Appendix H Landfill Engineering Memo

Memo

Subject:	Landfill engineering assessment	**Reference No:**	1092369.3000
Author:	Andrew Shallard	**Date:**	11 November 2025

1 Introduction

Tonkin & Taylor Ltd (T+T) has been engaged by WM New Zealand (WMNZ) to provide technical assessments to understand the effects from a proposal to reconsent Redvale Landfill, north of Auckland.

Redvale Landfill is currently scheduled to cease accepting waste in December 2028 and due to a delay in the authorisation and establishment of the replacement Auckland Regional Landfill (ARL) a transition plan is required. The proposal is to continue sending the current residual waste (around 600,000 tonnes per year) to Redvale Landfill, beyond the existing consent limit of December 2028. This would require new resource consents at Redvale Landfill.

To accommodate the on-going placement of waste at Redvale Landfill beyond 2028, the proposed works will involve the following:

- **Revised final surface profile of the existing landfill**: The current final design landfill ground profile varies but is less than 1V:3H across the footprint. That ground profile will be steepened up to a maximum grade of 1V:3H, to allow placement of additional waste within the existing landfill footprint. Bunds, varying in height between 2 and 6 m, will be constructed along the eastern and southern boundaries to accommodate the required additional waste volumes.
- **Class 2 extension**: The landfill is proposed to be extended to the south-west of the current landfill boundary, within the area currently occupied by the now decommissioned Managed Fill and Pond 6. The extension will comprise the excavation and lining of a new landfill cell, allowing the acceptance of waste that meets the Class 2 waste acceptance criteria, which will be constructed in a manner similar to the already constructed cells within the current landfill.
- **Relocation of ancillary activities**: the relocation of ancillary activities to allow for the placement of waste.
- **Sediment Retention Ponds**: The removal and filling in of Sediment Retention Pond 6 and the Office Pond while enlarging Pond 1 to capture and treat the stormwater from these catchments.

This memo provides an outline of the initial findings of the landfill engineering assessment and has been prepared for inclusion in an application for Ministerial referral of the project under the Fast-track Approvals Act 2024. Specifically, this technical memorandum responds to the requirements under section 3.4 of the Fast-track Approvals Referral Application Form. A full description of the draft proposal is included in the accompanying information attached to the application form for the referral.

2 Summary of findings

The proposal increases available airspace by about 4.6 Mm³ to a total of 24.3 Mm³. The existing consented airspace is approximately 19.7 Mm³ (post-settlement).

The increased airspace comprises two key components:

- The revised final surface profile steepens existing landfill slopes and adds a perimeter bund along the eastern and southern boundaries. This change provides more airspace within the existing consented footprint for Class 1 waste.
- The Class 2 footprint extension adds a new lined area south of the current landfill. It will be filled with non-putrescible construction and demolition (Class 2) waste.

The existing landfill's base lining system will not be altered. The new extension will feature a lining system, including leachate collection, designed to meet modern standards as embodied in the WasteMINZ Technical Guidelines for Disposal to Land, Revision 3.1, September 2023 (WasteMINZ Technical Guidelines).

The proposed design is based on the proven engineering principles applied at the site for over 30 years. Where appropriate, the changes outlined in this memo will be implemented to further improve containment and management of environmental effects..

The site's highly favourable geology, which includes deep, low-permeability soils and a naturally inward hydraulic gradient, provides a robust and reliable secondary containment system that offers an exceptional level of environmental protection.

The final landform will blend with the surrounding landscape, with stable slopes, effective surface water drainage, and a final cap complying with WasteMINZ Technical Guideline recommendations.

These findings are based on assessments undertaken to date and will be confirmed at the substantive stage of the application.

3 Assessment methodology

The preliminary landfill engineering assessment is a desktop study informed by a comprehensive review of existing site information and proposed designs. The methodology includes:

- Review of the original and current consented designs for the Redvale Landfill, including the base containment system, leachate collection, and final cap system.
- Analysis of over 30 years of operational history and performance monitoring data from the existing landfill, including leachate generation rates and groundwater monitoring results.
- Development of detailed engineering designs for the proposed revised final surface profile and the new Class 2 footprint extension, as shown in the drawings attached to this application.
- Assessment of the proposed designs against the requirements set out in the WasteMINZ Technical Guidelines to ensure alignment with modern best practice.
- Integration of findings from associated technical assessments, including the Geotechnical Assessment Memo and the Hydrogeological Assessment Memo.

4 Engineering design and performance

4.1 Site suitability

The Redvale Landfill site is exceptionally well-suited for a landfill. It is underlain by a very thick layer (at least 100 m) of naturally low-permeability materials (Northland Allochthon mudstone, siltstone

and limestone). In addition, groundwater levels outside the landfill are generally higher than the leachate levels within it, creating an "inward hydraulic gradient". This means groundwater tends to flow into the landfill rather than leachate flowing out, providing a high degree of natural containment.

4.2 Base containment (lining system)

The base containment lining system is designed to prevent leachate from escaping the landfill.

- **Existing landfill:** The current system features a 900 mm thick compacted clay liner (CCL) with as- constructed permeability significantly lower than the consent requirement of 1 x 10^{-9} m/s. While the current WasteMINZ Technical Guidelines recommend a composite liner (synthetic membrane plus clay) for Class 1 landfills, the combination of Redvale's thick, high-performance CCL and the site's unique, favourable geology and hydrogeology provides an equivalent or superior level of environmental protection.

  Fate and transport modelling set out the hydrogeological assessment memo indicates that even if an outward hydraulic gradient were to be maintained over a very long time, freshwater guidelines would still be easily met in the Rangitopuni stream. This is supported by 30 years of monitoring data showing no evidence of leachate in groundwater wells spaced around the landfill. The existing lining system is therefore considered appropriate in this context.
- **Proposed Class 2 extension:** The extension will have a new base containment lining system consisting of a 900 mm thick CCL with a maximum permeability of 1 x 10^{-8} m/s. This design is consistent with the WasteMINZ Technical Guidelines recommendations for a Class 2 landfill. The base of this extension is also below the natural groundwater table, which will help maintain an inward hydraulic gradient once the extension has been filled.

4.3 Leachate generation

Historical data shows that leachate generation rates align well with the original predictive models when updated for current operational practices. Future generation is expected to remain manageable through good operational practices.

The rate of leachate generation is mostly attributed to the open, operational parts of the landfill, as capped portions do not contribute significantly to the overall quantity of leachate. Under the proposal, open waste and daily cover areas will have reduced limits compared with recent operational practices. Daily cover thickness will be increased from the current 150 mm to 300 mm – reducing infiltration from those areas. Therefore, leachate generation rates are likely to remain comparable with, or lower than, current operations, despite the larger overall footprint with the Class 2 extension.

The expected leachate generation after closure is in the order of 13 m^3/day, which is similar to the current landfill estimate of 12 m^3/day.

4.4 Leachate management system

The leachate management system gathers leachate for safe collection, removal and treatment from the active landfilling area.

- **Existing landfill:** The existing leachate collection system consists of a network of collection drains and sumps where leachate is pumped out from the base of the landfill. Under the proposal the existing system will remain the same, except that the access risers for the sumps and cleanouts will need to be extended through the new perimeter bund to relocated access points.

For the revised profile, a network of leachate collection drains will be installed on the surface of the existing waste prior to adding on additional waste. These drains will collect leachate from the new waste should there be any unexpected hindrance to downward flow. These drains will direct leachate toward the perimeter of the landfill where a perimeter collection drain will be installed on the inside of the perimeter bund. In addition to collecting leachate from the new waste profile, this drain will provide additional security against leachate escape from the landfill.

- **Proposed Class 2 extension:** A new leachate collection system is proposed, consistent with WasteMINZ Technical Guidelines recommendations. This will include a 300 mm thick leachate drainage blanket over the CCL , a network of perforated collection pipes, and a collection sump for extracting leachate via pumping.
- **Leachate disposal:** Leachate will continue to be disposed of via the BeneVap leachate evaporator, with any excess leachate trucked off-site for treatment and disposal.

4.5 Final landform and final cap system

The final landform and cap are designed to ensure long-term stability, control water infiltration, and manage surface water runoff.

- **Final landform:** The proposed final landform will have maximum side slopes of 1V:3H and minimum crest/bench slopes of 1V:20H (5%). These grades are stable and promote effective drainage, consistent with WasteMINZ Technical Guidelines recommendations. The maximum elevation of the extension landform prior to settlement is RL 106.7 m.
- **Final cap system:** The proposed final cap for both the revised profile and the Class 2 extension will consist of a 150 mm topsoil layer over a 1,000 mm thick low-permeability compacted clay layer ($k < 1 \times 10^{-8}$ m/s). This is consistent with the existing consented design and significantly exceeds the WasteMINZ Technical Guidelines minimum requirements for both Class 1 and Class 2 landfills, providing excellent control of rainfall infiltration and long-term leachate generation.

4.6 Other key engineering aspects

- **Stormwater management:** The site's stormwater system will be extended to manage runoff from the new landfill areas. Permanent cap drains and perimeter channels will be designed to safely convey a 100-year storm event, in line with WasteMINZ Technical Guidelines recommendations.
- **Landfill gas management:** The existing active landfill gas collection system will be extended vertically to accommodate the revised final surface profile in the Class 1 waste areas. Due to the low organic content of Class 2 waste, an active gas collection system is not proposed for the new extension. However horizontal gas collectors could be installed if it becomes necessary.
- **Groundwater:** The Class 2 extension will require excavation below the water table, necessitating temporary dewatering and groundwater management during construction. The groundwater drainage system will be grouted up once sufficient weight of refuse is in place to prevent uplift. This will allow groundwater levels to return to pre-development levels and an inward hydraulic gradient.
- **Relocation of existing facilities:** A number of ancillary facilities, such as the Approved Transitional Facility (ATF), secondary wheelwash and a light engineering workshop are located within the existing landfill footprint. These will need to be relocated to complete filling of the extension. They will be relocated to alternative locations off the footprint as required. Similarly, some minor facilities such as water supply tanks located within the Class 2 extension area will need to be relocated in order to construct the extension.

- **Removal of BeneVap:** The existing BeneVap leachate evaporator, currently located on the landfill footprint, will be retained as long as possible. It will then be decommissioned and removed prior to filling that area with waste.

4.7 Proposed waste acceptance

Waste Acceptance Criteria (WAC) will be applied to both Class 1 and Class 2 waste being accepted at Redvale Landfill.

The WAC for Class 1 is proposed to enable the existing waste streams at Redvale Landfill to continue to be accepted. This waste includes mixed municipal waste from residential, commercial, and industrial sources, construction and demolition debris, soils, rocks, gravel, sand, clay, road sweepings, treated hazardous waste that meets specified leachability limits (TCLP), and asbestos. Generally, the WAC will follow the WasteMINZ Guidelines with some adjustments, where it is considered acceptable, to accommodate waste streams such as PFAS, auto shredder and nickel slag. Existing groundwater monitoring demonstrates that the effects from this waste are appropriately managed with no effect found in groundwater within or around the site. Therefore, it is considered acceptance of this waste, along with the deviation from the WasteMINZ Guidelines are appropriate.

The Class 2 landfill area will accept waste that meets the WasteMINZ Class 2 Waste Guidelines which reflects the lower containment capacity of Class 2 liner systems that have been designed. This area may accept waste from construction and demolition waste, managed fill, clean fill, and non-putrescible industrial waste. These materials must contain no more than 5% biodegradable content by volume per load. The TCLP limits for the Class 2 area are consistent with the WasteMINZ guidelines and HEPA criteria. The limits are more stringent than those for Class 1, reflecting the lower containment capacity of the Class 2 liner system.

5 Conclusions

The preliminary landfill engineering assessment concludes that the proposed expansion of the Redvale Landfill is technically robust and incorporates designs that are consistent with or exceed modern New Zealand standards and guidelines.

The proposed works build upon three decades of successful operation, leveraging proven design and construction methods that are well-suited to the site's unique and highly favourable geological and hydrogeological conditions. The existing base containment system has performed well, and the proposed systems for the new Class 2 extension are designed in accordance with current best practice.

The engineering designs for the final landform, final cap, and associated management systems (leachate, stormwater, and landfill gas) are considered to be appropriate and will provide for the safe, long-term containment of waste while minimising environmental effects.

6 Applicability

This report has been prepared for the exclusive use of our client WMNZ, with respect to the particular brief given to us, and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that WMNZ will submit this report to the Environmental Protection Authority in support of a referral application under the Fast-track Approvals Act 2024 for the works described herein, and that the Environmental Protection Authority will rely on this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Memorandum prepared by:

.....

Andrew Shallard
Senior Civil/Environmental Engineer

Memorandum reviewed by:

.....

Simonne Eldridge
Technical Director – Environmental Engineering

Authorised for Tonkin & Taylor Ltd by:

.....

Simonne Eldridge
Project Director

14-Nov-25
\\ttgroup.local\corporate\auckland\projects\1092369\workingmaterial\referral application\referral application\06 appendix f - landfill engineering memo\2025 11 14 final landfill engineering memo.docx