoring Network (Figure 7)**<br>Groundwater Monitoring Wells:<br>All those not included in any of the above described monitoring networks.<br><br>Sampling Frequency:<br>Once every three years.<br><br>Analysis:<br>• Field Parameters (redox potential, electrical conductivity (EC), dissolved oxygen (DO), temperature and pH).<br>• Laboratory Parameters<br>o Total dissolved solids (TDS), electrical conductivity (EC), total nitrogen, total Kjeldahl nitrogen (TKN), ammonia and nitrate.<br>o Speciated Phenols and Total Phenols.<br>o Metals (aluminium, arsenic barium, boron, chromium (total), chromium (VI), cobalt, copper, iron (total), lead, | On-going (once per three years) |

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| | manganese, mercury, molybdenum, nickel, selenium and zinc).<br>○ Cyanide.<br>○ Anions and Cations (calcium, magnesium, potassium, sodium, chloride, sulphate, bicarbonate, carbonate and hydroxide).<br>○ Selected organics:<br>▪ VOCs (including, vinyl chloride, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2,4-trimethylbenzene, chloroform, 1,1,2-trichloroethane, chlorobenzene). | |
| **3** | **Action 3: Control of Groundwater Use** | |
| **3.1** | Southern Rural Water (SRW) has been provided information regarding groundwater quality at and surrounding the site.<br>Approval for installation of groundwater extraction bores is governed by SRW, in the instance of an application for a bore within the current restricted zone, SRW is to inform Cleanaway who are to provide the applicant with any and all relevant groundwater data.<br><br>Cleanaway are to notify SRW if groundwater quality changes at the site to a significance where the currently precluded extractive beneficial uses change. | As Required |
| **4** | **Action 4: Contingency Measures** | |
| **4.1** | **Contingency Measures South and South East of Landfill**<br>As discussed in the SRA, instead of developing a contingency measure for the south and south east of the landfill, an ongoing program of groundwater monitoring was recommended. The groundwater monitoring program for the site and surrounds is outlined in Item 2.<br><br>The Environmental Auditor recommended in the review of the GQMP (Rev5), that access issues for the installation of off-site groundwater wells are discussed with Melbourne Airport. However this item requires site management to:<br><br>• Continue to consult with Melbourne Airport in order to gain access to the required locations. | Ongoing |
| **4.2** | **Contingency Measures East of Landfill**<br>The following applies to the East of the landfill:<br>• Continue monitoring in accordance with this SW, GW and LMP.<br>• Continue to monitor Natural Attenuation parameters, particularly chlorinated hydrocarbons.<br><br>Significant changes were not observed in the SRA and TRAR's, however the groundwater quality to the east of the landfill will continue to be monitored on a regular basis to continue to confirm the conclusions drawn in the SRA and confirmed in the 2011 TRAR and the 2014 TRAR. Further appraisal of this is to be completed in the 2018 TRAR. In addition, Cleanaway has voluntarily installed eight monitoring wells along Wright Street, Western Avenue and Hillcrest Drive to assist with confirming this assessment. Furthermore, Cleanaway has voluntarily extracted leachate and LNAPL from the landfill during 2016 and this extraction will assist with further reducing the already low risks to the east (and MPC). | Monitoring is ongoing. Reporting in 2018 TRAR |

| Item | Management Procedure | When By |
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| 4.3 | **Contingency Measures for the protection of Moonee Ponds Creek**<br><br>Refer to the Liquid Waste (Task - 001) and Surface Water (Task – 002) Monitoring Sections. As indicated in item 4.2 leachate and LNAPL extractions voluntarily conducted in 2016 will assist with further reducing the already low risk to the creek. | Ongoing |

## SW,GW&LMP-004-1. OBJECTIVES OF THE REPORTING TASK

The overall objectives of this task of the SW, GW and LMP is to collate and report upon environmental monitoring data collected from the site and surrounds.

It is intended that compliance with this SW, GW and LMP checked regularly and documented whilst interpretation of data collected as part of monitoring is completed within TRARs or after specific investigations are completed.

As such, reports to be completed are as follows:

- **Groundwater Monitoring Well Installation Report**

  This factual report is to be produced following the installation of groundwater monitoring wells to the east of the landfill (beyond Wright Street). The report should document the location and construction details of the wells and present geological data collected during drilling.

- **Annual Groundwater Reviews**

  These annual reports are intended to identify where a data gap or breach in works completed, progress in accordance with the SW, GW and LMP, Quality Assurance (QA) / Quality Control (QC) data review, checks against contingencies and any significant data outliers and/or changes in trend. Documentation of the review is voluntary, a tabular approach may be considered.

- **Technical Report for Auditor Review**

  The 2018 Technical Report for Auditor Review (2018 TRAR) is intended to combine and interpret the data collected between 2014 and 2017. And compare that data with the data collected during the preparation of the SRA the 2011 TRAR and the 2014 TRAR to evaluate whether there are any significant changes or trends that would indicate that the conclusions drawn in the SRA, the 2011 TRAR and the 2014 TRAR regarding the risk to human health and the environment.

- **Reporting of Voluntary Investigations**

  At times Cleanaway may choose to undertake investigations and/or assessments beyond what is required. In such instances a factual or interpretative report may be produced for a variety of reasons including (but not limited to:

  - Documenting activities for future reference.
  - Provision of data / conclusions to the Environmental Auditor for future consideration.
  - Provision of data / conclusions to stakeholders for their information.

## SW,GW&LMP-004-2. APPLICABLE ENVIRONMENTAL LEGISLATION & GUIDELINES

The applicable environmental legislation and guidelines is likely to be specific to the objectives, purpose or content of individual reports however, in general should comply with:

- Environment Protection Act (GoV 1970)
- SEPP – Groundwaters of Victoria (GoV 1997)
- SEPP – Waters of Victoria (GoV 1999)
- National Environment Protection (*Assessment of Site Contamination*) Measure (NEPM 1999)
- Environmental Health Risk Assessment (enHealth 2000)
- Proceedings of the National Workshops on the Assessment of Site Contamination (currently published under enHealth)
- Australian and New Zealand Guidelines for Fresh and Marine Waters (ANZECC and ARMCANZ 2000)

## SW,GW&LMP-004-3. PROCEDURES FOR ENVIRONMENTAL REPORTING

| Item | Management Procedure | When By |
|---|---|---|
| **1** | **Annual Monitoring Review** | |
| **1.1** | **Voluntary Annual Monitoring Review**<br>The objectives of the Voluntary Annual Monitoring Reviews are to:<br>• Check that data has been collected over the calendar year in accordance with the SW, GW and LMP and undertake a QA/QC review of that data, as relevant.<br>• Identify any deviations from the requirements of this SW, GW and LMP.<br>• Check data with respect to the contingency protocols to evaluate whether contingency triggers have been met.<br>• Identify any significant outliers in data or significant changes in trends.<br>• Provide recommendations for changes to the environmental monitoring program as outlined in this SW, GW and LMP.<br>The results of the reviews are to be provided to the Environmental Auditor. | Voluntarily Annual Review to be completed by 30 June from 2019. |
| **1.2** | **Data Management and Data Quality**<br><br>Data collected from the site is currently stored in a Tullamarine Environmental Monitoring Database. Given the large volume of data collected historically from the site and the reliance placed upon this data for the assessment of potential risk, rigorous ongoing management of data quality is an integral part of the post closure management of the landfill. | On-Going |

| Item | Management Procedure | When By |
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| **2** | **Technical Report for Auditor Review** | |
| **2.1** | **Technical Report for Auditor Review**<br>Overall, this report is not intended to represent a formal risk assessment, such as the SRA, rather it is intended to evaluate the underlying assumptions upon which the SRA was based and report upon further investigations undertaken over the period 16 September 2014 (15 September 2014 was the final day for data considered in the 2014 TRAR) to late 2017, building upon the work presented in the 2011 and 2014 TRARs, confirming the conceptual site model and demonstrating reduction in uncertainty. It is assumed that where trends are demonstrably inconsistent with the SRA and 2014 TRAR findings and assessment of low risk, that they will have triggered the contingency protocol for groundwater (see Task 002 – 4, Item 3) and hence further evaluation of the specific risk.<br><br>The specific objectives of this 2017 Technical Report for Auditor Review (2017 TRAR) are to:<br>• Collate environmental monitoring data collected from the site to the end of Q3, 2017. Data collected from the site will include:<br>  • Water quality data:<br>  ▪ Groundwater (including but not limited to results from contingency measure trigger wells)<br>  ▪ Surface water<br>  • Biological quality data:<br>  ▪ Macroinvertebrate<br>  ▪ Frogs<br>• Combine the environmental monitoring data collected over the period 15 September 2014 to late 2017 (the study period) with the data collected as part of the SRA, the 2011 TRAR and the 2014 TRAR.<br>• Update the conceptual understanding of the site based upon the additional data collected in the study period integrated with the historical dataset, plus any new knowledge gained from site investigations and assessments conducted during the study period.<br>• An update of the HCM and CSM.<br>• Interpret data trends to track any potential changes in the underlying assumptions upon which the SRA was based.<br>• Review the effectiveness and applicability of the environmental monitoring program adopted within the study period.<br>• Provide recommendations for changes to the monitoring plan for the period beyond 2017 if necessary.<br>• Refine the future environmental monitoring regime for water quality and biological quality beyond 2017. | During 2018 |