Under	the Resource Management Act 1991 (**RMA**)
In the matter of	an application by **Dunedin City Council** for resource consents for the operation, closure and aftercare of the Green Island Landfill, Dunedin.

Statement of evidence of Debbie Fellows

4 March 2025

Applicant's solicitors:
Michael Garbett | Rebecca Kindiak
Anderson Lloyd
Level 12, Otago House, 477 Moray Place, Dunedin 9016
Private Bag 1959, Dunedin 9054
DX Box YX10107 Dunedin
p + 64 3 477 3973
michael.garbett@al.nz | rebecca.kindiak@al.nz

anderson lloyd.

Qualifications and experience

1 My name is Debra Leigh Fellows.

2 I am currently employed as a Technical Director and Principal at GHD.

3 I am an engineering geologist and geotechnical engineer with nearly 40 years' experience in these fields. I have a BSc(Hons) from Victoria University of Wellington and a MSc from the University of Surrey, UK. I am a Chartered Professional Engineer (Engineering Geology) with Engineering New Zealand. Over the course of my career I have worked on a range of municipal waste landfill projects in the UK and NZ, this includes undertaking geotechnical investigations, assessing geohazards, geotechncial assessments and development on existing landfills as well as consenting new landfills.

Scope of evidence

4 I have been asked to prepare evidence in relation to geotechnical effects of the proposal and liquefaction risk. In particular, to address any outstanding issues that arise from the independent geotechnical review commissioned by ORC in November 2023.

5 This includes:

(a) Characterization of the site geology;

(b) Parameter Development;

(c) Slope stability assessment;

(d) Liquefaction potential and associated settlements; and

(e) Impact of predicted deformation on underground infrastructure (leachate pipes and trenches).

Executive summary

6 There is no outstanding adverse commentary or issues, provided from the independent technical review and associated report, in relation to the geotechnical elements of the landfill proposal.

7 The reviewer indicated that the following elements of work were appropriate:

(a) Site investigation and defining the ground conditions;

(b) Liquefaction assessment and predicted deformations and impact on buried infrastructure;

(c) Slope stability modelling; and

(d) Proposed mitigation measures

8 There was review commentary on the selection of specific geotechnical design parameters and the associated potential impact on slope stability analysis. I take no issue with the commentary on potential alternative parameters and agree that using these alternative parameters could have no material effect on the predicted slope stability and associated effects.

9 The reviewer's evidence has raised additional commentary and associated uncertainties on the lack of landfill waste parameter data, definition of the landfill embankment materials, lack of advanced laboratory testing and the potential use of more complex displacement assessments.

10 Regardless of the additional commentary on uncertainties the reviewer concludes that the remedial measures which minimise the adverse effects are considered reasonably acceptable.

11 I have provided some additional recommendations regarding proposed changes to the ORC draft conditions.

Overview

Geotechnical Design Parameters

12 The review provided commentary on the selection of geotechnical design parameters. In particular, the use of drained parameters for the UKEM layer for seismic and post seismic slope stability assessment. The soils of this unit have high silt and clay content which would suggest an undrained parameter maybe more appropriate.

13 The reviewer noted that the slope stability analysis for all seismic and non-liquefied load cases produced unsatisfactory factors of safety and the behaviour of the UKEM layer was considered noncritical. Regardless of the choice between geotechnical parameters it will make no material difference to the findings. On this basis the reviewer concluded that the stability analysis was considered acceptable and by corollary the predicted deformations and effect were unchanged.

14 I take no issue with potential use of alternative design parameters and agree that using these alternative parameters would have no material effect on the predicted slope stability and associated effects.

Feedback on Dr Trani Evidence

15 In addition to the technical review report, Dr Trani's evidence has noted uncertainty in respect of the lack of landfill waste parameter data, definition of the landfill embankment materials, lack of advanced laboratory testing and the potential use of more complex displacement assessments (Paragraphs 8.3, 8.5, 8.7, 8.10, 8.11).

16 I take note of these additional opinions and alternatives, However paragraph 8.14 of his evidence indicates that the geotechnical report has provided an understanding of the associated risks, anticipated ground displacements and movements. The remedial measures which minimise the adverse effects are considered reasonably acceptable.

ORC consent conditions

17 With regard to consent condition 7b (page 23) of the Discharge Permit RM23.185.01 Discharge of Waste and Leachate to Land Conditions that stipulates that "*the extended section of the leachate trench must be subject to detailed design and be designed with resilience to the anticipated deformations under the ULS seismic event."*

18 The use of the term resilience implies that this portion of the trench will have the capacity to withstand the ULS earthquake with no adverse effect on this.

19 I suggest that rather than the trench being resilient that the pipe within the trench is appropriately designed to withstand the earthquake event. I recommend that the wording is amended to reflect the pipe rather than the trench resilience. This is a practical approach that is consistent with the wider engineering design while maintaining leachate pipe integrity.

20 With regard to the deleted consent condition 9 (page 22) of the Discharge Permit RM23.185.01 Discharge of Waste and Leachate to Land Conditions which detailed the operating levels of the leachate head within 40 m of the landfill margin.

21 It is recommended that this condition is reinstated. The reason is that these leachate levels are a critical influencing factor for the slope stability of the landfill embankments as identified in the GHD Geotechnical Liquefaction and Stability report. Stability sensitivity analysis identified that leachate levels above those recommended will have an unacceptable adverse effect on slope instability. The original condition wording is to ensure that the owner has responsibility to maintain lower leachate levels for this reason.

22 I note ORC have suggested an alternative condition in regard to how leachate levels may be managed through pumping from LFG wells (proposed Condition 4 page 22 -23). Mr Roberts has addressed this issue in his evidence. I note that pumping from the LFG wells may be one of the tools use to control leachate levels from a geotechnical stability perspective.

Debbie Fellows

4 March 2025