

20 September 2024
Job No: 1090767

Otago Regional Council
Private Bag 1954
Dunedin 9054

Attention: Shay McDonald

Dear Shay

Mount Cooee Landfill Landfill and Geotechnical Consent Technical review RM21.668

1 Introduction

Tonkin & Taylor Ltd (T+T) have reviewed selected reports and responses compiled to support the consent application for the partial closure and extension of the Mt Cooee landfill in Balclutha for the Otago Regional Council (ORC). The review has been conducted as per the Purchase Order number PO 030980, issued 20 April 2023 and the included short form agreement.

This letter report relates to review of the following documents provided by ORC, meeting with WSP (the applicants technical experts for Geotechnical and Landfill aspects) on 1 February 2024, and review of further additional information received by T+T:

- Draft technical reports received 28 April 2023.
- Draft application and AEE received 2 May 2023.
- Insights from the site inspection conducted on 17 May 2023 by Jonathan Shamrock with the applicant, the applicant's consultant, the ORC and the ORC review team.
- Lodged application received 23 June 2023.
- Section 92 responses received 28 November 2023.
- Additional information, drawings and letter response received 09 April 2024.
- Additional geotechnical memorandum and MS Excel tracker sheet received 21 May 2024.
- Additional drawing and letter information received 27 August 2024.

The documents and information were reviewed to assess the design information, landfill design and geotechnical engineering, for the landfill development only, and did not include a review of the proposed resource recovery centre related aspects.

We have completed and summarised our review on the instructions from ORC, based on the information and responses received to date.

2 Response to ORC question form

For all technical matters
Is the technical information provided in support of the application robust, including being clear about uncertainties and any assumptions? Yes, or no. If not, what are the flaws?
No, refer responses below in section 3.
Are there any other matters that appear relevant to you that have not been included? Or is additional information needed? Please specify what additional info you require and why [please explain]
Yes, refer responses below in sections 3.
If granted, are there any specific conditions that you recommend should be included in the consent?
Yes, see some suggested conditions in the geotechnical section below, however as some matters remain unresolved, we do not believe it is appropriate to provide full recommendation on all aspects. We would be happy to assist ORC with review of proposed consent conditions and/or provide recommended updates or comments on appropriateness if request.
Landfill Design
Reports to audit: AEE, App B Design Report, App C Design Drawing Set, App G Sheet Pile, App S Proposed Conditions of Consent, App V Landfill Management Plan, and any other reports/sections of reports that you consider relevant to your understanding
Q: Is the Landfill design and management fit for purpose with regards to the Technical Guidelines for Disposal to Land (WasteMINZ, 2022)? Please explain.
No, require further clarification or technical justification, refer responses below in sections 3.
Q: Is the leachate and stormwater management appropriate for the site, including the current landfill area and the proposed expansion area? Please explain.
No, require further clarification, refer response below in section 3.
Q: Is the landfill gas management appropriate for the site, including the changes proposed by the Applicant as part of this application? Please explain.
No, require further clarification, refer responses below in sections 3.
Q: Does the risk of landfill fire need to be assessed? Please explain.
Yes, landfill fire is a real risk both from internal and external ignition sources, and can impact the new extension landfill liner. The risk of a landfill fire should be assessed by the applicant as outlined in Technical Guidelines for Disposal to Land (WasteMINZ, 2023). This should also take into consideration fires generated from the disposal of inappropriate items such as discarded lithium-ion batteries.
Q: In your opinion, are the proposed conditions of consent appropriate to mitigate adverse effects on persons and the environment?
As critical items remain unresolved, we do not believe it is appropriate to comment on this item.

Geotechnical
Reports to audit: AEE, App E Geotech Factual, App F Geotech Interpretive, App S Proposed Conditions of Consent, App V Landfill Management Plan, and any other reports/sections of reports that you consider relevant to your understanding.
<p>Q: Is the geological and geotechnical information provided sufficient to understand the site and the land stability effects from the continued operation, closure, and aftercare of the landfill? Please explain.</p> <p>We have reviewed the updated geotechnical assessment and believe it is appropriately representative of the landfill design, follows appropriate assessment standards and achieves acceptable performance outcomes for long term and temporary cases under static and seismic loading cases. (i.e. acceptable FOS and deformation are demonstrated through analysis of landfill sections). However, there appears to be differences, or lack consistency, between the geotechnical sections analysed and what is presented in the drawings set. This primarily relates to the piggyback section of the landfill design.</p> <p>The geotechnical assessment also highlights the critical requirement for an underdrainage or subsoil drainage system for the site to prevent uplift pressures on the liner system. While further details of the subsoil drainage system have been provided, there is further clarification required, refer to Section 3 below.</p>
<p>Q: Does the application adequately address potential effects on landfill stability for continued filling in current area and proposed expansion area? Please explain.</p> <p>Yes, refer to above response.</p>
<p>Q: Do you agree with the conclusions reached in Section 10 and recommendations in Section 11 of the Geotechnical Interpretive Report?</p> <p>Refer to attached comments on revised Memorandum -Geotechnical assessment report and appendices, 21 June 2024 and above response.</p>
<p>Q: In your opinion, are the proposed conditions of consent appropriate to mitigate adverse effects on persons and the environment?</p> <p>We recommend appropriate aspects for the geotechnical assessment are adopted as part of the consent conditions if granted. This likely relate the following main areas:</p> <ol style="list-style-type: none"> i. Guidance on appropriate analysis requirements (specific consideration of liner interface) and critical section selection. ii. Static and seismic loading considerations, including groundwater and leachate considerations. iii. Performance criteria, Factor of Safety and deformation limits. iv. Inclusion of a 2 m high toe bund. v. Summary of any independent review requirements, if a Peer Review Panel is not adopted as part of the consent conditions.
<p>Q: Do you agree with the Applicant's conclusion as the level of adverse effects (from a geotechnical perspective) on persons and the environment?</p> <p>Yes, provided clarification is provided on the consistency between the sections analysis in the geotechnical assessment and those presented in the final drawing set.</p>

3 Outstanding issues

We have reviewed the recently provided information from the applicant. In general, we are of the opinion that the majority of relevant technical information required for a consent application, in terms of the landfill design and geotechnical investigation and design, has been submitted, reviewed and assessed as appropriate, with a limited number of remaining omissions as noted below. We believe the remaining outstanding issues are fundamental to the expected performance of the landfill, and therefore the understanding of the proposed activity, assessment by consenting

offices and peer review panels, and consistency between what is consented and ultimately taken forward to detailed design, if the consent was granted.

We have summarised the remaining main areas of concern below based on our experience of what is considered acceptable landfill design state of practice. This primarily relates to aspects that would influence the expected containment performance of the landfill in the short and long term, and/or would affect the expected leachate leakage rate. Containment, and estimated leachate leakage rate, is a critical design parameter, as it is relied upon by other experts as input into their assessment of affects.

3.1 Absence of fundamental concept information

Thought the consenting review process we have requested further information and clarification of aspects of the landfill design that we consider fundamental to the understanding of the how the design will perform both long term and during the operational stages of the landfill. The information requested primarily relates to presentation of critical aspects of the design on the concept plans, that would allow the concept design plans presented at consenting to be taken forward into the future detailed design stage, if the consent if granted. These related to:

- 1 There is no design solution under the piggyback liner area (area of landfill founding on existing or historic landfill material) to accommodate the expected ongoing differential settlement, and the impact of this on the lining system, as new overlying waste material is placed. As outlined in the Wasteminz Technical Guidelines¹ the effects of “settlement of underlying material, for example, when a liner and leachate collection system is placed over an existing unlined landfill (piggy back liner)” requires a site specific assessment. The applicant proposes to assess landfill material exposed during the construction of the landfill liner systems and undertake proof rolling of the materials and further intermediate cover placement as necessary to form a smooth batter to place liners.

It is our opinion, and has been well documented in literature, that ongoing settlement of landfill material would be expected to occur as the waste material degrades. The impact of this degradation is exacerbated when further surcharge load is imposed (such as that imposed by the new overlying waste material). The primary concern relates to differential settlement of the underlying waste due to differences in waste composition/degradation, which would not be visible from conducting surface works prior to the lining being installed. The new waste surcharge loading, and the variability of waste fill placed in the old landfill, will determine the potential for differential settlement. Without an assessment or design solution such as a geogrid reinforced intermediate cover layer, or a substantial supporting layer of soil likely meters thick, the geomembrane in the piggyback liner will be exposed to the risk of tensile strains from the differential settlement and ultimately rupture, which would lead to a release of leachate into the old unlined landfill or tracking along the interface with the liner material.

- 2 There is no gas collection on the north eastern portion of the landfill built over the existing historic landfill, the degassing system seems to end at the top of the existing landfill slope. The applicant has responded that the age of waste and construction timing of the landfill is unknown, and that requirements of national standards at the time of the future extension construction is unknown. Irrespective of the age, or status of Emissions Reduction Plan legislation, the old waste area will continue to produce gas. Once a geomembrane piggyback liner is installed, this will create a barrier and gas will no longer have an outlet pathway on the top of the existing landfill, and gas pressure below the liner will need to be released to prevent a build-up of pressure under the new liner. A build-up of gas pressure under the piggyback liner can damage the geomembrane, which affects the containment ability of the

¹ WasteMINZ Technical Guidelines for Disposal to Land, Revision 3.1, dated September 2023

landfill, and could be a health and safety risk to workers if the gas is not collected and discharged/destroyed in a controlled way.

- 3 There is no geotextile, or other design solution, to mitigate the effects of physical clogging of the leachate drainage blanket through contact with the waste material and expected fines migration from the waste into the voids in the drainage layer. An appropriately selected geotextile will improve the performance, and the service life, of the leachate drainage gravel and therefore long term containment performance of the landfill. Omitting this layer will result in an accelerated decrease in permeability of the leachate drainage gravel, with the resulting build-up of leachate mounding on the landfill base, resulting in an increased leachate pressure on the liner which increases the potential leakage rate from the landfill into the environment from any defects in the liner.
- 4 Omission of key landfill infrastructure drainage pathway information. Throughout the S92 process we have requested clarification on landfill drainage paths (leachate, stormwater and groundwater) and how these are to be drained in a controlled manner from the proposed landfill extension. The applicant has highlighted that these are a matter for detailed design, however we believe that without outlining the concept of such systems, it is not possible to assess the effects of the expansion. This lack of clarity will also extend to setting out future consent compliance or monitoring requirements, even down to the proposed location of likely discharge locations. Such examples include:
 - The leachate discharge arrangements for temporary (as the landfill is proposed to be constructed in different stages) and final landfill. Currently the concept plans show the leachate collection system ending at the end of the landfill. On the site layout drawings there is a proposed leachate drainage pipeline shown discharging into an existing leachate pump station below the existing landfill. It is unclear how and where this is connected to the landfill collection system. It is also unclear how the staging of the landfill construction will be managed, as leachate drainage will be through the active construction area.
 - For the subsoil ground water and stormwater, the concept plans and response from the application outlines the subsoil water being collected into a manhole, for sampling and discharge as clean water. Similarly for stormwater, no details are provided for where collection drains are to be positioned, or how the connection to the proposed sediment retention pond is to be achieved.
 - From the responses it is apparent that there is uncertainty about what the final basegrade of the new landfill will be, specifically in the piggyback area. This is also reflected in inconsistencies between the geotechnical assessment profiles and those presented on the concept plans. The applicant has highlighted that the final existing landfill profile is not yet known, as filling is still underway under the existing consent at the site. Due to this, it is unclear if the geotechnical assessment is representative of the proposed activity.

4 Applicability

This report has been prepared for the exclusive use of our client Otago Regional Council, 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.

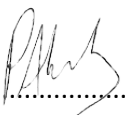
We understand and agree that this report will be used by Otago Regional Council in undertaking its regulatory functions in connection with the consent review for the Mount Cooee Landfill, Balclutha, reference RM21.668.

The sole purpose of this report and the associated services performed by Tonkin & Taylor Limited (“T+T”) is to undertake a limited review of, and comment on, the reports outlined above (“Reports”) prepared by Applicant (“Principal Consultant”) in accordance with the scope of services set out in the contract between ORC (the “Client”) and T+T. That scope of services, as described in this letter, was developed with the Client. T+T’s review was a form of peer review, undertaken on a level-of-effort basis, to provide comment to assist the Client in its decision making in relation to the Report’s compliance with the requirements specified in the scope of services. The responsibility for the Report remains fully with the Principal Consultant and T+T’s review does not constitute a means by which that responsibility can be passed on to T+T. This letter has been prepared on behalf of, and for the exclusive use of, T+T’s Client, and is subject to, and issued in accordance with, the provisions of the contract between T+T and the Client. T+T accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Tonkin & Taylor Ltd

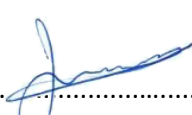
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20-Sep-24

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