TULLAMARINE CLOSED LANDFILL ANNUAL COMPLIANCE REPORT 2020

Presentation to Tullamarine Landfill Community Consultation Group

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Resolve Environmental

PRESENTATION CONTENTS

- Monitoring and Purpose of Annual Compliance Report (ACR)
- Scope of Monitoring Undertaken
- Issues Faced in the Reporting Period
- Response to Submitted Questions

MONITORING AND PURPOSE OF ACR

- ACR is factual in nature.
- Purpose of ACR is to determine compliance with:
  - The Environmental Monitoring Plan (EMP) which has been verified by the site's Environmental Auditor
  - Relevant government policies and regulations, including State Environmental Protection Policies (SEPPs) for groundwater and surface water, and
  - Post-Closure Pollution Abatement Notice (PCPAN) conditions
- Interpretation of environmental monitoring data is undertaken in the Aftercare Management (Post-Closure) Environmental Audit, and in reports such as a Hydrogeological Assessment or a Risk Assessment.

SCOPE OF MONITORING

Groundwater (GW), Leachate and Surface Water (SW) Monitoring

Monitoring Round	Monitoring Undertaken
February 2020	Gauged 47 GW wells and 16 leachate sumps Sampled 10 GW wells and 10 leachate sumps Monitored 10 SW locations Collected 13 LNAPL samples
May 2020	Gauged 48 GW wells and 16 leachate sumps Sampled 4 GW wells and 16 leachate sumps Monitored 13 SW locations, sampled 5
August 2020	Gauged 86 GW wells and 16 leachate sumps Sampled 61 GW wells and 16 leachate sumps Monitored 13 SW locations, sampled 5
December 2020	Gauged 59 GW wells and 16 leachate sumps Sampled 4 GW wells and 16 leachate sumps Monitored 13 SW locations, sampled 5

Leachate Level Monitoring

Monitoring Type	Frequency
Leachate Sumps and Mound 3 GW wells	Undertaken monthly

Landfill Gas Monitoring

Monitoring Type	Frequency
Perimeter Gas Monitoring Bores	Undertaken monthly
Surface Emission Monitoring	Annually (undertaken in July 2020)

ISSUES FACED IN THE REPORTING PERIOD

February 2020:

- unable to sample LS06 (blockage),
- unable to sample WELL15, L01, L04, L05, L07, L08, L11, L12 (viscous LNAPL)
- unable to monitor 3 SW locations (overgrown vegetation)

May 2020:

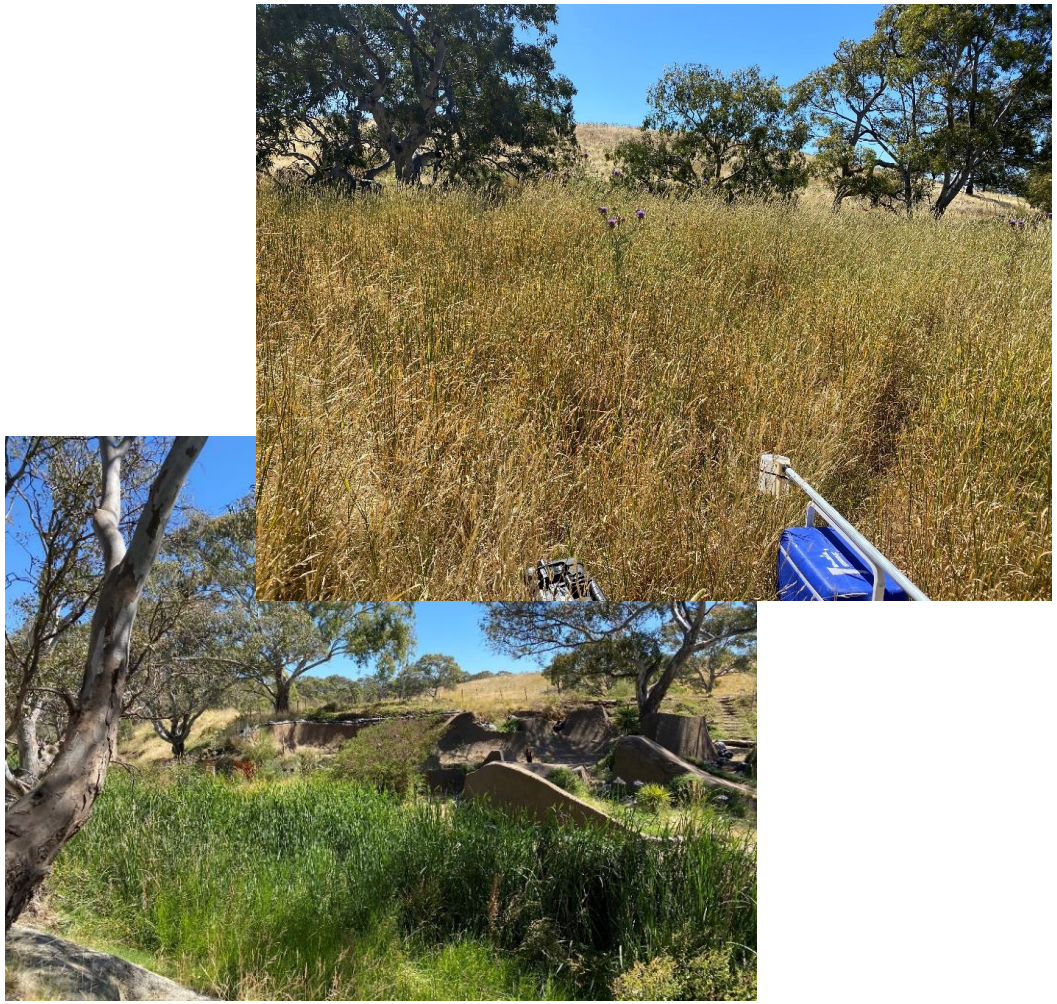
- unable to sample L06 (blockage)

August 2020 :

- unable to sample L01, L03, L05, L09, L12, L13 (LNAPL thickness and viscosity)
- unable to sample leachate from WELL15 (LNAPL to base of well)
- unable to sample MB36 (LNAPL present) (sampled MB37 instead)
- unable to sample MB85 (blockage)

December 2020 :

- unable to sample L01, L02, L03, L12 and L14 (sump infrastructure and damaged sample equipment)
- unable to sample L06 (blockage), unable to sample leachate from WELL15 (LNAPL to base of well)
- unable to monitor 4 SW locations (overgrown vegetation)



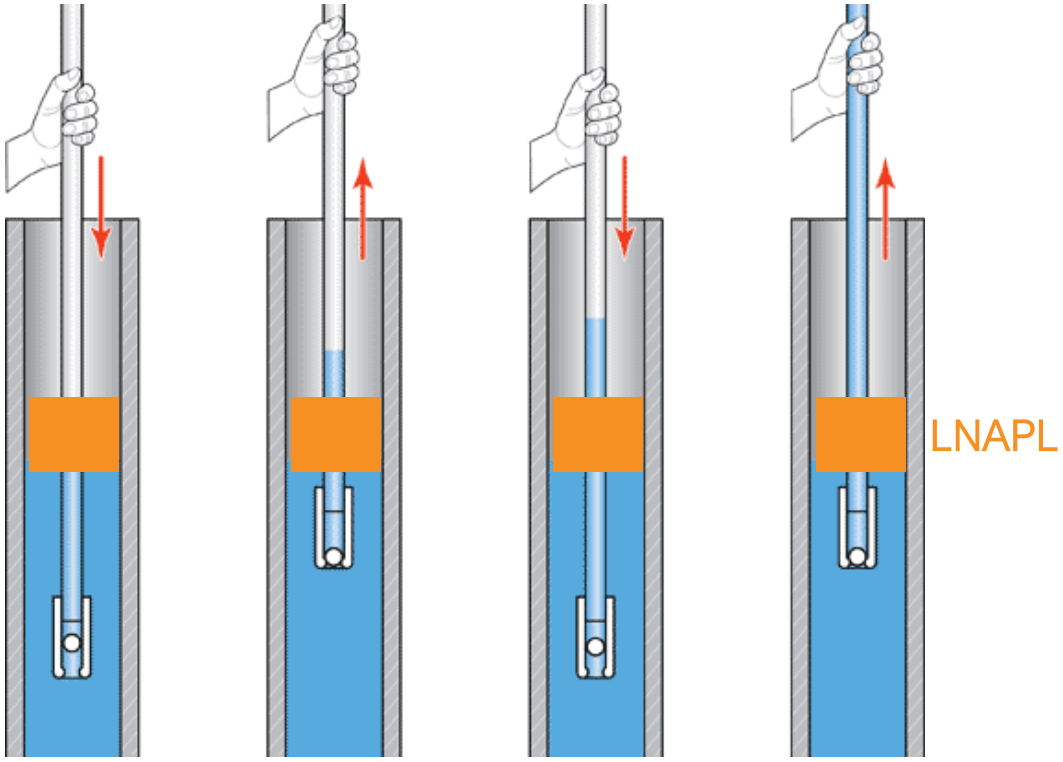
Examples of overgrown vegetation at the Moonee Ponds Creek

ISSUES FACED IN THE REPORTING PERIOD

Sump well head:

Discrete interval sampler:

'Waterra' foot valve sampler:



RESPONSE TO SUBMITTED QUESTIONS

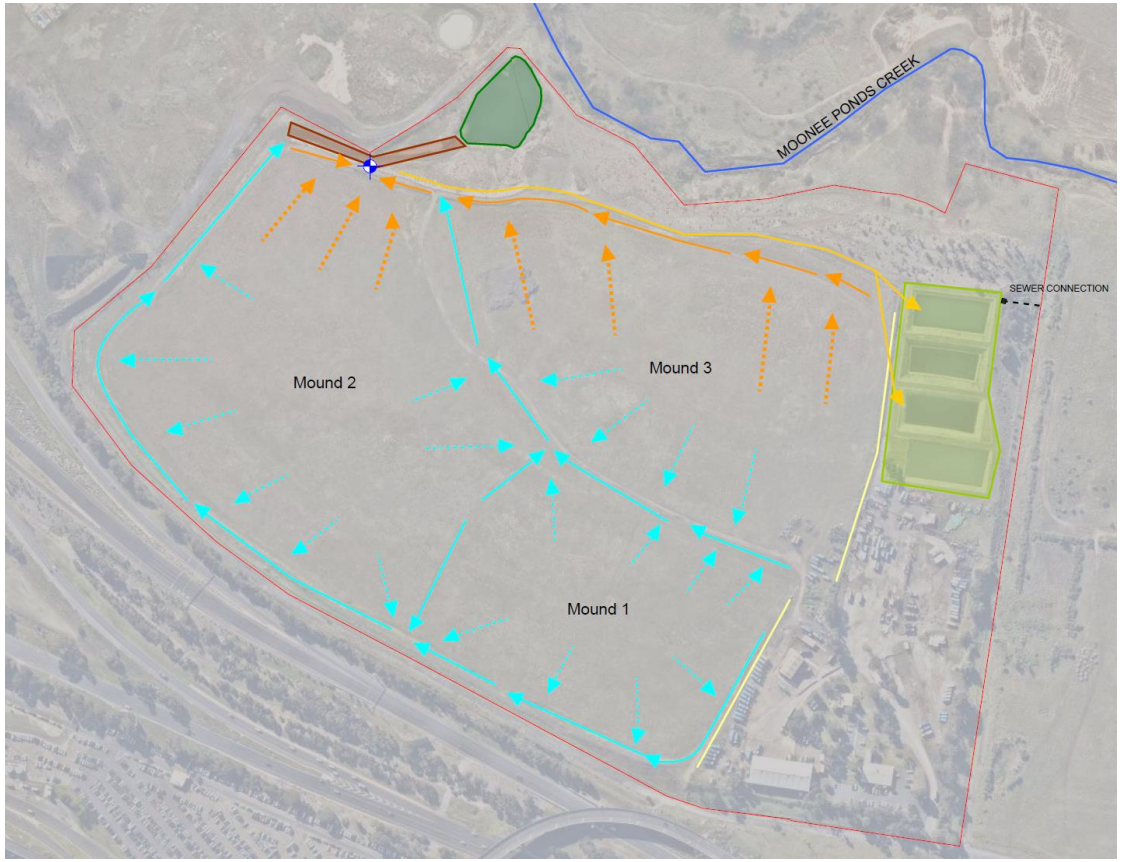
Q1) On the linked report 2.3 Topography & Hydrology refers to 'The collected storm water (from the mounds) is directed to the rock pond…'

At the last meeting I asked a question concerning the 4 settling ponds/dams on the Cleanaway site & was advised that runoff from the mounds was directed to these settling ponds and used to water the mounds.

What is correct?

With the settling ponds/dams and what they have been used for in the past & now what if any testing has been done under these dams to check if they are not leaking/cracked or what substances/gases etc are present under them and are they harmful now or in the future.

Q1) STORMWATER FLOW



Both are correct. Stormwater at the site flows to the Rock Pond and the settling ponds, based on where the stormwater is collected on site.

This figure demonstrates that stormwater collected at the southern and western landfill perimeter (in blue) is directed to the Rock Pond, while stormwater collected at the northern landfill perimeter (in orange) is directed to the settling ponds.

As for harm, groundwater and landfill gas monitoring is undertaken at the site in the vicinity of the settling ponds.

Development on the buffer land would be subject to environmental assessment to determine risk and suitability.

RESPONSE TO SUBMITTED QUESTIONS

Q2) How many of the 29 bores installed in 2020 result from the 2018 Post Closure Audit Report?

Were the bores all perimeter bores? If not where else were the bores placed?

Q2) LANDFILL GAS MONITORING NETWORK

These 29 landfill gas bores were installed as a result of the Landfill Gas Extraction Improvement Plan (Resolve, 2020) which noted that spacing of landfill gas bores and the proximity of these bores to the waste were inconsistent with the recommendations of appropriate EPA guidelines.

All bores installed are perimeter gas bores (>20 m from waste). The term ‘perimeter bore’ is used to describe a landfill gas bore that is used to assess landfill gas within ‘subsurface geology at the landfill boundary’ as per the EPA landfill guidelines.

The location of all landfill gas bores is provided on Figure 7 of the ACR and is repeated here.

RESPONSE TO SUBMITTED QUESTIONS

Q3) It is noted that the following locations were unable to be sampled:

- *LS01, LS02, LS03, LS12 and LS14: unable to sample due to sump infrastructure and damaged sample equipment.*
- *LS06: unable to sample due to a blockage.*
- *WELL 15: unable to sample – LNAPL to base of well.*
- *MPCL02, MPCL12, MPCL13 and Lower MPCL: unable to access due to overgrown vegetation.*

What action was taken to enable access to the above listed locations in a timely manner? If no action taken, why not?

Q3) DECEMBER 2020 MONITORING EVENT

What action was taken to enable access to the above listed locations in a timely manner? If no action taken, why not?

- L01, L02, L03, L12 and L14: unable to sample due to sump infrastructure and damaged sample equipment
  - We changed sample methods and devices between the Dec 2020 monitoring event and the first monitoring event in 2021.
  - With the new method, leachate sumps L01, L03, L14 were able to be sampled.
  - L02 and L12 remain unable to be sampled due to viscosity of LNAPL.
- L06: unable to sample due to a blockage
  - This leachate sump has historically been blocked. Leachate level was still able to be gauged. Sampling methodology was changed for the following monitoring event (Q1 2021) and sample was successfully collected.

What action was taken to enable access to the above listed locations in a timely manner? If no action taken, why not?

- WELL 15: unable to sample – LNAPL to base of well
  - This well has historically presented with LNAPL to the base of the well, and has not been sampled (no Leachate to sample). LNAPL however was collected from this well in the February 2020 event.
  - WELL15 has been removed from the leachate and LNAPL monitoring program as per the latest Auditor verified EMP (Resolve, 2021), however remains as a contingency well in the event that LNAPL can not be sampled from a well in the same area.
- MPCL02, MPCL12, MPCL13 and Lower MPCL: unable to access due to overgrown vegetation
  - Neither Resolve nor Cleanaway have permission to remove vegetation from the Moonee Ponds Creek.
  - Locations in the Moonee Ponds Creek further upgradient and downgradient are still monitored

RESPONSE TO SUBMITTED QUESTIONS

Q4) It is noted that the following locations were unable to be sampled:

- *LS01, LS02, LS03, LS12 and LS14: unable to sample due to sump infrastructure and damaged sample equipment.*
- *LS06: unable to sample due to a blockage.*
- *WELL 15: unable to sample – LNAPL to base of well.*
- *MPCL02, MPCL12, MPCL13 and Lower MPCL: unable to access due to overgrown vegetation.*

What impact upon the water quality assessment does the inability to sample the above locations have overall?

Q4) DECEMBER 2020 MONITORING EVENT

What impact upon the water quality assessment does the inability to sample the above locations have overall?

- L01, L02, L03, L12 and L14: unable to sample due to sump infrastructure and damaged sample equipment, LS06: unable to sample due to a blockage and WELL 15: unable to sample – LNAPL to base of well
  - One of the main reasons for sampling leachate and LNAPL within the sumps is to ensure that the correct set of analytes are included in groundwater and surface water monitoring.
  - This was a key component of the recent EMP update and was able to be completed with the dataset available.
  - There are further works being completed over the remainder of 2021 monitoring events as we increase the Leachate and LNAPL data base with new data.
  - The leachate chemistry is well known at this point and leachate samples provide limited additional information for water quality assessment.

What impact upon the water quality assessment does the inability to sample the above locations have overall?

- MPCL02, MPCL12, MPCL13 and Lower MPCL: unable to access due to overgrown vegetation
  - Limited impact to water quality assessment – nearby locations further upgradient and downgradient from these were able to be sampled.

RESPONSE TO SUBMITTED QUESTIONS

Q5) The table accompanying para 6 refers to Well ID L1 to L14. The same Well ID occurs elsewhere. Is there a table or something which links this nomenclature to one of the figures? It appears from Figure 3 that L1 to L14 may be TUL-LS01 to TUL-LS14; is this assumption correct?

Q5) LEACHATE SUMP ID

Correct, L01 to L14 was used interchangeably with LS01 to LS14 and TUL-LS01 to TUL-LS14. Consistent nomenclature is intended to be used going forward, in accordance with the EMP (which is **L01 to L14**).

EMP (Resolve 2021) Sump ID	Corresponding Sump ID	Corresponding Sump ID
L01	LS01	TUL-LS01
L02	LS02	TUL-LS02
L03	LS03	TUL-LS03
L04	LS04	TUL-LS04
L05	LS05	TUL-LS05
L06	LS06	TUL-LS06
L07	LS07	TUL-LS07
…	…	…

RESPONSE TO SUBMITTED QUESTIONS

Q6) How serious is the breaching of the Target Leachate Levels? Does this mean a pumping program to reduce levels and if so what happens to the leachate? Given the landfill is below the water table is this not a result of fluctuations in the water table or is it that the cap is allowing a greater ingress of rain water than it should?

Q6) LEACHATE LEVELS

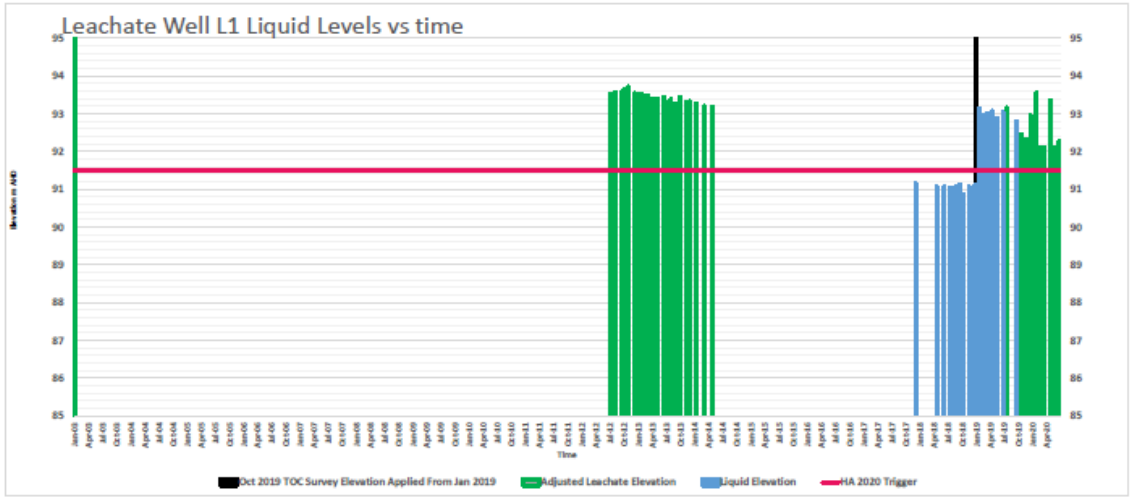
Leachate target levels were set for the site based on assumptions around how water levels would change over time.

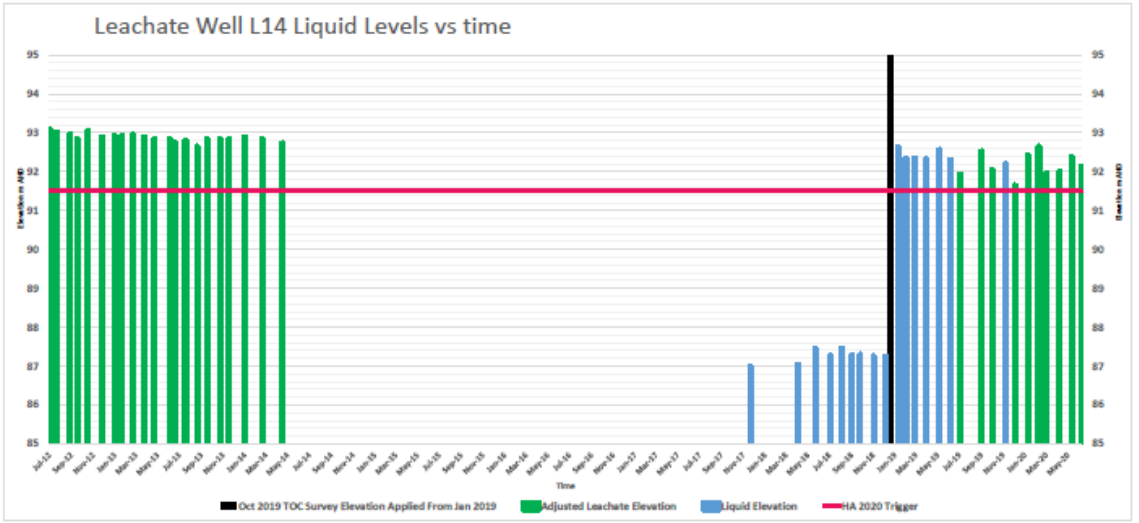
What we are now seeing is that conditions within the landfill are changing at a slower rate than first thought. This has resulted in target levels continuing to be breached.

These charts (taken from the 2019 Audit report) show the liquid levels in two of the sumps (L01 and L14). The data gap between mid 2014 and early 2019 is due to an issue with the survey elevation for the sumps.

The data demonstrate a slowly decreasing trend. The breaching of target levels is not suggesting that leachate levels have increased. Leachate levels have always been above the target levels.

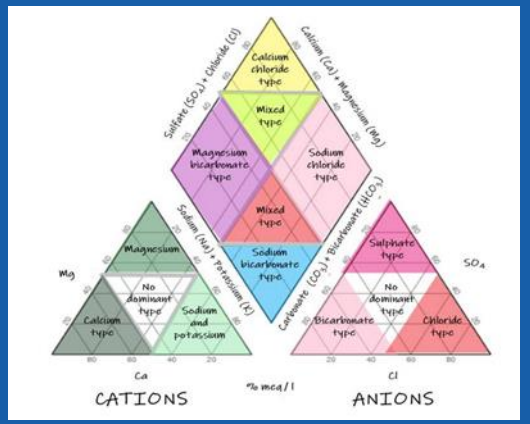
However, there are current investigations underway (Trend Assessment and a Hydrogeological Assessment) to investigate any implications of the slower than expected level decrease.

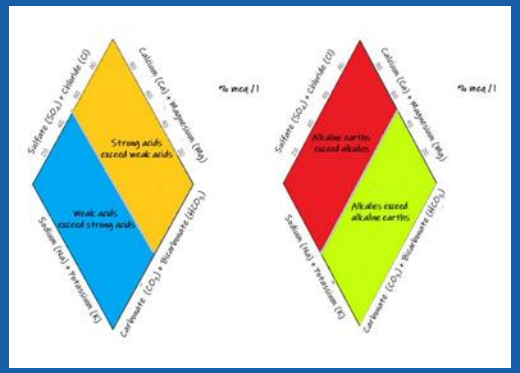




RESPONSE TO SUBMITTED QUESTIONS

Q7) *Would it possible to get a simple plain language explanation or presentation of how Piper Diagrams work and how an expert would interpret such diagrams referring to the importance or otherwise of the coloured areas as per the diagrams below.*



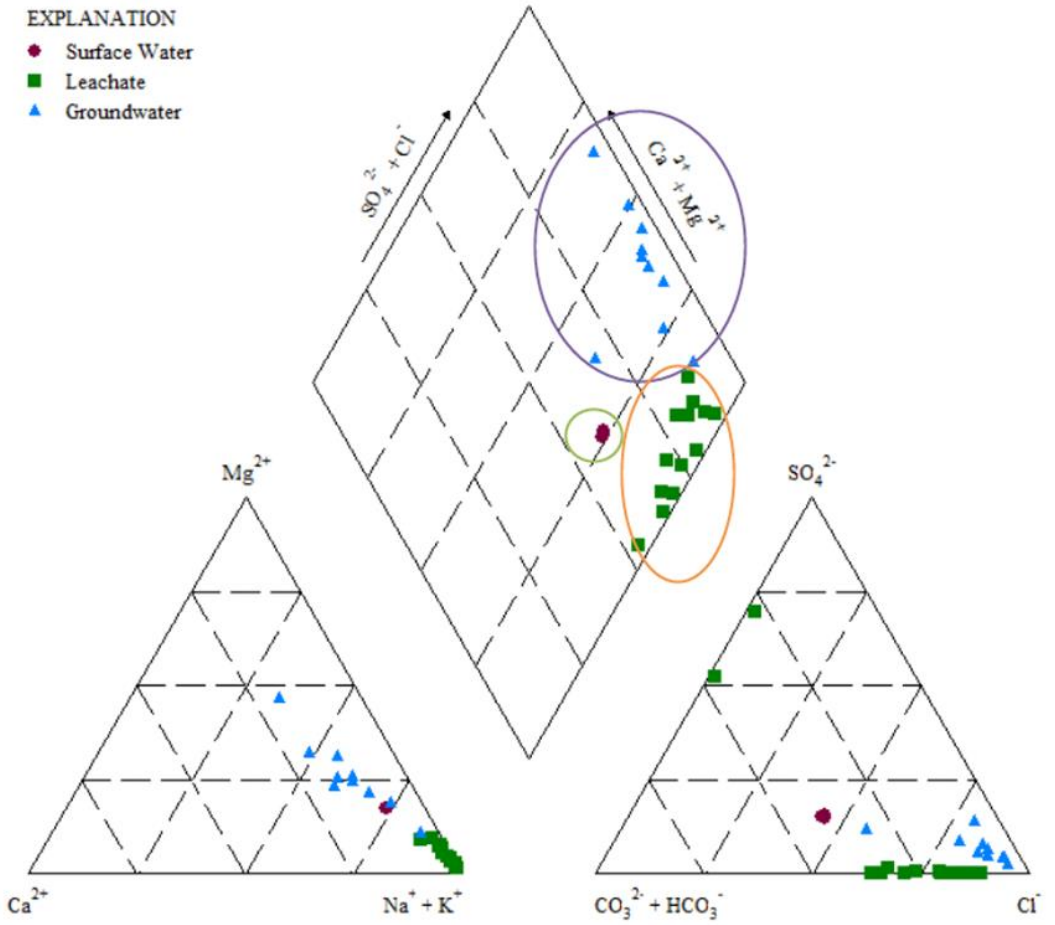


Q7) PIPER PLOTS

Piper diagrams can be used to plot the hydrogeochemical signature of water samples (groundwater, leachate, surface water) by analysis of major ions.

By plotting leachate and groundwater, distinct differences can be shown between the chemical signatures for leachate compared to groundwater and where mixing may be occurring.

In the piper plot for Tullamarine, leachate samples (orange circle) are characterised by sodium, potassium and chloride. Whereas groundwater samples (purple circle) are characterised by higher proportions of magnesium and chloride. Where surface water samples (green circle) are still characterised by sodium and potassium, they do not have a dominant anion which leads to samples being more of a mixed type than the groundwater or leachate samples.



RESPONSE TO SUBMITTED QUESTIONS

Q8) PFAS was detected in surface water. Prima facie the source of the PFAS would be the soil used to cap the mounds but there may be other sources. Is there an explanation for the presence of PFAS in surface water? If the top soil is contaminated what action is being taken to rectify the situation?

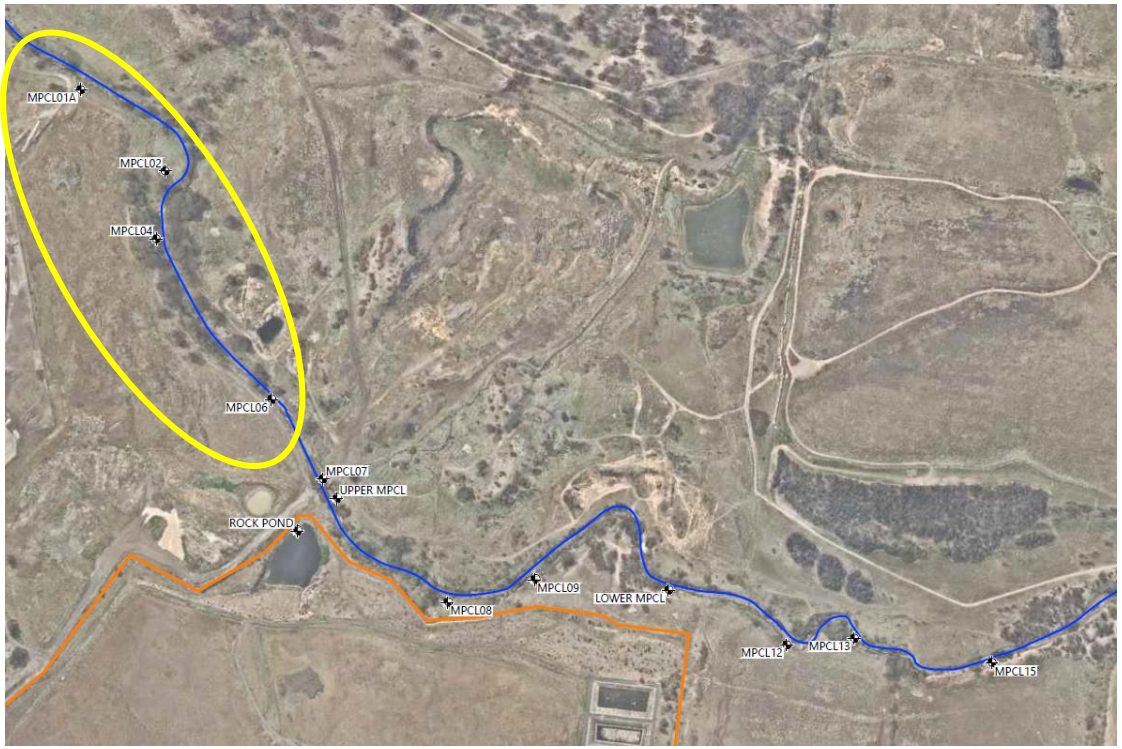
Q8) PFAS IN SURFACE WATER

PFAS was detected in all surface water monitoring locations (which are along the Moonee Ponds Creek) over the reporting period. As previously presented, stormwater from the cap is captured in the Rock Pond and the settling ponds.

A number of these locations (circled in yellow) are upgradient from the site, indicating that the source of PFAS is likely to be upgradient from the site.

Assessing the source of a particular contaminant (especially one as widely used as PFAS, e.g. aviation, fire fighting) can be difficult for surface water as the contaminant can enter the creek via many different pathways (for example):

- Stormwater outlet drain from the airport.
- Overland flow from surrounding land (including the landfill).
- Groundwater emanating from below the airport, landfill and other land uses.



RESPONSE TO SUBMITTED QUESTIONS

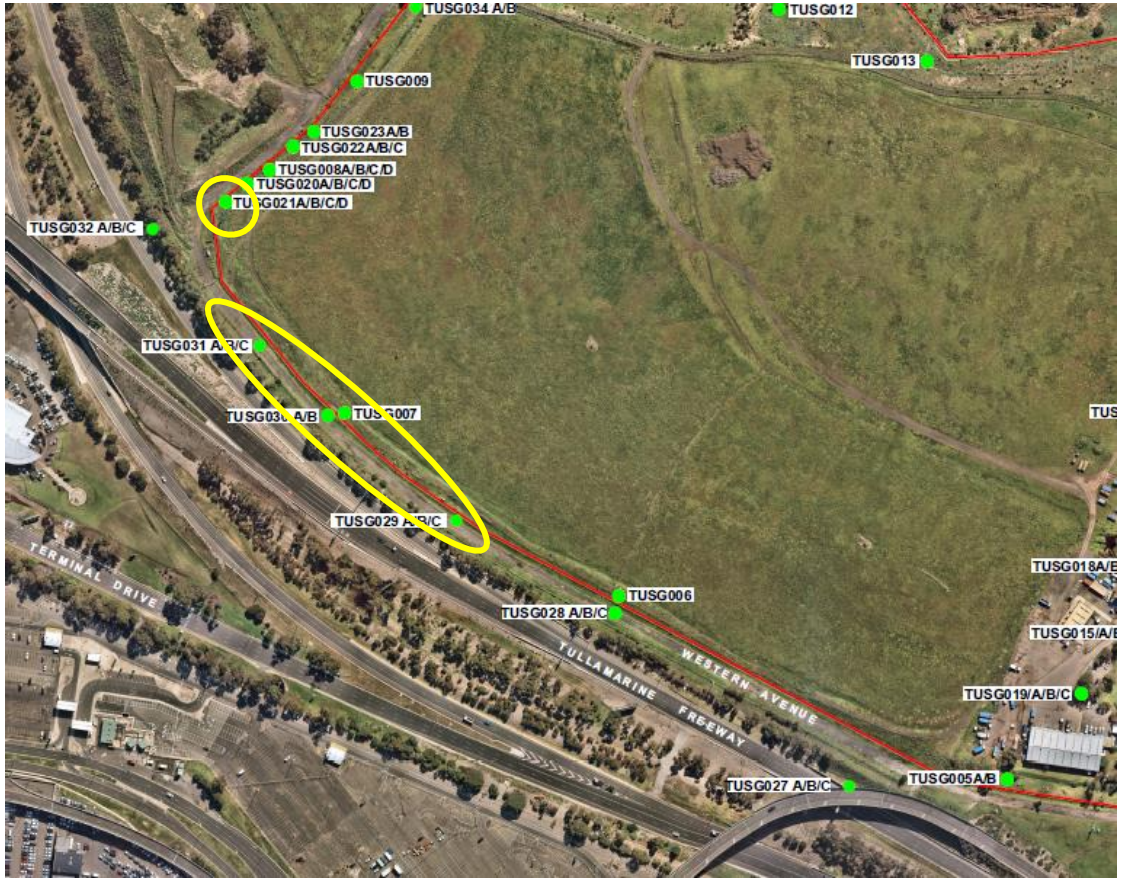
Q9) The 2019 Post Closure Audit Report identified a number of perimeter bores that were too close to the Landfill mass for which it was recommend they be correctly located. Are the above bores from which methane exceedances were recorded those impacted by the 2019 report, ie are the bores listed above too close to the landfill mass or are the results from relocated bores?

Q9) METHANE IN PERIMETER GAS BORES

"TUSG08C/D, TUSG18A/B, TUSG20B/C/D, TUSG21C/D, TUSG22C, TUSG29B/C, TUSG30B, TUSG31B) exceeded the action level of 1% v/v on one or more occasions. These boundary bores with exceedances are located on the eastern, southern and western boundaries."

Of these bores, TUSG08C/D, TUSG18A/B, TUSG20B/C/D, TUSG22C were too close to the landfill mass.

The remainder (bores TUSG21C/D, TUSG29B/C, TUSG30B, TUSG31B) are on the southern boundary of the site (circled in yellow).



RESPONSE TO SUBMITTED QUESTIONS

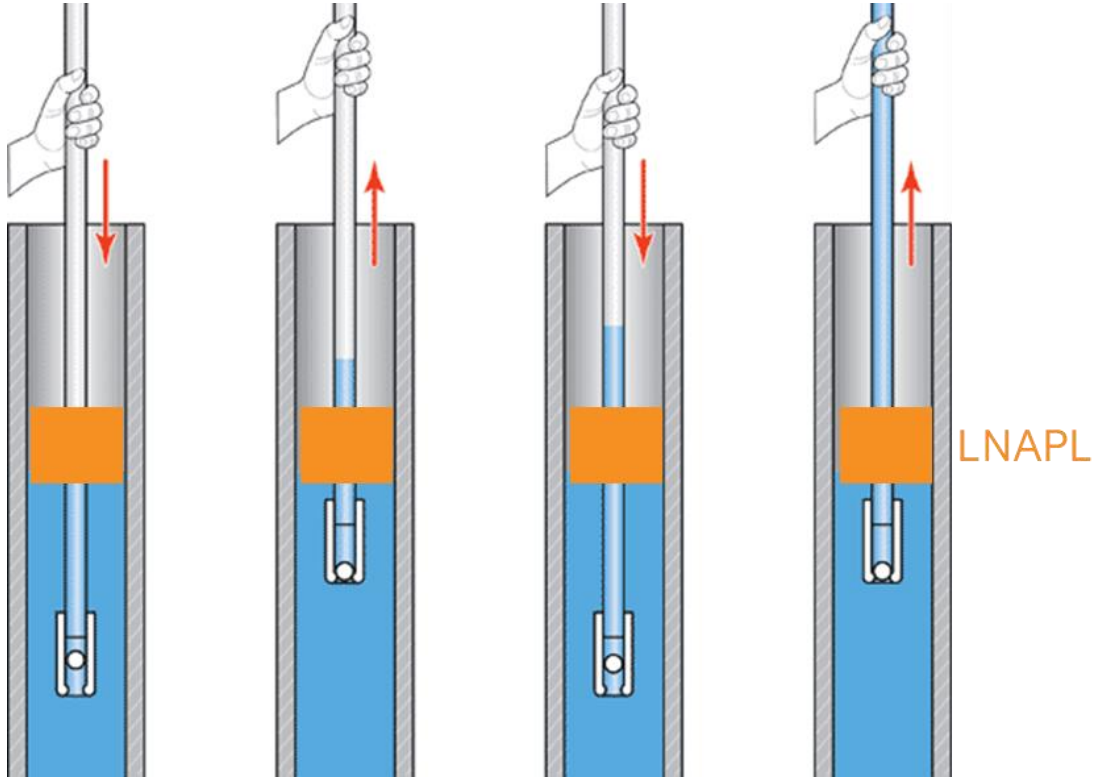
Q10) "As such, sampling was conducted at all leachate sumps/wells at the site where possible. It is noted, LNAPL was very thick at several leachate monitoring locations in terms of both depth of layers and consistency, and samples of the underlying leachate were unable to be retrieved as it was difficult to penetrate the LNAPL layer via bailer sampling technique."

The letter refers only to bailer sampling. Are there not other methods by which suitable leachate samples could be obtained? Pumping comes to mind. Were other sampling techniques tried and if not, why not?

Q10) COLLECTION OF LEACHATE SAMPLES

As previously presented, leachate sampling presented with a number of issues over the reporting period as the LNAPL is very viscous and it is difficult to break through to reach the underlying leachate. Equipment needs to be 'pushed through' the LNAPL, and at a depth of 20-30 m this becomes ineffective with certain types of equipment.

Leachate sampling techniques were developed over the year, culminating in the successful collection of samples in the monitoring round in Q1 2021 using the 'Waterra' foot valve.



RESPONSE TO SUBMITTED QUESTIONS

Q11) "Leachate was only able to be sampled at monitoring location TUL-WELL13"

If other sampling techniques had been used to extract leachate how many other wells or bores could have been sampled?

Q11) COLLECTION OF LEACHATE SAMPLES

Leachate was only able to be sampled at monitoring location TUL-WELL13 in the Q1 2020 GME.

The lack of success of sampling leachate in this round (using the bailer technique) prompted a thorough review of available monitoring techniques and equipment throughout the year. Interval sampler method was used in Q2 2020, 'Waterra' foot valve method in Q3 2020, and then interval sampler method in Q4 2020.

Using the sampling technique developed over the reporting period, 12 leachate sumps were able to be sampled in the Q1 2021 GME using the 'Waterra' foot valve method.

RESPONSE TO SUBMITTED QUESTIONS

Q12) What action has been taken by Cleanaway to clear the bores so that the leachate sample can be retrieved? If no action why not?

There appears to be quite a number of blocked bores and I am wondering what impact these blockages may have on the overall picture of groundwater quality / contamination.

Q12) LEACHATE SUMP BLOCKAGES

Leachate sump L06 has a blockage at approximately 18 m below surface.

Inability to sample this leachate sump (L06) does not limit the understanding of groundwater quality as:

- 12 other leachate samples were able to be collected in the Q1 2021 GME
- The leachate chemistry is well known at this point and leachate samples provide limited additional information for water quality assessment, and
- Leachate elevations are still able to be recorded within this sump.

Difficulties in sampling leachate beneath viscous LNAPL appear to have been largely overcome by the adoption of the 'Waterra' foot valve sampling technique.

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