| Otago Regional Council Letter | | | |
|---|---|---|---|
| **S92 questions (October 2020)** | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| **Assessment of Alternatives** | | | |
| An assessment of alternative locations for creating a landfill was undertaken in the 1990s. Please can you provide details of the criteria that were used in this assessment, what additional matters would be taken into consideration if that assessment had been undertaken in 2020 (e.g. new legislation, urban sprawl etc), and whether the resulting recommendations would have been any different. | A report was undertaken by Beca in 1992 to assess potential locations for a future Dunedin City landfill. A copy is attached. The locations were assessed based on the following criteria: ecological (vegetation, wildlife, aquatic life, habitat, bird strike/airfields exclusion zone) Physical (available capacity, land use inventory classification, availability of cover material, geology/mass movement, topography/stability, climate, surface hydrology, proximity to water catchment area, hydrogeology, leachate control, gas control); Social (residential area, recreational areas, traffic access and impact, public health, visual; impact/screening potential, cultural/archaeological features, impact on local water, end use of site) Economic (distance from refuse source/energy consumption, site purchase, establishment cost, requirement for road upgrading). If the Council was to select a site for a landfill, today it would likely undertake the same assessment. The Council has applied for resource consents and is not applying for a designation. The operative designation in the 2GP has a term of 40 years. This means it can be and is being relied on in its present form, with its current conditions, to authorise the principal construction and operational work needed that would otherwise need resource consents under the district plan. We also note that the validity of the designation has not been challenged and cannot be challenged through the resource consenting process. Therefore the Council has not re-assessed the Smooth Hill site or other potential sites against the criteria from the 1992 report as part of this application. Such an assessment is considered unnecessary because there is no statutory requirement to "re-assess" the merits of the operative designation when applying for resource consents. Nor is a Council required to periodically review its operative designations or reassess them when new legislation comes into effect or the receiving environment changes. Please see the response provided in the attached cover letter to ORC dated 31 May. | Schedule 4 of the RMA states that if any activity includes the discharge of any contaminants, the assessment of effects must include any possible alternative methods of discharge, including discharge into any other receiving environment. We have previously discussed how the Beca report from 1992 provides an assessment but that this report is almost 30 years old. The purpose of the questions was for the Beca assessment to be revisited to demonstrate that it was still applicable. This question remains unanswered. Alternatively, the applicant could provide a discussion of possible alternative waste management options, which may include other methods or sites within, or outside of, the district. We note that the presence of a designation does not make the applicant exempt from sections 13-15 of the RMA. | Long term options for the management and minimisation of waste have been an ongoing issue for the DCC to consider since at least the late 1980's. The Council has expended considerable time, resources, and investment in guiding its role and investment into waste management. The Green Island remains the principal alternative option for the DCC to operate a landfill for municipal solid waste in the City, however the foreseeable end of the functional life of the landfill due to capacity constraints means it is not a viable long term option. The assessment of alternatives set out at section 6.1 of the AEE has been updated to provide additional description of the alternatives that have been considered as part of the programme business case for Waste Futures Programme of work. See attached assessment. In summary this work included assessment of nine different programmes incorporating a range of potential waste and diverted material interventions. These interventions included alternative waste disposal options, including exporting waste from the City, developing a waste to energy facility, as well as the development of Smooth Hill. No other potential landfill sites in Dunedin, including those identified in 1992 were included in the assessment as the Council already had a designated landfill option at Smooth Hill, there had been no significant change in the relevant criteria upon which the Council had made its decision to select the Smooth Hill site in 1992, and there had been no significant change to the site or surroundings that necessitated reassessment of other sites.<br><br>Through the programme business case, waste to energy was discounted as an option due to high indicative capital and operating costs and it being reliant on securing large proportions of combustible waste (including from out of district) to be viable. This option was also unlikely to be culturally acceptable. Export of waste (while viable) presented risks and uncertainties in terms of the capacity to accept waste, waste acceptance criteria, and resource consent constraints on the operation of the out of district landfills. Furthermore export of waste would incur transport charges and may be impacted by future national levies on waste / CO2 charges. Manawhenua also raised concerns over the export of waste out of the district. Following on from the programme business case, further work has been completed to confirm the technical feasibility of Smooth Hill to be developed and operated as a landfill which did not identify any fundamental flaws, thereby effectively confirming the 1992 evaluation findings. |
| **Waste Management** | | | |
| Based on disposal rates of 90,000 tonnes per year, the proposed landfill has an expected life of 55 years. The actual rate of waste disposed will be dependent on both population growth and the effectiveness of waste minimisation initiatives. Nonetheless, the projected rate of waste disposal seems to be at odds with DCC's WMMP targets. Please provide further detail regarding how both of these factors have been considered in the waste disposal rates predicted. | The application as lodged was based on the current (at that time) average disposal rate of 90,000 tonnes per year. The DCC has reviewed this in light of more recent data collected at Green Island and now assumes a rate of 60,000 tonnes per year and this, along with the smaller footprint in the updated design has reduced the expected life of the landfill to about 40 years. The annual waste disposal rate will however fluctuate based on population changes, changes to waste diversion and other events (such as significant natural disasters or other commercial collectors changing their practices). Please see the response provided in the attached cover letter to ORC dated 31 May. | WMMP targets include a reduction in waste generation per capita by 15% and a reduction in the amount of municipal waste disposed/incinerated by 50% by 2040. This does not seem to be reflected in the 60,000 t/yr. average disposal rate used. Please provide further clarity regarding how disposal rates are predicted. | The WWMP targets are aspirational and their achievement is contingent on many factors, including future commitments and decisions of the Council to continue the transition from the existing kerbside diverted materials collection and processing (or 'business as usual') approach. The 60,000 t/yr. average disposal rate is an estimated rate of disposal only based on current data which recognises the inherent uncertainties in future waste management and disposal rates. As noted in the application it is not possible to accurately predict disposal rates as they are contingent on Council investment in other waste management improvements and facilities; public response to waste minimisation/diversion efforts; practices of commercial collectors/disposers; population and/or economic growth; and unforeseen events. Significant region-wide events (for example a natural disaster) could result in significant generation of waste that could significantly exceed the 60,000 t/yr. average disposal rate. Similarly increased requirements for disposal of contaminated soils due to increased regulatory requirements or brownfield development, or disposal of waste from exposure events at historic landfills may increase disposal demands. Despite therefore a commitment to waste minimisation and the Council's target of zero waste, it is anticipated that uncertainty will remain regarding the city's waste disposal needs. A conservative approach that retains the existing 60,000 t/yr. as an average disposal rate but also allows for higher disposal rates is appropriate, noting the landfill has been designed to ensure any effects on the environment will be managed irrespective of the annual disposal rate. |

| Otago Regional Council Letter | | | |
|---|---|---|---|
| **S92 questions (October 2020)** | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| It may be appropriate to apply an annual limit on the volume of waste that can be received to ensure that the activity is undertaken as described and assessed in the AEE, and that waste minimisation efforts are being implemented as effectively as possible. Please indicate what a suitable annual limit might be based on projected population growth and planned waste minimisation initiatives. | The DCC is not seeking an annual limit on the amount of waste that can be disposed of… Please see the response provided in the attached cover letter to ORC dated 31 May. | To ensure that the activity undertaken is consistent with that described in the consent application, would a 5-year rolling average be more appropriate? | DCC does not propose an annual limit on the amount of waste that can be disposed of. As noted above, the 60,000 t/yr. disposal rate adopted is an estimated rate of disposal only based on current data which recognises the inherent uncertainties in future waste management and disposal rates. It is not possible to accurately predict disposal rates and significant region-wide, unexpected events could result in spikes in waste disposal rates. Where those spikes result in a significant generation of waste (for example a natural disaster), it is conceivable that those rates could significantly exceed a 5-year rolling average of 60,000 tonnes. Given these factors, a rolling average is not appropriate or workable. |
| **Draft Consent Conditions** | | | |
| Condition 50: There is no discussion of potential effects on neighbouring covenants from the influx of pests. Please take this into consideration when preparing the management plan. | This point is noted. As outlined above plant and animal pest control measures are outlined in the draft LMP, and which takes into account effects on neighbouring areas. A specific Plant and Animal Pest Control Programme will be developed as part of the final LMP which will incorporate effective contemporary pest control measures available at that time. | The draft LMP says that there may be effects, but says that Regional Pest Management Plan rules will be met. This does not answer the question of what the effect will be compared to the current situation. Will the number of pests in the area be more or less than current levels? | The intention is that pest management will be undertaken on the Smooth Hill landfill site that keep's pest animal numbers to the same or below current levels on the site so as to minimise the risk of immigration of pests to neighbouring properties. The methods to achieve this will be detailed in a Pest and Animal and Control Programme that will form part of the final LMP. The programme has not been prepared at this time, in recognition of the developing status of the LMP which will be further refined pre and post consent, and ultimately be finalised and approved by ORC prior to landfill construction commencing. Furthermore because the programme will need to be prepared cognisant of baseline pest numbers, potential pathways, and utilises the contemporary pest control measures available at that time, it would not be efficient to prepare the document at this time. However, in order to provide greater certainty of the intended outcome of the programme, the following amendment is proposed to LMP ecology objective (g) in proposed condition 68 - "Weed encroachment into indigenous vegetation communities, and populations of animal pests within the site are kept to below current levels in accordance with a Pest and Animal Control Programme." See attached amended conditions of consent. While the programme is intended to minimise the risk of immigration to neighbouring properties, it will not necessarily ensure pests in the wider area outside the site are kept to less than current levels, as the success of that is also dependent on the actions of other landowners in fulfilling their own obligations under the Regional Pest Management Plan which is outside the DCC's control. |

| Appendix 3 - Landfill Concept Design Report | | | | |
|---|---|---|---|---|
| **S92 questions (October 2020)** | | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| **2.3** | **Landfill Stability** | | | |
| a | No calculations have been provided for the stability of the Stage 1 waste that clearly show the parameters used, particularly at the interfaces of the lining system. Without having seen any calculations, the stability of the Stage 1 waste would seem to be marginal with long slopes towards the toe where post peak parameters will apply and only small flat areas where peak parameters may apply. Please provide details of the stability calculations for the Stage 1 filling with clear description of the parameters used, particularly the friction angles at the liner surface and where peak or post peak parameters are used. | The changes to the design have included a revised approach to filling and stage development for the landfill (see Drawings C210 - C214 and Design Report). The proposed approach outlined in the report and drawings is more typical of landfill development and provides a inherently more stable filling regime, Landfill stability calculations have been included in the Design Report with more details provided in the Geotechnical Interpretive Report. However, it should be noted that the filling sequence presented in the design remains indicative and will be developed further (or an alternative adopted) during detail design. At that time further analysis will be required to confirm waste stability as the landfill is developed. | The redesign of the landfill and proposed changes to the staged development of the landfill adequately address our concerns regarding the stability of Stage 1. Section 3.6 of the updated Landfill Concept Design Report describes that stability analysis will be undertaken as part of detailed design. To fully address our concern, we consider that a consent condition should be included to describe stability requirements. Note:<br>there is already a draft consent condition proposed by the applicant (Condition 6) but this needs to be updated to describe all design cases. | Please note Condition 6 captures all relevant design cases as the design case for short term static stability with elevated leachate is incorporated into the one static design assessment included - see GIR response 3.21 b<br><br>Conditions 6 and 7 have also been amended to require the detailed design to include slope stability analysis to verify that the proposed landfill design will be stable in the short (construction/operation) and long-term (closure/post-closure). This will include:<br>- Geotechnical stability analysis of the proposed subgrade arrangement for each stage considering excavation/filling arrangement.<br>- Veneer slope stability analysis of the proposed liner and capping arrangements for each stage.<br>- Waste stability analysis of the proposed landfilling stages.<br>The analysis will utilise site specific parameters where possible for the various materials, and/or publicly available material data where site-specific information is not available. Where publicly available material data is used, a verification program will be included as part of the construction documentation to verify that the construction materials align with any assumptions made as part of the slope stability analysis.<br>The analyses will adopt relevant factors of safety adopted for landfill industry practice, with justification provided for any deviations from these values.<br>The amended wording of the conditions is attached to this response. |
| **2.6** | **Stormwater treatment** | | | |
| a | Please provide details of the design parameters and expected performance for the proposed sediment treatment facilities. | Design parameters and performance criteria are described in the Surface Water Report. | The response references performance criteria described in the Surface Water Report. Section 4.1 and 4.2 of the Surface Water Report describe a series of sediment retention ponds and the attenuation pond downstream of the western stockpile. Design data are provided for the attenuation capacity of the attenuation pond. However, there appears to be no information provided on the design criteria for sediment removal through this system in terms of the design criteria, the standards to be adopted and the expected performance of the system for sediment removal.<br>Please provide this information or, if the applicant feels that this information has already been provided as stated in the response, please provide a specific reference to this information. | A similar question has been asked by the Surface Water Report Reviewer (6.2.3 b)). A full response is provided to the Surface Water question and the reviewer is directed to the response to 6.2.3.b). |
| **2.9** | **Landfill settlement** | | | |
| a | Drawing C202 shows the landfill cap contours. Please confirm whether these are proposed to be pre-settlement contours or post-settlement contours, i.e. is filling proposed to be to a higher elevation than shown to allow for future settlement? | Addressed in Design Report - section 3.8 The contours shown are at closure. It is anticipated that some settlement will have occurred before closure and this has been specifically assumed in the landfill waste volume calculations (assumed additional void created by settlement during operations will be offset by daily cover volumes). Therefore, further settlement after closure is possible and will need to be managed to ensure landfill cap surface drainage remains appropriate. It is possible that that an operator may also opt to overfill to allow for long tern settlement post closure. However, this has not been assumed in this design. | The response allows for the possibility for an 'operator' to decide whether the waste will be over-filled to allow for future settlement. The applicant needs to make a clear statement regarding the maximum fill height to form the basis for effects assessments (e.g. landscape/visual effects). | The Concept Design has assumed there will be no filling over and above the landfill cap contours identified on Drawing C202, including no over-filling above those contours to allow for future settlement. This has also been assumed in the Landscape assessment. The final cap contours presented in Drawing C202 represent the maximum cap height at any time during landfill development. |

## Appendix 5 - Geotechnical Interpretive Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **3.4** | **Section 2.3.2: Faults** | | | |
| a | Refer to comments in GFR Report Section 4.3 (a) and (b) of this report | N/A | Refer to GFR Report 4.3 (a) response, namely that the proposed approach is unclear.<br>Section 2.2.3 of the Geotechnical Factual Report now notes that "….this new data will be included in the seismic hazard assessment of the site…".<br>However, Section 4.5 of the Geotechnical Interpretive Report now notes that "….we do not believe a SSSHA is required for the site…".<br>Please clarify whether you intend to carry out a site-specific seismic hazard assessment, (SSSHA) and, if not, justification for that approach. | For clarity, Section 2.2.3 of the GFR should be re-worded to say<br>" ...this new data will be included in GHD's assessment of seismic hazard of the site"<br>and as a conclusion of considering this data we conclude<br>"...we do not believe a SSSHA is required for the site..."<br>GHD does not intend to commission a SSSHA at this site. |
| **3.12** | **Section 3.5: Gaps in the Ground Model** | | | |
| a | Please see the comments in GFR Report Section 4.4 of this report | N/A | Refer to GFR 4.4 (a) response, namely that the revised (reduced) landfill footprint means that the area in the south-east, which was not able to be investigated, now comprises about 50% of the overall landfill footprint, (based on the Geotechnical Factual Report, Figure 6). Neither the Geotechnical Factual Report nor the Geotechnical Interpretive Report provide comment on how that information 'gap' will be addressed.<br>Please advise the extent of investigations proposed for the remaining 50% and when these will be carried out. | While we remain comfortable that the geology model for the site is adequately defined for the resource consent process, we recommend that additional investigation in the form of a single PQ cored borehole to a target base of 90 m RL is undertaken in the vicinity of the south-east block of land in the "data gap". A nested piezometer will be installed to add further data into the hydrogeology model.<br>The location and depth of the hole will be dependent on access but the intention would be to aim for a mid-slope position between BH08 and BH211, along contour 120m. The drillhole will be completed by the end of September 2021.<br>If a high quality bedding plane is recovered in the core (the formation is massive with rare bedding), this feature will be considered for shear box testing. |
| **3.14** | **Section 4.5: Site Seismicity; Section 7.4.4 Seismic Loading** | | | |
| b | The final paragraph notes that "... a site specific probabilistic seismic hazard assessment could be completed...". Elsewhere you imply that such assessment will be carried out. Please confirm whether a site specific probabilistic seismic hazard assessment will indeed be carried out. If not, please provide justification as to why you consider that such an assessment may not be required. | GFR Section 2.2.3 and Design Report Section 3.4.2<br>At this stage there is no plan to undertake a site specific hazard assessment. The recent research is consistent with the fault database.<br>The site does not have a liquefaction potential. | Refer to GFR 4.3 (a) response, namely that the proposed approach is unclear.<br>Section 2.2.3 of the Geotechnical Factual Report now notes that "…this new data will be included in the seismic hazard assessment of the site…".<br>However, Section 4.5 of the Geotechnical Interpretive Report now notes that "…we do not believe a SSSHA is required for the site…".<br>Please clarify whether you intend to carry out a site-specific seismic hazard assessment, (SSSHA) and, if not, justification for that approach. | Refer to 3.4 response above |
| **3.16** | **Section 5.2: Preliminary Geotechnical Design Parameters** | | | |
| a | Please provide further justification for the currently proposed design parameters in Table 2. In particular, how they have been derived and how they compare with design parameters used elsewhere for similar materials. | GIR Section 7.4.1 has been added | Geotechnical Interpretive Report Section 7.4.1, Section 7.4.2 and Table 3 have provided clarity. However:<br>a) Why has the RocData rock mass strength assessment results been presented as c' and phi' values? Some of the quoted values seem extraordinarily high and unrealistic. Provide justification for that<br>approach and why Hoek-Brown strength parameters are not<br>presented instead.<br>b) Potential sliding on bedding within the Henley Breccia has been identified as a potential issue, (see also Comment 3.21(d)).<br>Although Geotechnical Interpretive Report Section 7.4.1 notes that "….no data on bedding discontinuity strengths….", the available information should allow GHD to provide at least an estimate of residual strengths along such potential bedding plane shears. | a) A qualitative approach to slope stability has been used in the revised design and the Mohr-Coulomb c' phi' approach for rock strengths have not been used.<br>The c' and phi' values presented in Table 3 were assuming whole-slope instability i.e. slopes in the range of 50-100 m high with the following Hoek-Brown strength parameters:<br>- Unit Weight; 20 kN/m3<br>- UCS range; 1MPa (Very Weak), 5MPa (Weak to Mod. Strong), 20 MPa (Mod. Strong to Strong)<br>- GIS; 60<br>- Mi; 17 (sandstone), 7 (siltstone), 19 (breccia), 21 (conglomerate)<br>- Disturbance factor; 0<br>Using RSData (update to RocData) and allowing for lower normal stresses for local slope stability (~10 m high slopes), the mohr-coulomb c' and phi' are significantly lower .<br>The GIR data can be updated with revised c' and phi' values, or remove these and include only Hoek-Brown strength criteria. Since the mohr-coulomb values are not being used, the latter may be more appropriate. b) Refer 3.21 d) |
| b | Currently a (relatively wide) range of geotechnical design parameter values are given for most of the defined geotechnical units. Please provide clarification as to what particular ground conditions, or geological units, such a range of parameters applies to, and the level of confidence in those values. | GIR Section 7.4.2 Table has limited the range<br>We have commented on our level of confidence | Refer 3.16(a) above. | |

## Appendix 5 - Geotechnical Interpretive Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **3.18** | **Section 7.3.1: Landfill Liner** | | | |
| b | The proposed liner system is shown on Drg No. 51-12506381-01-C207/1. Slope stability failure mechanisms affecting such composite liner systems, i.e. liner systems with a combination of compacted clay and various geomembrane/geocomposite materials, often do not preferentially affect the compacted clay component. More commonly, critical failure mechanisms and surfaces typically involve sliding along the interfaces between the various components. Please therefore provide assessed design parameters for the various component interfaces, and your assessment of the likelihood of movement along those interfaces. | This will be covered at the Detail Design stage and will depend on the liner combination.<br>This is not covered in the GIR | The response notes that this issue "….will be covered at the Detailed Design stage….". The potential for sliding over a composite liner is often a critical consideration for landfill stability design. The redesign of the landfill and proposed changes to the staged development of the landfill adequately address our concerns regarding the stability of Stage 1. Section 3.6 of the updated Landfill Concept Design Report describes that stability analysis will be undertaken as part of detailed design. To fully address our concern, we consider that a consent condition should be included to describe stability requirements. Note: there is already a draft consent condition proposed by the applicant (Condition 6) but this needs to be updated to describe all design cases.<br>See also Comment 3.21(c) below. | Refer to Concept Design Section 2.3a |
| **3.19** | **Section 7.4.2: Engineered Slopes** | | | |
| b | The Report text (and drawings) indicate fill heights up to 16 m. Please provide details of the likely settlement behaviour of such fills, i.e. settlement magnitudes and settlement rates. Will your proposed liner design be able to cope with the possible settlement behaviour? Has an assessment been made of the resulting strains in the geosynthetic liner components? | Re-design now excludes significant thicknesses of engineered fill | Although the fill heights have reduced, the queries remain valid and a response is required. | The maximum thickness of engineered fill in the base of the landfill is 2.5 m thick. The fill will be placed and compacted at its maximum dry density and at optimum moisture content. Under these conditions, post construction settlement is assessed as very low. Assuming a Youngs Modulus for engineered fill of 60 MPA loaded with 20m of fill, this equates to ~10 mm of settlement<br>The detailed design will keep the settlement within tolerable limits to design guidance on allowable tensile strain of the proposed geomembranes. |
| **3.21** | **Section 7.5.2: Critical Cross Sections and Structures; Appendix C Slope Stability Modelling Results** | | | |
| a | Slope stability assessment has been carried out along three cross-sections through the site. However, as noted above, about 40% of the proposed landfill footprint has not been investigated. Please clarify the number and layout of additional cross-sections which you consider necessary to ensure that they adequately model the site, the proposed landfill layout, construction sequence and staging, and likely failure mechanisms. | GIR Section 7.5 - the slope analysis undertaken for the re-design covers all slopes, Assumptions have been made for the section of investigated site based on the regional geology . | Refer to 3.12 response, namely that the revised (reduced) landfill footprint means that the area in the south-east, which was not able to be investigated, now comprises about 50% of the overall landfill footprint, (based on the Geotechnical Factual Report, Figure 6).<br>The response advises that the slope analyses for the designed landfill footprint have made assumptions for the area of investigated site based on the regional geology.<br>What additional investigations are proposed to allow more confidence in those sections, and hence the stability analyses? | Refer 3.12 |
| b | The slope stability analyses all appear to be relatively simplistic, and in particular they appear to only have assumed circular failure surfaces. Do you consider the shown critical failure surfaces (circles) are representative of realistic failure modes? Are analyses of non-circular surfaces, compared to the analysed circular surfaces, more appropriate? Please clarify your slope stability modelling philosophy and assumptions. | GIR Section 7.6.1 - we have specified user-defined failures on new design | While the user-defined surfaces are considered acceptable for this consent stage, their validity is compromised by the assumptions regarding ground conditions in the investigated portion of the site, and shown on the stability cross sections, refer to 3.21(a) response above. Geotechnical Interpretive Report, Table 4 now no longer gives a target FoS for "Short Term Static including Elevated Leachate Condition", and this has also been deleted from the draft consent condition 6. Please clarify why this has been deleted and what FoS will be assumed for short term stability | The static slope stability model presented in Appendix C represents a worst-case scenario incorporating<br>- an elevated leachate level (worst case 1.5 m above landfill base)<br>- the long term MSW material . A sensitivity check was undertaken on MSW short and long term material which showed minimal change in FoS.<br>- a theoretical residual strength material remaining along the base of the landfill. This is considered unlikely because this material will be removed during earthworks<br>The resulting model is a combination of the two previous models, and is considered more conservative, yet still meets the required factor of safety.<br>The row heading for this load case could be re-named " Static load case with elevated leachate" |
| c | Have analyses been carried out assuming non-circular failure surfaces, for example along various unit interfaces such as refuse/liner; between the various liner component layers (as shown on Drg No. 51-12506381-01-C207/1); liner/fill; and fill/in-situ materials?<br>In particular, the slope stability analyses do not model the potential for the refuse (MSW) to slide over the liner system, nor for sliding between the various composite liner components. The potential for such movements should be modelled both for when the landfill is partly filled, i.e. internal refuse slopes have been formed as part of construction staging, and also for the final completed landfill. The potential for such movements should be particularly assessed under seismic loading conditions. Please provide analyses and discussion of those potential failure mechanisms. | No inter-liner stability analysis included in the GIR<br>Waste sliding over liner is a function of landfill staging | The response notes that "….no inter-liner stability analyses included in the GIR…." . Are the analyses therefore included elsewhere in the responses?<br>See also Comment 3.18(b) above. | Refer 3.18 |

| Appendix 5 - Geotechnical Interpretive Report | | | | |
|---|---|---|---|---|
| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
| d | Has an assessment been carried out on the potential for discontinuity controlled slope failures, in particular along adversely dipping Henley Breccia bedding planes? | GIR Section 7 - have moved away from SlopeW analysis for all slopes and look qualitatively at the geological structure | Comment 3.16(a) above notes potential sliding on bedding within the Henley Breccia has been identified as a potential issue and asks for an estimate of residual strengths along such potential bedding plane shears.<br>While accepting that the Geotechnical Interpretive Report, Section 7.6.2, provides a qualitative slope stability analysis discussion, please provide some analyses to justify those qualitative results.<br>Geotechnical Interpretive Report, Section 7.4.1 notes that "...slope instability will be driven either by rock mass strength…….or by bedding….".<br>However elsewhere, e.g. Geotechnical Interpretive Report, Section 7.6.2, the risk of bedding controlled failure is assessed as low and in Section 7.5.2 as "…very unlikely….". Please clarify these apparently contradictory statements. | The contradiction is due to poor wording.<br>Section 7.4.1 could be better worded "It is considered that slope stability could be driven..." By writing "will" implied we consider this is a mechanism that will happen - this is not the case.<br>We wanted to initially consider all the possible failure mechanisms - rock mass and/or bedding. We then worked through all the mechanisms during our overall slope stability assessment. Based on core recovery (bedding is massive and rare) and lack of site observation of bedding driven failure, we considered a quantitative assessment of bedding would be appropriate for concept design stage based on landfill slope geometry and bedding orientation (Section 7.6.2). If bedding orientation was unfavourable, then stability would be dependent on the strength of the bedding plane. The analysis confirms that bedding orientation is favourable, or the proposed slope cut is favourable.<br>For this reason, no attempt has been made to apply a residual soil strength to bedding based on the quantitative assessment and lack of evidence of this type of failure i.e. we do not believe that bedding is sitting at its residual soil strength.<br>Bedding plane orientation will be considered in more detail during detailed design.<br>During construction, cut slopes in rock will be inspected by an Engineering geologist, and if required, rock stabilisation works will be undertaken. |
| h | The design drawings, e.g. Drg No. 51-12506381-01-C204/1 and -C208/1, show temporary slopes formed at 1V:3H in the refuse. Please provide stability analyses demonstrating such temporary slopes are stable both for internal failure, and also for potential sliding over the liner component interfaces, (see also (i) below). After how long will such slopes cease being "temporary" and be categorised as "permanent" or long-term, with consequent changes in required target FoS? | Re-design has reduced need for waste slopes at 1V:3H | The response states that "…re-design has reduced need for waste slopes at 1V:3H…". However, that implies that the need for temporary waste slopes will still exist, albeit reduced from the earlier design, and possibly not at<br>1V:3H; the response is unclear.<br>Drg Nos 12506381-01-C204/2 and -C205/2 show what appear to be interstage slope profiles, presumably formed in waste, at about 1V:4.3H. Other cut/fill slopes are shown as 1V:4H but a "temporary slope" is shown as 3V:1H on -C205/2.<br>Please respond to the initial queries, and also clarify with respect to the queries on -C204/2 and -C205/2 noted above. | The interstage slopes in the waste are discussed in the design report section. The GIR focus is the stability of the landfill form.<br>The temporary slopes referred to in the GIR (Section 7.2.2) and shown on the GIR Appendix B drawings relate to temporary slopes in the landfill form and not waste.<br>We do note, however, an error on Drawing 12506381-01-C205 Rev 2 which shows a temporary cut slope in the landfill form of 3V:1H - this should be 1V:3H.<br><br>Note waste stability issues/temporary slopes in waste have been addressed in comment 2.3 a) - Concept Design question |

## Appendix 6 – Geotechnical Factual Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **4.3** | **Section 2.2 3: Nearby Faults** | | | |
| a | We understand that GHD intend to carry out a site-specific seismic hazard assessment for the site. We consider that assessment should, in particular, consider the potential for rupture of nearby faults, (certainly closer than the distant Alpine Fault which is currently identified as the closest active fault). Please clarify whether your site-specific seismic hazard assessment will include such an active fault assessment and will consider information in more detail relating to nearby faults and their likely recurrence intervals. | GIR Section 4.5<br>GFR Section 2.2.3 | The proposed approach is unclear. Section 2.2.3 of the Geotechnical Factual Report now notes that "…this new data will be included in the seismic hazard assessment of the site…". However, Section 4.5 of the Geotechnical Interpretive Report now notes that "….we do not believe a SSSHA is required for the site…".<br>Please clarify whether you intend to carry out a site-specific seismic hazard assessment, (SSSHA) and, if not, justification for that approach | refer to GIR comments 3.4 |
| **4.4** | **Section 3.1: General** | | | |
| a | The Report advises that portions of the proposed landfill site, in the south-east and along the western edge, were unable to be accessed due to existing tree cover and for environmental reasons. That meant that only about 60% of the overall proposed landfill footprint was investigated. Please advise the extent of investigations proposed for the remaining 40% and when these will be carried out. | Landfill re-design has reduced lack of coverage.<br>GIR Section 3.5 | The revised (reduced) landfill footprint means that the area in the south-east, which was not able to be investigated, now comprises about 50% of the overall landfill footprint, (based on the Geotechnical Factual Report, Figure 6). Neither the Geotechnical Factual Report nor the Geotechnical Interpretive Report provide comment on how that information 'gap' will be addressed.<br>Please advise the extent of investigations proposed for the remaining 50% and when these will be carried out. | refer to GIR comments 3.12 |
| b | What further investigations are proposed to fill in the 'gaps' in the current model and to provided additional information for the detailed design? In particular, the distribution of the Loess, and its properties, and the extent and nature of current slope instability identified in the Report to date | This will depend on detailed design. | Refer comment above in Section 4.4 (a). | refer to 4.4 a) response |
| **4.5** | **Section 3.8.1 and 3.8.2: Laboratory test schedule** | | | |
| d | Henley Breccia is proposed for use as engineered fill. What additional testing and investigations are proposed to determine the material's suitable for engineered fill, in particular confirmation of geotechnical design parameters. | GFR Section 3.8.5 Tables 20 and 21<br>Part of detailed design | Response refers to Geotechnical Factual Report, Table 21, but there is no Table 21 in the updated May 2021 report. | Refer to Tables 19 and 20 for data on use of Henley Breccia as engineered fill |
| e | The Henley Breccia is interbedded siltstone, sandstone and conglomerate. Are different geotechnical design parameters proposed for each of those different materials, both in-situ, and when reused as engineered fill? | GIR Section 7.4.2 Table 2.1 | The response refers to Geotechnical Interpretive Report, Section 7.4.2, Table 2.1. However, that Section does not specifically answer the query. Also, there is no Table 2.1 | GIR Table 3 provides design parameters for each rock type and the Henley Breccia used as an engineered fill |
| **4.6** | **Appendix B: Borehole and Test Pit Logs** | | | |
| b | How were the various borehole and test pit target depths selected? | GFR Section 3.2 | Clarification is needed as to whether those target depths are now appropriate to the revised landfill footprint. | Comment is provided on the limitations of the depth of the current investigation in Section 7.6.2 of the GIR. However, we note that the base of the landfill/excavation depth is very similar to the previous design. Therefore, the revisions to the design do not have implications for the depth of drillholes or the understanding of the deeper geology. For consenting purposes, we consider the investigation is sufficient to understand the ground model. However, note an additional drillhole will be completed by September 2021 (see GIR comments) |

| Appendix 6 – Geotechnical Factual Report | | | | |
|---|---|---|---|---|
| **S92 questions (October 2020)** | | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| **4.7** | **Appendix C: Laboratory Testing Results** | | | |
| a | The triaxial permeability tests have been carried out using de-aired tap water. Is it the intention to carry out further tests, including using leachate as the permeant liquid? | Additional testing will be part of detailed design | There is no response to the query as to whether further tests would include using leachate as the permeant liquid. | It is anticipated that additional investigations and laboratory testing (including tiaxial testing) will be done as part of detailed design. This may include use of leachate as the permeant liquid. The type and design of these tests will depend on the liner design selected for final design. The Concept Design report has presented one option for liner design but the final design may select an alternative (while remaining compliant with WasteMINZ guidelines). |

## Appendix 8 – Groundwater Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **5.3** | **Section 3.2: Geology** | | | |
| a | Provide detail on the depths of the weathered Henley breccia and depth to unweathered bedrock to give a clearer understanding of the groundwater pathways. | As per Section 2.3.2 in Geotechnical interpretive report (GIR), joints, and other rock defects, were rare in both the sandstone/siltstone and breccia units of the Henley Breccia. Where boreholes did encounter defects, spacing was typically in excess of 10 m and too few were encountered to obtain any meaningful sense of predominant defect sets or trends. As per Section 3.2.7 of GIR, completely weathered - highly weathered rock was encountered at depths ranging from 0.7 - 4.4 mbgl, and was typically between 1 - 5 m thick (very stiff to hard soil and extremely weak to very weak rock). The remainder of the units encountered included moderately weathered - unweathered sandstone, siltstone, conglomerate and breccia. GIR Cross sections X-X', Y-Y' and Z-Z' indicate depth of MW-UW Henley Breccia across the site. | Answered in part.<br>- What is the depth to the unweathered bedrock?<br>- The cross sections X-X', Y-Y- and Z-Z' are not provided in the GIR. | The Breccia has been grouped into completely weathered - highly weathered, and moderately weathered - unweathered for reporting and figures, for which depths were provided in the initial s92 response. More detailed weathering descriptions are provided in individual bores logs (Appendix B). The varying properties of the Breccia with depth have been taken into account in the hydrogeological assessment. Therefore, in response to the further questions: the data provided gives the available information on depth to unweathered bedrock; cross sections have been included with this response.<br><br>We note that the cross sections were omitted in error from the revised application GIR |
| **5.4.1** | **Section 3.3.1: Hydraulic conductivity** | | | |
| a | Provide a description of the geology, such as mention of any evidence of fractures or fissures within the bedrock that could increase the recorded hydraulic conductivities in order to assist with interpretation of the results of the hydraulic conductivity tests. | See response to 5.3 (a) | Answered in part with exception of unanswered question in 5.3 (a). | See above 5.3 (a) response |
| **5.4.2** | **Section 3.3.2: Hydraulic gradients, groundwater recharge and flow** | | | |
| **Hydraulic gradients** | | | | |
| b | Reference to "dipping of layers of the Henley Breccia is expected to promote some horizontal movement". Provide further detail clarifying how this has been established, e.g. records of bedding, direction of dip etc from the site investigation data and published information (where available). This information will support the identification of the potential groundwater flow paths and the inferred direction of groundwater flows within the deeper aquifer. | As per Section 2.3.2 of GIR - Literature reports dipping of Henley Breccia to the west or northwest at 15-30 degrees (Bishop, 1994). Observed unit contacts in boreholes generally confirmed the bedding dip angle where it could be discerned (between 10 - 80 degrees), however dip direction could not be confirmed as the boreholes were not oriented. No outcrops were present at site to confirm bedding orientation. Given the very long travel times, and lack of nearby receivers within the deep groundwater system, direction of deep groundwater flow is not considered a risk, as it would take >8,000 years to reach either the Pacific Ocean or Taieri Basin, with discharge rates considered to be very low due to the low permeability. | Answered in part, but inconclusive answer.<br>• Groundwater flow direction in the deeper aquifer has been dismissed whilst the data show a groundwater gradient to the south.<br>• Further clarification is required to support the small volumes (0.26 m3/yr.) of leachate leakage at the site.<br>• Please provide HELP model inputs/outputs. | HELP model files provided.<br>Horizontal groundwater flow direction has been addressed - it is reported within section 3.3.2, however it is also stated that downward vertical gradients are expected to dominate the deeper groundwater system. As also included in initial response, horizontal flow in the deep groundwater system is not considered a risk due to the extensive travel times due to the low permeability.<br>See 5.8.1 (a) regarding low leachate leakage. |
| c | The description of groundwater movement is not clear. Further development of the hydrogeological conceptual site model and annotated sections is required to clarify the groundwater regime. This will help to show how groundwater is inferred to be recharged in the two identified groundwater systems. | As described in Section 3.5 - the deep groundwater system is located within the Henley Breccia and is subject to vertical downwards hydraulic gradients, with very low rates of rainfall recharge through the overlying low permeability loess/siltstone/Henley breccia. Horizontal groundwater gradients are relatively flat, however infer a flow direction towards the south east.<br>The shallow groundwater system is considered to be relatively localised within the base of the valley predominantly within permeable alluvium and colluvium, with high rates of recharge from rainfall and runoff, and groundwater flow directions following topography. Its also likely that some groundwater within the shallower, more permeable units of Henley Breccia discharges to this system at the base of the valley (upwards hydraulic gradients at BH01, and groundwater gradients towards the Otokia Creek in piezometers installed above the fine-grained low permeability layer where present). | Answered in part.<br>• Description of conceptual model is provided but annotated sections have not been provided. | Conceptual groundwater model figure provided |

## Appendix 8 – Groundwater Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **Groundwater recharge and flow** | | | | |
| d | Clarify conceptually how recharge is received to the underlying aquifers, given the extent of the alluvium and colluvium shown on Figure 7 is limited to the valley floor within the gullies at the site. | Recharge to the localised shallow groundwater system is considered to predominantly be from direct rainfall recharge and runoff to the permeable alluvium and colluvium units. Additional recharge to the shallow groundwater system is likely to come from shallow groundwater within the adjacent more permeable Henley Breccia units. The deep groundwater system is likely to receive only a small volume of recharge directly through vertical percolation of rainfall that manages to recharge through the loess, and migrate vertically through the Henley breccia and fine-grained low permeability layer. Recharge from the shallow system to the deep system is considered to occur (elevated concentrations of nitrate-N and ammonia as N (BH201)), however this recharge may be impeded to some degree by the fine-grained low permeability layer where present. No recharge from the shallow groundwater system is inferred where upwards hydraulic gradients are present in the base of the valley (BH01) where alluvium and colluvium are present. | Answered but:<br>• Clarification sought on last sentence “No recharge from the shallow groundwater system is inferred where upwards hydraulic gradients are present in the base of the valley (BH01) where alluvium and colluvium are present”.<br>• Provision of annotated sections, as previously identified would be beneficial to illustrate the hydrogeological conceptual model. | Recharge from the shallow groundwater system to the deep groundwater system will not occur where there are upwards hydraulic gradients between the deep and shallow units, due to groundwater flow directions being controlled by differences in pressure. Where downwards hydraulic gradients are present in the alluvium and colluvium, and shallow breccia, recharge to the deeper system will occur.<br>Conceptual groundwater model figure provided |
| e | Based on the input parameters in Table 3, it appears that the extent of the aquifer is 250 m wide and possibly represents the alluvium, although this is not established. Provide a figure (in plan and section view) as part of the hydrogeological conceptual site model showing the extent of the shallow groundwater system. | The extent of the shallow groundwater system cannot be well defined at the site as groundwater is flowing both vertically and horizontally. Table 3 adopts a conservatively large saturated aquifer thickness at the location of BH03 along the central ridge, however the thickness is anticipated to be less than this in the adjacent valleys and closer to BH01. While the discharge quantified by the Darcy's law calculation goes some way to attempting to understand the existing site conditions, ultimately the outcome of the assessment will not fundamentally change if the actual discharge is significantly higher or lower. This is because although a reduction in groundwater levels is considered likely due to placement of the landfill, this is considered to be than offset by the Stormwater retention ponds and attenuation basin, which will provide flow attenuation and stormwater soakage to ground through the valley floor. | • Provide a figure (in plan and section view) as part of the hydrogeological conceptual site model showing the extent of the shallow groundwater system.<br>• There is no detail on the use of the stormwater soakage as a mitigation measure on the projected reduction in groundwater levels due to landfill placement. | Conceptual groundwater model figure provided<br>-The provided conceptual groundwater model demonstrates the approximate extent of shallow groundwater within the alluvium/colluvium and shallow breccia units - however as discussed in the initial response, this cannot be well defined. The uncertainty of aquifer 'area' in relation to the Table 3 discharge calculations however is not significant within the expected parameter range for aquifer width and thickness. As also discussed in initial response - the outcome of assessment will not fundamentally change if the actual discharge is significantly higher or lower.<br>-Detailed quantification of the mitigation provided by the stormwater soakage has not been undertaken. Instead two scenarios which reflect the upper range of potential effects have been included in the assessment: Section 4.4.2 Scenario 1 - upper bound of effects (no mitigation considered) and 4.4.3 Scenario 2 - Predicted effect (includes mitigation in the form of attenuation pond discharge). Scenario 2 is the more likely outcome, as under current conditions rainfall is quickly flushed through the system (steep slopes, low permeability materials and limited unsaturated storage within alluvium and colluvium unit). Retention of stormwater within the SRPs and attenuation basin will moderate flows, allowing greater opportunity for recharge to groundwater and contribution to stream baseflow when compared to the current regime. |
| g | Clarify the amount of recharge to the groundwater system. Data in Table 3 reports on groundwater discharge rather than flows, since no velocities are provided. The size (area and depth) of the shallow aquifer in Table 3 is small and information on the deeper groundwater system should be provided for the remainder of the site area. | As discussed in the response to 5.4.2 (e) the discharge from (and hence recharge to) the shallow groundwater system does not impact the outcome of the assessment due to the mitigation provided by the SRPs and attenuation basin. Quantification of recharge or flow within the deep groundwater system is not considered to be necessary as travel times are in excess of 8,000 years and discharge to the Pacific Ocean is considered to be negligible. | Answer provided does not address the question | As per first response, recharge to the shallow groundwater system is quantified by the Darcy's Law calculation of discharge (Table 3 in report). Recharge to the deeper system is considered to be the residual of that recharging to ground and that flowing to the shallow groundwater system. More detailed quantification of recharge to deep groundwater system is not considered to add value to the assessment, as the risks associated with this flow path are minimal relative to those of shallow groundwater. Key aspects of the deep groundwater system that contribute to this are: very long flow path to potential receptors; low permeability, very long travel times (estimated to be >8,000 years). |

## Appendix 8 – Groundwater Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| h | The report states that "Flow has not been estimated in the deeper groundwater system", although a flow rate of 4 m3/d is provided later in the report. Accordingly, clarify how this has been calculated? | The sub-soil drain discharge calculations have been updated for the revised design. See section 4.4.3 of report. Flow has not been estimated for the deep groundwater system (as discussed in (g) above) | Answer provided does not address the question.<br>• Response provides detail on sub-soil discharge drain calculations which raises other questions.<br>• Ref Dwg: 12506381-01-C207 Typical liner/capping details shows groundwater collection drain taking water to either attenuation pond or leachate treatment system. Clarification on the discharge location of the drainage water needs to be provided. The report references use of the collected drainage water for non-potable supplies, further detail is required.<br>• The assessment requires greater clarity on whether the extent of the shallow groundwater is limited to the valley deposits or whether the shallow groundwater system extends into the shallow Henley breccia overlying the deeper aquifer. Various sections in the report refer to the shallow groundwater differently. E.g. Table 7 refers to a different aquifer saturated thickness than in Table 3. | -It is not yet known whether the groundwater collected from the sub-soil drains will be used on site as non-potable supply, or whether it will be discharged to the Otokia Creek. Due to this, it has not been discussed as a mitigation to loss of groundwater flow in either Scenario 1 or 2 (Sections 4.4.2 / 4.4.3)<br>-As discussed in Section 3.5.2 - the shallow, more permeable Henley Breccia units are considered to form part of the shallow groundwater system where they are saturated (in close proximity to the base of the valley) and where groundwater flow reports predominantly to the stream. This is demonstrated by horizontal flow directions in these shallow units following topography towards Otokia Creek. At ridge locations, any recharge is expected to contribute more to the deeper system. Table 3 saturated aquifer thickness is different to Table 7 as Table 3 calculations refer to catchment areas, and therefore the calculations are based on specific cross sectional aquifer areas at the discharge point of each catchment. Table 7 is not a catchment calculation and calculates discharge at the proposed location of the sub-soil drains (which is not the same location as the landfill sub-catchment discharge). Furthermore, Table 7 adopts a highly conservative saturated aquifer thickness across the full 120 m width (even though the saturated aquifer thickness in the centre of the valley is expected to be less), this is to ensure that sub-soil drain discharge is not underestimated to allow for appropriate water storage facilities on site. |
| **5.4.3** | **Section 3.3.3: Groundwater and surface water quality** | | | |
| a | A reasonable amount of detail has been provided on existing nitrate-N concentrations in the groundwater samples and fertiliser application. Further clarification is required as to whether fertiliser has been applied at this site to validate these discussion points. Are there any other potential sources for the elevated nitrate-N concentrations? | There are no other potential sources of elevated nitrate concentrations at the site. It is standard practice for forestry operations to use fertiliser. | Answered in part.<br>• Has fertiliser been applied at this site? | Recent communication with the forestry operator has indicated that to the best of their knowledge no fertiliser has been applied at the site during the previous 30 years. Prior to forestry, the land was operated as a farm (1980s-1990s), however it is understood that the land was mostly covered in gorse. There is some evidence of nitrate leaching from legumes associated with gorse (a nitrogen fixing plant), which may have provided a historical source of TIN (Mason et al. 2016 (https://doi.org/10.1080/03036758.2015.1127261)) and go some way to explain the relatively elevated concentrations within the deep groundwater system (e.g. BH201). However, the elevated concentrations recorded on site within the permeable alluvium (BH01A) are likely to be attributed to a more recent source (particularly given the deeper BH01B has TIN <0.3 mg/L). TIN in the shallow groundwater is therefore still likely to be associated with the recent forestry operations at the site, including removal of trees. exposure/disturbance of soils and mobilisation of nitrates that were previously "locked up" in the soil profile. Trees have been removed over the past 5 years. No other potential sources have been identified. |
| **5.5** | **Section 3.4: Surface water interactions** | | | |
| a | Provide further detail on the flow rates in the Otokia Creek, with stream monitoring and more detailed assessment of the location of where stream flows become perennial in relation to the proposed landfill to support the water balance. | *See Surface Water report* | Answered in part.<br>• Please provide an annotated figure to show these stream locations in relation to the proposed landfill e.g. distances downstream of the site. | Surface water sample locations and culvert at Mclaren Gully Road (intermittent flow recorded at least as far downstream as this location) are presented in Figure 6. |
| b | Provide further information to support the conclusions of how no leachate will enter the Open Stream surface water catchment at the south end of the proposed landfill. Since the deeper groundwater flows have been identified to flow into this surface water catchment. | Leachate is not anticipated to impact surface water catchments (away from Otokia Creek) as a result of migration within the deep groundwater system. Each valley is considered to host it's own localised shallow groundwater system similar to that present in the upper stretches of the Otokia Creek, with limited to no interaction with deep groundwater. The rates of deep groundwater flow are also so low that potential impacts to receptors would be negligible. | Answered in part.<br>• Further quantification of the deeper groundwater system is required to show leachate will not impact other surface water catchments away from Otokia Creek. | As per the initial response, the deep groundwater system is not considered to interact with the shallow groundwater/surface water systems in adjacent valleys. Further, the volume of leachate that may migrate to the deep groundwater system is likely to be significantly less than the predicted leakage as the catchment for deeper groundwater recharge is more associated with the elevated sections of the landfill, where the occurrence of leachate on the liner is more transient. It is noted that even if deep groundwater was to interact with the surface water in the down gradient Fern Stream catchment, travel times for migration are likely greater than 1,000 years. During such timeframes the extensive attenuation of chemical constituents are expected to effectively mitigate potential adverse effects to water quality. |

## Appendix 8 – Groundwater Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **5.6** | **Section 3.5: Conceptual hydrological and hydrogeological model** | | | |
| **5.6.1** | **Section 3.5.1: Deep groundwater system** | | | |
| a | Further detail of the hydrogeological conceptual site model is required on the deeper groundwater system and the extent of the deeper groundwater system across the site. Information on groundwater flows, areas of recharge and discharge need to be included. | See responses 5.4.2 (d) and (g) | • Will be addressed when all parts of 5.4.2 are answered. | See response to 5.4.2 |
| b | Describe how groundwater is recharged at the southern edge of the site (i.e. within the Open Stream surface water catchment) and clarify if this forms part of the deeper groundwater system. | No longer applicable - updated landfill design does not extend into Open Stream catchment. | Consideration should be made on potential impacts on the deeper groundwater regime in adjacent surface water catchments unless conceptual model identifies the deeper groundwater system matches the surface water catchment. | See response to 5.5 (b) |
| **5.6.2** | **Section 3.5.2: Shallow groundwater and surface water system** | | | |
| a | The assessment of effects needs to include the Open Stream surface water catchment. Whilst placement of clean engineered fill is reported to be the only fill material placed in this catchment, since deeper groundwater flows are reported to flow toward the southeast, there is the potential for contaminated groundwater from the leakage of leachate through the liner to enter into this catchment. These potential effects need to be assessed. | Updated landfill design does not extend into Open Stream catchment. Impact from deep groundwater responded to in 5.5 (b) | Will be addressed when 5.5 (b) is answered. | See response to 5.5 (b) |
| **5.7** | **Section 4.1: Landfill activity** | | | |
| **5.7.1** | **Section 4.1.2: Landfill design** | | | |
| a | The recent groundwater levels recorded over a 6 month duration in the shallow valley bores generally record groundwater levels at depths of between near surface and 5 m depth.<br>Provide annotated figures of the hydrogeological conceptual site model to show the amount of excavation in these areas. | Discussed in Groundwater Report | Provide annotated figures of the hydrogeological conceptual site model to show the amount of excavation in these areas. | Drawing No.C209 shows Earthwork cut and fill amounts across the site. The controlling factor on groundwater is the sub-soil drain located at the up stream base of the Toe Bund (see Drawing C308), which will be located down-hydraulic gradient of all construction that is likely to intercept and divert groundwater. Attached to this response is a annotated version of Drawing C209 which shows the excavated areas where shallow groundwater is anticipated to be encountered. |
| b | It is uncertain whether the design of the attenuation basin is sufficient to provide capacity for the stormwater and groundwater flows, in particular associated with the predicted changes (reductions) to the groundwater levels. Further detail is required to support the design. | See Surface Water Report for Attenuation basin design parameters | Answered in part.<br>Information to be included in the updated Landfill Management Plan. | Attenuation pond design parameters are discussed in the updated Surface Water Report - Section 4.2.1 |
| **5.7.2** | **Section 4.1.4: Leachate management** | | | |
| b | Show how the monitoring will ensure that there are no significant effects from leachate leakage on the groundwater, attenuation basin and Otokia Creek. | Monitoring will not prevent effects, however will provide the ability to monitor landfill performance and provide advance warning of potential impacts to surface water quality (wording revised within report). | Answered in part.<br>• Information to be included in the updated Landfill Management Plan. | No further response |
| c | Appendix D (Monitoring Plan) provides very limited information. Upgradient groundwater monitoring locations need to be included. Monitoring bore locations in relation to the inferred deeper groundwater flows being toward the southeast of the site need to be considered. | Further information to be provided in the Landfill Management Plan | Answered in part.<br>• Information to be included in the updated Landfill Management Plan. | No further response |

## Appendix 8 – Groundwater Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| d | Demonstrate how discharges from the landfill reach the groundwater i.e. source-pathway- receptor detail and the detail of how the groundwater will be protected from the proposed landfill activities. | This is described in the Groundwater Report in terms of the liner design and receptors. The Design Report provides more details on this issue | Answered in part.<br>• Potential receptors not identified.<br>• Provision of annotated sections, as previously identified would be beneficial to illustrate the hydrogeological conceptual model. | As per Section 3.5.2, given the absence of consented groundwater takes, nearby recorded bores or active surface water takes from the Otokia or McColl Creeks, the assessment has focussed on environmental receptors only. Section 4.4 considers effects to shallow groundwater and surface water, Section 4.5 considers effects to deep groundwater and Section 4.6 considers effects to water quality. Conceptual groundwater model figure provided. |
| **5.8** | **Section 4.2: Landfill water balance and leachate** | | | |
| a | Further details are required on the volumes of rainfall predicted to report to the attenuation basin. | Provided in Surface Water Report | Answered in part.<br>Information to be included in the updated Landfill Management Plan. | Attenuation pond design parameters are discussed in the updated Surface Water Report - Section 4.2.1 |
| **5.8.1** | **Section 4.2.3: Leachate generation and leakage** | | | |
| a | A leachate leakage rate of 3 m3/year at Stage 5 is reported. It is not clear whether this is an average year or a peak year. If it is for an average year, please provide expected leakage for a peak rainfall year and provide an assessment for that leakage rate. Please provide HELP output data to support the information provided in Appendix C. | The leachate leakage for each landfill stage is calculated using annual average leachate rates for different landfill areas and conditions (cover/slope etc.). Worst case leachate leakage is 0.3 m3/year when using annual average rates. The peak daily values after closure of the landfill are 0.000043 mm/day (through 4% grade 'base') and 0.00001 mm/day (through 20% grade slopes). Leachate leakage using the peak daily values would equate to 1.35 m3/year. | Answered in part.<br>• For the stated modelling parameters (25 installation defects per has and poor installation) the resulting annual average leachate rate of 0.3 m3/yr. through the liner seems low. As per the original request, please provide the HELP input/output printouts so this can be verified. Please provide justification for using annual average leakage for assessment of effects. We consider a peak annual leakage rate should be used for the assessment. | HELP model files provided.<br>It is considered that sufficient conservatism has been built into the HELP model that use of annual average leakage is appropriate for the assessment; particularly considering that advection, dispersion and retardation of contaminants in groundwater will subdue variability caused by temporal changes in discharges between years. Conservatisms include: poor FML installation, relatively high FML pinhole density, FML installation defects. Additionally, adopted hydraulic conductivity values for capping and liner materials are at the higher end of the expected range. Further, a small section of the landfill base has a slope of 10%, which was modelled with a 4% slope.<br>With respect to the leachate leakage rate appearing to be low, this is a function of the climate conditions at the site (low rainfall and high evapotranspiration). The 10-fold reduction in leachate leakage from the initial landfill design is due to the large reductions in average distance to a leachate drain, which has a controlling influence of the head of leachate above the liner, which subsequently controls leakage. |
| b | Leachate quality has been obtained from published data (CAE, 2000). Assessment should be considered against recorded leachate quality for other landfill sites in the region (particularly Green Island) for a comparison of the data. | Please refer to Green Island concentration comparison (image snipped to the right).<br>Leachate quality at Green Island has been compared to the upper quartile concentrations from published data used in the assessment (CAE, 2000). The published data provides a more conservative assessment for all parameters, with the exception of chloride and sodium. Although the maximum recorded concentration from Green Island is greater than the values used in the assessment for magnesium and nitrate, the adopted assessment value was greater than the average concentration from Green Island. Further, the adopted assessment value for total inorganic nitrogen (NH4N & NO3N) concentration is much more conservative than the Green Island leachate. | Answered part, although we cannot see the screenshot of the Green Island leachate comparison. | Green Island leachate comparison table: |

| | | Adopted for Assessment (Upper quartile of highest leachate constituent concentrations of eight NZ landfills (CAE,2000)). | Green Island (Maximum leachate concentration 2012 - 2019)* | Green Island (Avgerage leachate concentration 2012 - 2019)* |
|---|---|---|---|---|
| **Parameter** | **units** | | | |
| Aluminium | mg/l | 7.9 | 1.2 | 0.24 |
| Ammoniacal Nitrogen | mg/l | 704.5 | 424 | 345.7 |
| Arsenic | mg/l | 0.17 | 0.0050 | 0.0040 |
| Biological Oxygen Demand | mg/l | 380 | 170 | 68.8 |
| Cadmium | mg/l | 0.0063 | 0.00011 | 0.000087 |
| Calcium | mg/l | 377.5 | 147 | 136.4 |
| Chloride | mg/l | 1733.5 | 2400 | 1818.8 |
| Chromium | mg/l | 0.17 | 0.029 | 0.020 |
| Dissolved Reactive Phosphorus | mg/l | 3.4 | - | - |
| Iron | mg/l | 183 | 15.5 | 3.35 |
| Lead | mg/l | 0.13 | 0.0032 | 0.0018 |
| Magnesium | mg/l | 193.8 | 244 | 183.7 |
| Manganese | mg/l | 5.4 | 0.47 | 0.40 |
| Nickel | mg/l | 0.19 | 0.045 | 0.025 |
| Nitrate Nitrogen | mg/l | 0.86 | 2.0 | 0.85 |
| pH | pH units | 8.1 | 7.6 | 7.1 |
| Potassium | mg/l | 630 | 327 | 233.8 |
| Silica | mg/l | 36 | - | |
| Sodium | mg/l | 1165 | 1890 | 1442.5 |
| Sulphate | mg/l | 291.9 | 109 | 58.4 |
| Total Kjeldahl Nitrogen | mg/l | 1225.8 | - | - |
| Zinc | mg/l | 1.2 | 0.85 | 0.16 |
| Total Inorganic Nitrogen | mg/l | 705.4 | 426.0 | 346.6 |

* Green Island Landfill 2019 - 2020 Annual Monitoring Report. December 2020.

| | | | | |
|---|---|---|---|---|
| **5.9** | **Section 4.3: Catchment water balance** | | | |
| a | Clarify how the outputs of the catchment water balance are derived, in particular evapotranspiration and the shallow and deeper groundwater system. It appears that shallow and deep groundwater has been modelled as one unit in this assessment. It is not clear how the amount of evapotranspiration can be increased during the landfill operation with a reduction in plant cover. | The water balance makes use of HELP calculations of actual evapotranspiration, runoff, leachate collection and leakage. In addition to the landfill scenarios, a scenario was also undertaken for the existing environment (details now included in appendix C). The shallow and deep groundwater components are derived as per Table 3 and the discussion in Section 3.3.2 of the report. The recharge is assumed to come from the runoff component of the water balance, with the runoff value from the HELP model adjusted to represent this.<br>As discussed in Section 4.3, evapotranspiration increased during landfill operation due to an increase in water infiltration and soil moisture retention within the surface soils (existing environment modelled as silt loam (1x10-8 m/s), which has lower permeability and lower field capacity than modelled landfill soil cover materials). | Answered in part.<br>• Confusion between infiltration and evapotranspiration.<br>• Table 3 shows different aquifer parameters than used in Table 7. | There is no confusion between infiltration and evapotranspiration. In response to the initial question as to why evapotranspiration increased during landfill operation - this is due to the greater infiltration to, moisture retention within, surface soils. These surface soils are then subject to evapotranspiration processes, reducing the subsequent amount available for deeper infiltration to groundwater.<br>- See 5.4.2 (h) for detailed Table 3 / Table 7 response |

## Appendix 8 – Groundwater Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| c | How has the long-term effects as a result of the groundwater diversion through the sub- surface drains been calculated? | While Section 4.4.2 discusses the initial rate of discharge anticipated, there will be no long term effect as the lack of recharge due to landfill placement will cause a reduction in groundwater levels and groundwater gradients within the shallow groundwater system and is anticipated to reduce groundwater levels below the level of the subsoil drains. | Long term effects are not considered. | The long term effect has been considered as part of the wider assessment, in that there will be no further recharge due to landfill placement. It is considered that this will lower the groundwater level below that of the sub-soil drain - this is a greater effect than any long term effect from the sub-soil drain. However, if groundwater levels do not drop below the sub-soil drain, then the rate of discharge from the drain will decrease from that predicted in Section 4.4.2 as the groundwater system equilibrates (section 4.4.2 provides the maximum rate when groundwater gradients towards the drain are at their greatest at the start of dewatering). |
| **5.10.1** | **Section 4.4.2: Scenario 1 - Potential upper bound for effects to shallow groundwater** | | | |
| a | More detailed assessment on the effects on groundwater is required. The effects on the shallow groundwater appears to be based on the entire landfill area covering the shallow groundwater system, whereas other parts of the report indicate that the shallow groundwater system is within the lower gullies. | Assessment updated for updated design. | Inconsistencies still remain with reference to the extent of the shallow aquifer system and the deeper aquifer | - See 5.4.2 (h) |
| b | The predicted effects to shallow groundwater have been assessed and identify a reduction in groundwater levels during the landfill development of 2-3 m beneath the landfill footprint.<br>This lowering of the groundwater levels has been taken into account for the design of the soakage of stormwater from the attenuation basin. No calculations on this design have been provided and the back calculation using Darcy's Law is not clear. Accordingly, provide detail on the duration of these predicted changes. | The revised assessment indicates that groundwater levels will reduce by approximately 1 m down gradient of the landfill in response to the lack of recharge across the landfill footprint - this is considered to be a permanent change that will persist as long as the landfill is in place. | Inconsistent response. Other places in the report state that discharge via the attenuation ponds will recharge the shallow groundwater levels. | There are 2 scenarios assessed - Section 4.4.2 Scenario 1 - upper bound of effects (no mitigation considered) and 4.4.3 Scenario 2 - Predicted effect (includes mitigation in the form of attenuation pond discharge). The 1 m reduction in groundwater level is predicted during Scenario 1. |
| **5.10.2** | **Section 4.4.4: Effects to surface water level flow** | | | |
| a | Further detail is required on the potential effects on surface water flows in Otokia Creek based on the reported decrease in baseflows and the estimated regression of the perennial reach of this surface water. In particular, how the measurement of 50 m regression has been calculated and whether the reported stream flows of 10 L/s will be maintained. Stream flow monitoring needs to be completed to support these assessments. | Discussed extensively in Section 5 of the Surface Water Report | Answered in part.<br>• Further site visit(s) to assess stream flow has been undertaken, however, the stream flows and impact on the flows has not been quantified.<br>• Answer includes that the effects on the stream and wetlands will be less than minor and possibly beneficial to maintaining stream baseflows. Further detail is required to support this. | Due to the intermittent nature of the stream, the loss of baseflow due to the 1m reduction in local groundwater level (Scenario 1) is not considered to be significant. Under current conditions rainfall is quickly flushed through the system (steep slopes, low permeability materials and limited unsaturated storage within alluvium and colluvium unit). The retention of stormwater within the SRPs and attenuation basin (Scenario 2) will moderate flows, allowing greater opportunity for recharge to groundwater and contribution to stream baseflow when compared to the current regime. |

## Appendix 8 – Groundwater Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **5.12** | **Section 4.6: Effects to water quality** | | | |
| **5.12.1** | **Section4.6.1: Assessment methodology** | | | |
| b | The modelled rate of leachate leakage reflects the closed landfill scenario and considers the operational scenarios to be temporary in nature. Given that the indicative operation durations may be ongoing for up to 55 years, show the assessments of the contaminant flux, in particular ammoniacal nitrogen, when the calculated peak rates of leachate generation are predicted. | Revised assessment indicates worst case leachate leakage during closure scenario (0.26 m3/year), with this value used within assessment of effects. | Answered in part.<br>• Refer to 5.8.1(a) above. | See response to 5.8.1 (a) |
| d | Provided detail on how the travel times have been established for the migration of groundwater through the shallow aquifer. | Shallow groundwater flow calculations provided in table 3. | Discharge volumes have been provided not groundwater velocity | Travel times were not established for the migration of groundwater through the shallow aquifer, as the conservative mass flux assessment assumes travel occurs instantaneously. This considers the impact of leachate immediately downgradient of the landfill using the maximum predicted leakage rate and without attenuation within the ground. The results indicate that the effect to the environment is likely to be less than minor. Conceptually this approach assumes that the toe drains do not intersect groundwater after placement of the landfill. However the positioning of the drains is as such that discharge of leachate from the landfill is expected to be captured. Travel times and velocities were not provided as the above reflects a significantly more conservative prediction of potential effects to the receiving environment. While velocity is not a factor in the conservative approach we estimate shallow groundwater velocities at the toe of the landfill to be between 1x10-7 – 1x10-6 m/s. |
| **5.12.2** | **Section 4.6.4: Surface water quality limits - Regional Plan** | | | |
| a | Provide further information on the potential contaminant flux in the deeper groundwater system, since the groundwater quality monitoring identified similar water chemistry in samples collected. | Assessment of contaminant flux within the deep groundwater system is not considered to be necessary as travel times are in excess of 8,000 years and discharge to the Pacific Ocean is considered to be negligible. | Question not answered. | Assessment of contaminant flux in deep groundwater system still considered to be unnecessary, as per initial response. |
| **5.13** | **Section 5.4: Monitoring recommendations** | | | |
| a | Provide further details in Appendix D (Monitoring Plan) to show bore locations, depth and which groundwater system they are monitoring. | Details provided in Landfill Management Plan and shown on Drawing C308 | Answered in part.<br>• Bore locations shown on Drg. C09.<br>• Landfill Management Plan incomplete. | Where the shallow groundwater system is present, all monitoring wells will be constructed to monitor both the deep and shallow groundwater systems at each location. Where only the deep system is present a single monitoring well will be constructed. |
| **5.14** | **Other comments** | | | |
| a | We understand the physical constraints of the monitoring bore installations and the preference for drilling along the ridgeline where access tracks provide access to the site. The cross sections provided in the report reflect the ridgeline data (Figure 7) and the large depths to groundwater. Further information needs to be provided regarding potential changes to groundwater levels at the valley sides and whether changes to the depth of groundwater would be expected. Another section, shown as a figure, should be provided east-west across the proposed landfill footprint in the southern part of the site to show the groundwater levels. | See Updated landfill design and GIR | New cross-sections showing hydrogeological conditions are not provided | Cross section at location across northern end of landfill provided as an attachment to these responses |
| b | Figures 7 and 8 geological sections need to include an overlay of the landfill footprint including areas of cut and fill for greater clarity and to show areas where excavations may extend into the groundwater level. | See updated Report. | Cross-sections showing groundwater levels in relation to the cut and fill areas are not provided. | Please see conceptual cross section and plan provided with this s92 response. |
| c | Groundwater seepages have been identified at the site and within the proposed landfill footprint. Further details need to be provided on their location, elevation and estimates on the volume of seepage to support the engineering design. | Landfill design updated | Reference to where this has been reported on needs to be provided. | Seepages that may be due to groundwater have only been identified close to the base of the valley, north of the proposed landfill footprint. Other seeps at the site are considered to be due to ponding of rainfall, or interflow, where deeper infiltration was prevented by the low permeability of soil/rock (this is supported by nearby boreholes or trial pits that did not encounter saturated conditions near the ground surface). Attached figure (annotation of Drawing C309 shows the area of the landfill footprint where shallow groundwater is anticipated to be encountered during excavation of the base. |

| Appendix 9 - Surface Water Assessment Report | | | | |
|---|---|---|---|---|
| **S92 questions (October 2020)** | | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| **6.2.3** | **Monitoring** | | | |
| b | That further information is provided on the design and performance of the stormwater treatment ponds, including its performance during construction and operation of the ponds, proposed monitoring, trigger levels and response actions. | An approach to monitoring and compliance is set out in the Surface Water Report | The Applicant had responded that these details are in the draft Landfill Management Plan. However the draft Landfill Management Plan does not contain this information. | Design of the erosion and sediment control (ESC) measures will reference AC GD05 and Ecan toolbox. The sediment and erosion control measures will include treatment ponds but it is noted that these are just one of the measures that are being adopted and operate in conjunction with diversions channels to limit run-on, early revegetation to limit sediment entrainment and management practices to limit extent of exposure.<br>The sediment ponds will be designed in general accordance with criteria set out in Auckland Councils GD05. These criteria have been developed considering Auckland conditions including fine clay geology which is difficult to retain and higher rainfall intensities increasing impact and entrainment of sediment along with receiving environments including the sheltered, low-energy environments of the Waitemata, Manukau and Kaipara Harbours and the inner Hauraki Gulf which are particularly vulnerable. The adoption of these approaches and design criteria for the Dunedin site are therefore considered to be appropriately conservative.<br>Operation of the pond during the various phase of the construction and operation of the landfill will be monitored to ensure that it, along with the other ESC measures, is achieving the required level of performance. Should this not be the case additional measures can be included as part of the treatment stream including the use of flocculant to assist settlement of suspended sediment.<br>1) Proposed monitoring and trigger level methodology is presented in Section 5 of the Surface Water Report - reference only, no additional edits.<br>2) Schedule of monitoring for Surface Water (and Groundwater) is included in Appendix D of the Groundwater Report - reference only, no additional edits.<br>The proposed monitoring has been further articulated in the proposed conditions of consent attached to the application. Ultimately detailed measures will be included in the LMP . At this point only a draft LMP framework has been developed, which provides a starting point for the completion of a final plan for approval by ORC as part of detailed design, and before construction commences. As set out at section 5.15 of the AEE, it is common practice to prepare a full LMP post construction to enable the LMP procedures to align with the detailed design, landfill developer/operator needs, and facilitate compliance with the conditions of approved resource consents. |
| | | | | We note that representatives of T+T and GHD have had a further discussion on Surface Water Management and have identified some additional areas for clarification (9 July 2021). Key discussion and agreement points were as follows. Please advise if any additional clarification is required:<br><br>1)GHD confirm that groundwater drains discharge to a sump at the toe of the landfill and will then flow to the wetlands downstream of the site and not to the Attenuation basin. Groundwater will be continually monitored for EC, pH and ammonia to detect leachate contamination.<br>2) GHD propose to add continues monitoring of surface water flows to the attenuation pond (when flows occur) for pH, EC and ammonia to identify any contamination of the surface water collection and diversion system by leachate. |

## Appendix 10 - Air Quality Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **7.2** | **Odour** | | | |
| **7.2.2** | **Complaints analysis** | | | |
| | Provide a detailed complaint analysis regarding Green Island Landfill, including: | | | |
| a | A review of the wind conditions and separation distance to complainants at the Green Island Landfill. | See Section 9.2 | This question has largely been resolved and highlights a significant number of valid complaints associated with the operation of Green Island Landfill. The following questions have arisen as a result of the information provided:<br>• Please provide an analysis indicating the distance from the landfill for the complaints that related to "general landfill / no abnormal conditions".<br>• Regarding complaints relating to miscellaneous odorous loads, please clarify what is different for the waste acceptance measures to be adopted at Smooth Hill that will make this an improvement over that used currently at Green Island.<br>• With regard to WWTP sludge grit, what systems have been implemented for controlling the receipt of this odorous material without warning. Furthermore, please clarify whether measures now in-place at Green Island are controlling on-going odour from the receipt of this material.<br>Tipping face – please clarify what size tipping face is used currently at Green Island and how this relates to what is proposed for the Smooth Hill site. We note that a 300 m² working face has been assumed for the dispersion modelling – is this the intended as the maximum size of the working face? | See GHD Technical Memorandum Smooth Hill Landfill – Additional s92 Question responses for detailed response |
| b | Identified causes of the individual complaints. | | | |
| c | Detailed commentary of how the issues identified in complaints at Green Island would be addressed at Smooth Hill. In particular, describe how the proposed mitigation measures proposed for Smooth Hill vary from those currently undertaken at Green Island. | | | |
| **7.2.3** | **Separation distance guidance** | | | |
| a | Provide a consideration of the Auckland Council 1 km separation distance for new landfills. Furthermore, clarify how separation distances are used within the odour assessment and provide further discussion and justification of the statement that the information supports "… departing from the recommended separation distance". | See section 6.2 & 9.3 | Section 9.3 considers its unlikely that nuisance odours will be caused at off-site sensitive locations given the strong mitigation controls and having reviewed the Green Island complaints register.<br>Despite this we note that Green Island has received a significant number of complaints out to at least 1,000 m. Furthermore, the question regarding how the proposed odour control measures conform to industry best practice remains unanswered. | See GHD Technical Memorandum Smooth Hill Landfill – Additional s92 Question responses for detailed response |
| **7.2.4** | **Odours from normal operation versus odorous loads of waste** | | | |
| a | Provide an assessment of odour effects associated with activities that fall outside of 'normal operations' and describe in detail how those measures will be addressed at the proposed Smooth Hill landfill. This question should be addressed in conjunction with our comments below regarding mitigation measures. | Section 5.1.5 & Section 13.1.3 | Section 5.1.5 provides a very high-level description of 8 measures that would be done in the event of abnormal odours. These are largely repeated again in Section 13.1.3. Given the large number of such events giving rise to odour complaints associated with Green Island landfill it remains an important consideration to understand the potential odour effects of these events. While the possible causes of abnormal odours have been identified, no assessment has been provided of the potential effects of abnormal odour discharges and consequently this matter remains unanswered. | See GHD Technical Memorandum Smooth Hill Landfill – Additional s92 Question responses for detailed response |
| **7.3** | **Dust** | | | |
| **7.3.1** | **Dust suppression** | | | |
| a | Describe how the water application rate was derived and demonstrate that sufficient water supply is available or being sought for this activity. | See Section 5.2.1. The estimated maximum daily water supply volume required to control dust emissions of 40 m³ has been based on our experience for other similar projects and will be further refined as part of detailed design. | It has been clarified that 40 m³ is based on experience at other landfills, but would be refined as part of detailed design.<br>No details have been given of how this was determined.<br>However, we note that a volume of 40 m³/day would enable an application rate of 4 mm (typical summer daily evaporation rate) over approximately 1 ha. This seems a very small area for the application of water for dust control. Accordingly, it should be clarified what maximum area of the operation is likely to require the application of water for dust control and calculation to confirm the water needed for dust control and whether there is sufficient available water supply. | For the Concept Design we have assumed only internal roads (ex wheel wash) will require regular water application to control dust. The Concept Design internal road network (including access roads to both stockpiles and an allowance for tip face temporary roads) is approximately ~ 1km in length. Allowing for an 8 m carriageway the total area is ~8,000 m2 (0.8 ha). Therefore, at an application rate of 4mm the 40 m3/day is sufficient. It is assumed that stockpiles and other semi-temporary areas will be treated/managed to control dust. However, it is also noted that while the indicated application rate is appropriate to manage and control dust associated with the roads the detail design process will need to confirm the wider dust control requirements as the project is developed and operated and this may require adjustment to the water use requirements. |
| **7.5** | **Mitigation measures** | | | |
| a | Provide a draft LMP, or equivalent detail, that addresses odour control, contingency measures and monitoring in detail. | Section 5.1 and refer to LMP | The LMP provides relatively high level descriptors of odour controls, but does not set out details of landfill gas or odour monitoring (only section headings for these are included). Contingency measures are not explicitly discussed in relation to odour and LFG controls, other that measures to identify and control excessive abnormal odour which is characterised at a very high level. These matters should be clarified. | See GHD Technical Memorandum Smooth Hill Landfill – Additional s92 Question responses for detailed response |
| b | Provide a more detailed discussion on mitigation measures that are proposed and how those measures conform to the "best practice operations standards", measures currently in place at Green Island, and current industry practice. This should include details relating to contingency measures and highly odorous wastes. | Section 5.1 and refer to LMP | Section 5.1 of the updated air assessment simply refers to the LMP.<br>However, no discussion is given in the report or the LMP describing how the landfill would meet current industry best practice operating standards regarding odour control. Measures described in the LMP are relatively general in nature such as 'needing to minimise the working face as far as practicable', or that monitoring would be carried out 'regularly' – this type of wording provides little clarity as to what is expected. | See GHD Technical Memorandum Smooth Hill Landfill – Additional s92 Question responses for detailed response |

## Appendix 10 - Air Quality Report

| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
|---|---|---|---|---|
| **7.6** | **Proposed conditions** | | | |
| a | Comment on whether it is appropriate to exclude existing land uses other than residential and whether this is consistent with the FIDOL assessment approach. | This consent condition (now condition 34) is designed based on the assessment of potential effects on the environment as it exists now. Should the environment materially change in the future , the general duty under section 17 of the Resource Management Act 1991 to avoid, remedy or mitigate adverse effects on the environment will apply. | The s92 response has not clarified whether it is appropriate under the RMA to impose offensive or objectionable odour on sensitive activities other than those residences existing at the time consent is granted. This is a key condition of the air discharge permit for the proposed activity. The wording as proposed would enable offensive or objectionable impacts of the proposed landfill on new potentially sensitive activities. As such it is imperative that we understand how the proposed wording of the consent would apply to the establishment of new residences or other sensitive activities close to the landfill following any decision to grant consent. The s92 response has instead described that the general duties under s17of the RMA could be used. This does not in itself address whether it is appropriate for consent to provide for an activity that is contrary to the general duties of s17.At present we consider the proposed wording of Condition 32 is inappropriate, and that it is not consistent with the nature of such a condition as set out in the Ministry for the Environment Good Practice Guide for Assessing Odour. | Condition 34 is proposed to be amended to apply to any residential activity, irrespective of whether the activity is in existence at the date the consent is granted. We note that the provisions of the 2GP otherwise do not enable any other odour sensitive activities to establish in the Rural Zone surrounding the site as a permitted activity. Any other sensitive activities would require resource consent, enabling the Dunedin City Council the ability to determine the appropriateness of that activity with regard to proximity to the landfill and potential reverse sensitivity effects. The amended wording of the condition is attached to this response. |
| b | Comment on whether it is appropriate/legal within the context of the RMA to exclude the requirement of the landfill in relation to future activities. | If the environment changes in the future and residential activities choose to locate close to the landfill, the general duty under section 17 of the Resource Management Act 1991 to avoid, remedy or mitigate adverse effects on the environment will apply. | | |

| Appendix 11 - Ecological Assessment Report | | | | |
|---|---|---|---|---|
| **S92 questions (October 2020)** | | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| **8.1** | **Freshwater ecology** | | | |
| **8.1.2** | **Sections 5-7** | | | |
| b | Proposed management plans that include a detailed methodology of how any potential loss of downstream wetland and stream habitat will be measured and managed to achieve a no net loss (ideally net-gain) outcome. | As above, a draft Vegetation Restoration Management Plan has been developed.<br><br>Further, no net loss calculations now included in EcIA for wetland offset (Appendix 7). | A methodology for stream habitat loss has not been provided, presumably due to applicant's ecologists position that effects are very low. We think further evidence of level of effect is required. | Section 5.4.1 of the EcIA describes the anticipated ecological effects on freshwater ecology values, particularly on the downstream tributary of Otokia Creek. Our assessment of ecological effects is based on GHD's surface water assessment, where a ""down-valley shift"" in the perennial flow transition is possible as a result of the landfill. As discussed in the EcIA, we anticipate that any changes in downstream water quantity are likely to be only slight changes and limited to the first c. 300 m of waterway (as a worst case scenario) - i.e. a Negligible magnitude of effect on the freshwater ecology values at the Otokia Creek catchment scale. A Negligible magnitude of effect on a Moderate value equates to a Very Low level of effect (without mitigation). Also see response to 8.2.1(a) Paragraph 1, below.<br><br>This assessment has been based on the following: the tributary stream downstream of the designation is classified as a 2nd order waterway (based on Topo50 river centrelines). However, field observations have shown that the 1st order waterways indicated on Topo50 maps within the Designation site are not intermittent or perennial waterways, and no 1st order waterways enter the tributary stream, so it is more likely described as a 1st order waterway. Nevertheless, Otokia Creek catchment has approx. 41 km of 1st order waterways and 38 km of 2nd order waterways. It is considered appropriate to assess these effects at the Otokia Creek catchment scale.<br><br>At most, 450 m of 1st (or 2nd) order waterway (i.e. the downstream tributary) may be affected, with a potential reduction or ""down-valley shift"" in the perennial flows. This equates to approximately 1% of 1st order waterways and 1% of 2nd order waterways (at the Otokia Creek catchment scale). Moreover, the potentially affected reach is subject to naturally fluctuating flows as has been described in the EcIA. |
| **8.2** | **Terrestrial ecology** | | | |
| **8.2.1** | **Sections 5-7** | | | |
| a | Provide an updated overall effects assessment that considers the effects before and after mitigation for all ecological features/ecosystem component. This will enable more transparency on the extent and level of ecological effects of the landfill before any management/mitigation is applied, which will indicate the level and nature of impact management measures required to sufficiently address the effects and achieve a no-net loss (ideally net-gain) outcome. In this regard, we recommend using a consistent assessment approach for all ecological features. For each ecological attribute, please amend Table 19 to include a column for level of effect (before any effects management measures are applied), a summary of relevant effects management measures that will be applied and level of effect (after effects management measures are applied). | The tables within Sections 5.5 and 7 of the EcIA have been updated to address this. Also see above. | The effects assessment has not been updated to include the magnitude and level of effect pre and post mitigation being applied. The updated ecological effects assessment states that the assessment has been completed "without mitigation" but then contradicts this by stating that mitigation in terms of falcon, bird strike and lizard management has been considered within the level of effect. This adds a level of confusion and with no transparency in terms of how mitigation has been applied and what the outcome of applying the mitigation is. | **8.2.1(a), Paragraph 2:**<br>We acknowledge the potential confusion in Section 5.0 and Table 18 highlighted by the reviewer. We are able to update Table 18, to provide a level of effect without impact management measures for all ecosystem components, if required.<br>**Terrestrial vegetation and wetlands**<br>- Without mitigation, the level of effect is as stated in Table 18 of the EcIA (i.e. Low, for downstream effects to the swamp wetland; Very Low, for all other components).<br>- With mitigation (i.e. implementation of the Vegetation Restoration Management Plan) the level of effect is Net Gain for all wetlands and Very Low for all other components that would be adversely effected.<br>This reflects the modified nature of the construction footprint and receiving environment, the comprehensive measures proposed in the Vegetation Restoration Management Plan, and the baseline situation (plantation forestry, with ongoing adverse effects especially during harvest cycles).<br>Specifically, the Vegetation Restoration Management Plan mitigates (reduces the severity of) Low level adverse effects in the swamp wetland, at the point of impact, to Positive i.e. Net Gain (as stated in Table 19 of the EcIA). The Vegetation Restoration Management Plan offsets Very Low level adverse effects to wetlands along McLaren Gully Road, not at the point of impact but in a like-for-like site, to Positive i.e. Net Gain (Table 19; see also responses to 8.2.1(c)-(f) below). |
| | | | | **Herpetofauna**<br>- Without mitigation, the level of effect is the same as that currently stated in Table 18 (i.e. Low or Very Low level effects), at the Ecological District scale, and at the national scale.<br>- With mitigation, (i.e. implementation of impact management measures outlined in the Lizard Management Plan and Vegetation Restoration Management Plan), the level of effect is Low or Very Low as stated in Table 18 (and in Table 19, noting that this focusses on southern grass skink only).<br>The authors acknowledge the difficulty in surveying very large sites, the cryptic nature of many lizard species, and the subsequent uncertainties in assessing possible effects to lizards. Accordingly, in response to this uncertainty, and the need to take a precautionary approach, the Lizard Management Plan describes measures dependent on the species found and numbers of individuals found (as described below), to ensure that the level of effect is Low or Very Low. This Lizard Management Plan (and the Vegetation Restoration Management Plan) approach ensures that adverse effects to lizards themselves are avoided via best -practice salvage and translocation efforts by qualified herpetologists, and that other adverse effects (loss of existing low quality habitat) are avoided / remedied by the provision of expanded and substantially enhanced, fenced, and protected habitat (via the Vegetation Restoration Management Plan, and pest management measures / plan contained in the Landfill Management Plan, in draft). |

| Appendix 11 - Ecological Assessment Report | | | | |
|---|---|---|---|---|
| **S92 questions (October 2020)** | | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| 8.2.1 (b) | Cont'd | | | **Avifauna**<br>- Without mitigation, the level of effect is the same as that currently stated in Table 18 (i.e. Low or Very Low level effects), at the Ecological District scale, and at the national scale.<br>- With mitigation, (i.e. implementation of impact management measures outlined in the Falcon Management Plan and Bird Strike Management Plan), the level of effect is Low or Very Low as stated in Table 18 (and in Table 19, noting that effects would be Low only if falcon were breeding at the site, and Very Low if falcon are not breeding).<br>The impact management measures in the Bird Strike Management Plan relate to strike risk with aircraft for black-backed gulls, native Not Threatened waterfowl and shag species, and At Risk waterfowl and shag species. Without mitigation the effects at the Ecological District and national scale will be the same, given the large size of the populations of these species (particularly the Not Threatened species). For example, if bird strike were to occur it would likely to have a Negligible magnitude effect (defined in terms of the EIANZ EcIA methodology used as a ""negligible effect on the known population or range of the element/feature". The assessment is considered precautionary because At Risk waterfowl and shag species are in fact considered unlikely to be attracted to the landfill, given that the intention is the attenuation basin (i.e. the only potential habitat for such species within the designation site) will be empty most of the time. The chance of strike risk is slim (in particular for shag species, which are not scavenging species and typically exhibit flight behaviours significantly below the height of aircraft), hence the Very Low overall level of effect. We have conservatively and precautionarily included a wide range of species possibly present at the site or possibly present within the wider area in our assessment, in spite of such slim risks to many of the assessed taxa.<br>The Falcon Management Plan ensures that the potential Low level effects to falcon are minimised by avoiding construction during the falcon breeding period (if falcon are present on site). Or, as outlined in this Plan, if construction occurs during these periods, it can only occur subject to pre-construction checks by a qualified ornithologist to ensure that no falcons are breeding in any areas possibly impacted by that construction (impacted whether in terms of direct construction or indirect effects of noise, etc.). As a highly mobile species, effects outside the breeding season are considered Very Low.<br>The Falcon Management Plan and Bird Strike Management Plan are measures to avoid / mitigate impacts to avifauna. They are not offset or compensation measures. |
| | | | | **Freshwater**<br>- Without mitigation, the level of effect is Very Low as stated in Table 18.<br>- With mitigation, the level of effect is Positive (i.e. Net Gain), at best, or Very Low, at worst (as stated in Table 19). A Very Low level of effect should not normally be of concern and following the EIANZ EcIA methodology can generally be classed as 'not more than minor' (Roper-Lindsay et al 2018).<br>Positive (Net Gain) effects in relation to freshwater habitat values assume implementation of the Vegetation Restoration Management Plan, subsequent improvement in ecological functioning in the swamp wetland, and hence improvements in terms of downstream water supply from the swamp wetland (i.e. avoidance of changes to the perennial stream reach between the swamp wetland and a downstream pond). Effects are Very Low if enhancements to the swamp wetland do not / do not fully avoid changes to the perennial stream reach. |
| | | | Furthermore, it seems that the magnitude and level of effects for the sedgeland, rushland, downstream effect on the swamp wetland and marshland, avifauna and three lizard species have been significantly underestimated and need to be addressed with further assessment. | **8.2.1(a), Paragraph 2:**<br>This is a peer review statement and not a matter for s92, which is to request information as necessary to understand the application and consider effects.<br>If there are specific questions as to our methodology or assessment these should instead be put forward. The phrase ""significantly underestimated"" suggests to us that the reviewers have additional information (or can offer an alternative interpretation of the same information) to support a different conclusion to the one we have reached, but none is offered. To provide further detail in response to the point, for example, the project herpetologist notes:<br>• The Lizard Management Plan considers the level of effect without management and seeks to apply adaptive management to avoid, remedy and mitigate for these effects.<br>• The EcIA and Lizard Management Plan acknowledges that the level of effect is precautionary, based on the species that may or may not be present within the footprint of the landfill.<br>• This is why the EcIA / Lizard Management Plan addresses all species, including those that are very unlikely to be present given availability of habitat, level of habitat modification, and the potential level of predation pressure any populations or nearby populations may already be experiencing.<br>• We consider that we have addressed the level of effects sufficiently at both a local and national scale for lizards, on the basis that there is likely to be a very low abundance of lizards within the site.<br>• Any wider effects on lizards such as residual predator increase will be addressed in the predator control plans in the Landfill Management Plan, and this has been acknowledged in the Lizard Management Plan. |
| c | Specify the mitigation measures to be applied for each significant vegetation type and quantum of mitigation proposed. | We have updated our EcIA and provided draft management plans to address this query. For example, impact to significant wetland habitat is addressed in the draft Vegetation Restoration Management Plan; impact on lizard habitat and lizards is addressed in the draft Lizard Management Plan and the draft Vegetation Restoration Management Plan. The draft Falcon Management Plan details management requirements for the effects management approach relevant to the eastern falcon. The draft Landfill Management Plan outlines objectives and procedures for plant and animal pest control, which is relevant for all of the above. | It is still unclear if a no net loss (or preferably net gain) in biodiversity value will result from this application. The quantum of wetland loss is uncertain with different impact area quoted throughout the effect's assessment. For instance, the effects assessment has stated that wetland areas are significant wetland vegetation types but the impact in terms of wetland reclamation (albeit small sections) is considered as a very low level of effect. The impact on the wetland below the toe of the landfill has been clearly articulated (change in hydrological condition which would change plant community or drying wetland edge) but results in a low or very low level of effect. | The EcIA quotes different areas as they apply to two different wetland vegetation types, or in combination. These are, 13.8 m2 for sedgeland, 2.7 m2 for rushland, or 16.5 m2 in combination. To refer only to a single quantum of "wetland loss" (i.e. 16.5 m2) throughout the EcIA without breaking this down into the relevant vegetation types is considered reductionist. The sentences following "For instance" are factual statements and presumably do not need to be addressed. |
| | Section 6 provides an overview of recommendations for impact management measures in accordance with the mitigation hierarchy (avoid, remedy, mitigate, offset, compensate). While the recommendations have been well thought out, clarification is needed as to whether any of the proposed measures will actually be undertaken. This will have an important bearing on whether the ecological impacts of the landfill laid out in section 4 will be effectively managed and a no net-loss (ideally net-gain) outcome is achieved. | Draft management plans have been developed. This includes a draft Vegetation Restoration Management Plan, which addresses the mitigation required to address wetland loss. | | |

| Appendix 11 - Ecological Assessment Report | | | | |
|---|---|---|---|---|
| **S92 questions (October 2020)** | | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| d | Clarify which of the recommendations for impact management measures in accordance with the mitigation hierarchy set out in Section 6 will be undertaken. If this information is to be provided in ecological management plans, these plans need to be provided upfront in order to determine whether ecological effects associated with the project will be appropriately avoided, minimised, mitigated or offset/compensated. | As above, draft management plans have been developed. | This has been answered in part. Ecological management plans have been provided but it still remains unclear what the level of effect is and therefore what the management plans are required to address (effects v's residual effects). | See response to 8.2.1(a) above. |
| | In Section 6.3 (Mitigation), clarification, calculation (and methodology) and rationale is needed on how much replacement treeland and wetland habitat will be created and how much will be enhanced to mitigate for the loss of these vegetation types as assurance that no-net-loss (ideally net-gain) will be achieved. | As above, a draft Vegetation Restoration Management Plan has been developed.<br><br>Further, no net loss calculations now included in EcIA for wetland offset (Appendix 7). | | |
| e | Clarify how much replacement treeland and wetland habitat will be created and how much will be enhanced to mitigate for the loss of these vegetation types. Provide calculations (including methodology) and rationale for quantum proposed. | No net loss calculations have been included in EcIA for wetland offset using best practice Biodiversity Offsets Accounting Model for New Zealand. These calculations have been included in Appendix 7 of the EcIA. | Wetland loss offset calculations have been provided, however no detail in terms of benchmark have been provided. Using the Biodiversity Offset Model is the appropriate tool, however no supporting data or literature has been provided nor the total extent of wetland impacted. | We note that the statement does not explicitly request further information, however, we also acknowledge that more methodological detail could have been provided to support the Biodiversity Offsets Accounting Model used. Additional methodological notes for the use of the Model are provided below, but we are uncertain if these will wholly satisfy the reviewer's requirements, as they are reliant upon expert opinion rather than external references. Nevertheless we wish to highlight that our straightforward application of the Biodiversity Offsets Accounting Model closely and deliberately follows the metrics used in the worked examples provided with the Biodiversity Offsets Accounting Model User Manual (see: 'Scenario One - Simple Case Study: 2, Raupo Flax, Carex Wetland' in Maseyk et al. 2015). For our assessment, the use of specific nearby benchmark wetlands or providing references to support alternative benchmarks was considered, but not explicitly incorporated into the EcIA for the reasons outlined below.<br><br>Because the level of effect is clearly outweighed substantially by the proposed offset, it was considered that providing the underlying calculations upfront would suffice as evidence. Were the offset calculations straying toward a neutral to only slightly Net Gain situation we would of course see the need to provide detailed supporting data or literature. However, the proposed offset is a c.100-fold Net Gain (in terms of the metrics chosen) and we think it highly unlikely that subjective variation in methodology / use of different benchmarks by another practitioner would materially affect the clear Net Gain outcome. Because the sedgeland and rushland areas potentially impacted by the proposal have been likely been induced to a high degree by recent land use (e.g., forestry / grazing / road construction), this creates difficulty in selecting appropriate benchmark wetlands, and we acknowledge that accordingly the benchmark numbers used are an estimate. To determine appropriate benchmarks for the metrics used (percentage cover of indigenous vegetation and the number of vegetation height tiers, a proxy for structural diversity) in intact, approximately equivalent wetland systems, other nearby examples and historic evidence were interpreted based on the experience of the author. |
| | | | | As a nearby example, Otokia Swamp supports some areas dominated by the same / similar indigenous sedge and rush species but is similarly or more modified compared to the sedgeland and rushland areas potentially impacted, and was therefore not considered an appropriate benchmark in terms of either percentage cover or height tiers. Nearby Takitoa Swamp has been subject to significant modification and more recent restoration efforts, is largely a different wetland type, and accordingly is also not an appropriate benchmark. We also considered other (somewhat more distant) wetland areas in the vicinity of Lake Mahinerangi that are of a similar sort (similar especially to the sedgeland) and that also occur in valley bottoms beneath plantation forestry areas. Some of these wetlands include sedgeland marsh areas that support many of the same indigenous species (to those impacted) but they are in better condition, likely better reflect the historic vegetation of the site, are almost wholly dominated by indigenous species (in terms of cover), and have somewhat more structural diversity. The benchmark estimates of 90% percentage indigenous cover and four vegetation height tiers (simplistic tiers being, for example: forbs, low grasses, sedges and rushes; tussocks, tall rushes, and low shrubs; shrubs; and trees - noting not all wetland types naturally contain all these tiers) were made with particular regard to this example (photos may be able to be provided subject to approval from a separate client). We wish to highlight that, as the calculations show, the offset measures do not assume that the benchmark 90% indigenous cover can be achieved at the offset site, and instead a conservative estimate has been applied (we have assumed that 70% indigenous cover can be achieved, from an existing cover of approximately 50%, based on removal of exotic weeds and plantings of indigenous species). In spite of this conservative approach, the results demonstrate a clear Net Gain.<br><br>The statement that the ""total extent of wetland impacted"" has not been provided is incorrect. This is indicated in the 'area of impact' section of the table in Appendix 7 of the EcIA (the Biodiversity Offsets Accounting Model itself) and repeatedly throughout the EcIA (being, as stated above in response to 8.2.1(c), 13.8 m2 for sedgeland, 2.7 m2 for rushland, or 16.5 m2 in combination). The combined amount (presented as 0.0017 ha) is used in the Model calculations." |

| Appendix 11 - Ecological Assessment Report | | | | |
|---|---|---|---|---|
| S92 questions (October 2020) | | Applicant team response (May 2021) | ORC response (June 2021) | Applicant team response (August 2021) |
| f | | Given the updated design, which has reduced effects on indigenous / ecological values, we have updated Table 20 to incorporate / provide this information - using bold font, for example. | This has been answered in part but based on the above comments it is unclear whether no net loss in biodiversity value will be achieved. | With respect to whether no net loss of biodiversity value will be achieved in relation to wetlands, the wetland loss offset calculations clearly demonstrate a c.100-fold Net Gain (EcIA Section 6.4, final paragraph, and Appendix 7). The reviewers suggest that there is a lack of methodological detail to support these calculations but do not explicitly question the result of the calculations, nor explicitly request further information to support them (see also response to 8.2.1(e), above).<br><br>As described in the EcIA, the proposal would result in the loss of 16.5 m2 of wetland vegetation (comprising widespread and common Not Threatened indigenous species found throughout the adjacent and wider area, and exotic species) at the immediate (cms - 10s of cms) edge of a roadside, and assesses this as a Negligible magnitude of impact / Very Low level effect at the scale of the Ecological District (the assessment would be the same if the magnitude / level of effect was assessed at the scale of the wetland itself). The loss of extent described above would be highly unlikely to affect the overall ecological functioning or integrity of the wetlands impacted.<br><br>The proposed offset is to remove existing habitat-altering weeds such as crack willow (averted loss) and to undertake plantings to enhance indigenous species richness and abundance (i.e. increase in percentage cover), as well as structural diversity at a 0.49 ha (4900 m2) similar / better wetland area below West Gully 3 and 4, at least part of which would be fenced and protected for the lifetime of the proposal. These actions would enhance the ecological functioning and integrity of the offset wetland area. |
| g | Provide the method and calculations used to determine the proposed mitigation and offsetting quantum for terrestrial and wetland vegetation creation and enhancement. Please demonstrate how a no-net-loss (ideally net gain) can be achieved by the proposed actions.<br>Please also clarify how time lags associated with mitigation and offset planting will be addressed by the proposal. | No net loss calculations have been included in the EcIA for wetland offset using best practice Biodiversity Offsets Accounting Model for New Zealand. This is provided in Appendix 7 of the EcIA. | This has been answered in part but based on the above comments it is unclear whether no net loss in biodiversity value will be achieved. | See responses above, especially responses to 8.2.1(c) and 8.2.1(e). |
| h | If the further information requested above is to be laid out in detail in the series of ecological management plans proposed, these plans need to be provided upfront in order to assess whether the ecological impacts of the project will be adequately addressed and whether appropriate effects management measures will be applied. | As above, draft management plans have been developed to be lodged with the resource consent application. | Management plans have been provided but uncertainty still remain regarding the level of effect that these management plans are attempting to address. Therefore it is unclear if these management plans are adequate. | See responses above, especially responses to 8.2.1(c) and 8.2.1(e). |

| Appendix 16 - Acoustics Assessment Report | | | | |
|---|---|---|---|---|
| **S92 questions (October 2020)** | | **Applicant team response (May 2021)** | **ORC response (June 2021)** | **Applicant team response (August 2021)** |
| **9.1.1** | **Construction Noise** | | | |
| a. | Please redraft condition 16 so that a CNMP is prepared regardless of the 40 m trigger to ensure that the Best Practicable Option(s) (BPO) are employed during road improvement works and that any results noise effects are reasonable. | See amended condition (now condition 19). | The 40 m minimum separation distance remains in the revised conditions.<br>Hence there is no trigger to implement BPO to control noise other than not exceeding the noise limits of Rule 4.5.4.1. It is noted that 'where practicable' has been deleted. This now addresses the issue of not preparing a CNMP.<br>It is noted that Condition 19 now triggers the requirement for a CNMP if working beyond the hours of Condition 16. This new wording should be removed as works should only occur during the time limits imposed by Condition 16. | The noise conditions have been redrafted to make it clear that a CNMP is to be prepared and implemented irrespective of whether the road upgrade works are within or outside the 40m separation distance from the dwellings at 108 and 109 McLaren Gully Road. The condition has also been redrafted to require compliance with the specified working hours. The amended wording of the conditions is attached to this response. |