

10 June 2021



Scope Resource Management Limited
Attn.: Garry Blay
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Via email: scope.resm@gmail.com

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Dear Garry

Request for Further Information

Applicant: Woodstock Quarries Limited
Record Number/s: CRC214073, CRC214074, CRC214075, CRC214076, CRC214077
Activity Description: Various activities associated with a new landfill proposal

As you are aware, I have been processing the above resource consent application.

The information listed in Attachment 1 to this letter is hereby requested under Section 92 of the Resource Management Act 1991 (the RMA). As this information is required in order to fully understand the potential effects of the proposal, we are unable to further process the application until it has been supplied.

The options available to you under Section 92A(1) of the RMA are summarised below. A response is required by 1 July 2021. You must choose one of these options.

A. Supply the requested information by 1 July 2021

If the information can be easily collated and supplied by this date, please provide it in writing (via email is fine) to me.

B. Agree in a written notice by 1 July 2021 to supply the information requested

Sometimes technical information will take some time to collate or key contacts may not be immediately available. If you need more time to supply the information requested, please advise me in writing when you can provide the information. You can do this via email or letter.

C. Refuse in a written notice by 1 July 2021 to supply the requested information

If you choose not to provide the requested information by the above date, or any date subsequently agreed to by the Canterbury Regional Council, or if you refuse to provide the requested information, then your application must be publicly notified and may be declined.

Public notification enables any member of the public, including potentially affected parties, to submit on your proposal. If submission/s are received on your application, then you can expect a hearing to be held. Information on [the notification process](#) and on the [likely costs](#) for notification and a hearing can be found on our website.

Please contact me via email (Nick.Reuther@ecan.govt.nz) or phone (03 367 7320) if you have any questions.

Yours sincerely

A handwritten signature in black ink, appearing to read 'N. Reuther', with a stylized flourish at the end.

Nick Reuther
Senior Consents Planner

cc:
Woodstock Quarries Limited
Attn.: Darryn Shepherd
39 Stott Drive
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Darfield 7571

Via email: darryn@wql.co.nz

ATTACHMENT 1

Information Requested under Section 92 of the Resource Management Act 1991

Application Number/s: CRC214073 – CRC214077

Date: 10/06/2021

1	GEOLOGY AND HYDROGEOLOGY
1.1	<p>The technical review by Tonkin & Tylor Limited of the Geology Report provided with the application stated that the report forms a sound basis for providing inputs to the design of the landfill. However, there are several issues identified that require to be addressed.</p> <p>(a) Please provide responses to all question in Section 5 of the attached <i>CRC214073 Landfill Compliance Review Woodstock Quarries Limited</i> letter, dated 31 May 2021, and address all the issues identified, particularly in relation to the recommendation to reconsider or further justify the proposed cut slope profile.</p>
1.2	<p>The monitoring wells (MWs) do not appear to have been placed to intercept fault/shear zones. The highest groundwater conductivity (K) values would be expected in the faulted/fractured rock. Groundwater levels may also be most critical near these structures, i.e., if the faults/shears act as drains then the hydraulic gradient may increase significantly near these features. Further, it is understood that drilling of MWs was carried out without extracting a core, which would have been useful to characterise the fractures below the site (i.e., are they clean/infilled, open/tight, etc.?).</p> <p>(a) Please provide an investigation of fractures and joints of the exposed pit walls to get an understanding of the fracture characterisation for the site.</p> <p>(b) Please also consider whether or not further investigations are necessary to confirm conductivity of the underlying rock and whether there are fault/shear zones within the site of the proposed landfill.</p>
1.3	<p>In the rising head test's Hvorslev calculation a R value of 2.5 cm (radius of screen) was used; however, it is believed that this should have been 5.5 cm (radius of drilled hole). This changes the K values slightly, although the conductivity values already show a very wide range.</p> <p>(a) Please confirm whether the calculated numbers are or have been used for any specific calculations.</p> <p>(b) If so, please provide revised calculations with the correct R value.</p>
1.4	<p>The K value calculated from the rising head test would be an average value over the screened length in the piezometer (which is about 2.5 m in most piezometers). As the site is underlain by fractured rock, the K values are expected to be low in the bulk rock and high in the fractures. Therefore, groundwater velocity estimates should take this into account as it would result in preferential flow paths through the fractures. The calculated value would represent an average of the high and low together, but the highest velocity would occur in the fractures.</p> <p>(a) Please confirm the screen length in the piezometers installed on the site.</p>

	<p>(b) Please confirm how representative the investigations carried out are in relation to the varying K values across the site and at the depth of the final quarry pit that is proposed to be filled with landfill waste. This should include a description of the highest K values that can be expected at the site and depth and where these are likely to be experienced (i.e. will the landfill cells be located on top of areas with a high conductivity?).</p>
1.5	<p>The Geology Report notes “<i>minor rock types that may be found interbedded with, or faulted into, the greywacke include limestone, chert, and conglomerate, none of which have been observed on site</i>”. The geologist confirmed in the site visit that there is no limestone onsite.</p> <p>(a) Please confirm this in writing and whether this statement applies to all areas and depths to be quarried and filled.</p> <p>(b) Please confirm whether or not the argillite beds are calcareous as carbonates can dissolve in weak acids such as rainwater over long periods of time, or very quickly with stronger acids (i.e. potential leachate from the landfill).</p>
1.6	<p>Overall, it is considered that the local groundwater system has not been characterised sufficiently. This is also evident from the Hydrogeology Report, which acknowledges in the limitations section that the assessment to date is “<i>limited to the location and depth of monitoring wells installed at the site</i>”, and the majority of these wells are installed above the planned quarry pit floor, in material that will be removed (i.e. monitoring wells MW5 to MW10 were installed in the rock that will be removed from the quarry pit and only MW11 reaches the rock that will remain in the pit base). Further, springs are a common feature in areas of high topographic relief with a high water table. Discharge from the groundwater system is likely to be springs (including the streambed) unless there is a deep fractured system that the water flows down towards.</p> <p>(a) Please provide further information to characterise the groundwater system for the final pit shape.</p> <p>(b) Please provide baseline information of groundwater quantity, including information on whether groundwater from the quarry site feeds springs or nearby stream in the valleys below and how might it affect them, or whether groundwater would flow downslope and feed the gravel aquifers on the plains.</p> <p>(c) Please provide further information about any springs (in addition to the stream identified) in the area.</p> <p>(d) Please provide an investigation of baseline levels for spring flow volume/quality and streamflow volume/quality.</p> <p>The Hydrogeology Report notes future work including sampling and a water balance model. This would assist in the environmental impact assessment and operational flowrates to expect for the drainage system design.</p> <p>(e) In light of the above questions, please carry out further hydrogeological investigations to confirm the hydrogeological characterisation for the site and address the issues and risks identified below.</p>
1.7	<p>We agree with the description given for the expected groundwater behaviour, i.e. the intact rock has a low conductivity, and groundwater flow is likely to be dominantly fracture flow or</p>

	<p>along bedding planes. However, to predict where potential contaminant may flow, it is recommended that structural mapping of faults/shear zones in the area (local to pit, not just regional). This would help with placement of monitoring wells (also see Question 5.9 below).</p> <p>(a) Please provide a conceptual model of the groundwater system specific to this site, considering local structure, geology, recharge, and specifically discharge mechanisms.</p>
1.8	<p>Blasting is currently used as part of pit excavation. This is expected to increase fracturing and potentially increase permeability in the rock surrounding the pit.</p> <p>(a) Please confirm how fracturing and increase in permeability in surrounding rock will be monitored and managed throughout the quarrying operation and how the proposed landfill cell design will be informed by this information.</p>
2	QUARRYING AND ANCILLARY ACTIVITIES
	Authorisations for Current Quarry Operations
2.1	<p>The quarrying operation is understood to have commenced in 2018, and includes the excavation, handling and processing of quarry rock. While it is understood that the current operation holds resource consent from the Waimakariri District Council, the Canterbury Land and Water Regional Plan (LWRP), the Waimakariri River Regional Plan (WRRP) and the Canterbury Air Regional plan (CAPR) are regional plans that contain rules that are relevant to those activities.</p> <p>(a) Please confirm whether regional resource consents are required for the existing quarrying operation.</p>
	Management of Water Accumulating in Excavations during Current and Proposed Quarrying Operations
2.2	<p>It is evident from aerial images and from the conditions encountered during the site visit that water accumulates within the quarry pit. The source of water has not been described in the application (see above) and neither has the management thereof or the effects of management of the water. It is understood that water accumulated in excavations is pumped out as required and discharged within the wider site.</p> <p>(a) Please confirm the source of the accumulating water, i.e. is this fed from groundwater, rainfall, or a combination of both. Will there be an increase in inflows into excavations if artesian conditions are encountered in future quarry stages?</p> <p>(b) Please confirm where the water accumulating in the excavation would normally flow if the excavation was non-existent (i.e. will this feed springs or nearby streams, or flow downslope and contribute to the plains gravel aquifer recharge; etc.).</p> <p>(c) Please confirm whether water is removed from the excavations and if so by what means and at what frequency and rates and volumes.</p> <p>(d) If water has been removed previously, please confirm whether pumping rates were measured and perhaps compared to recent rainfall data. If not, please confirm if this will be instigated going forwards, including setting up a rain gauge, to provide</p>

	<p>more field data for input to the water balance model construction as suggested in the application (and addressed under Question 1.6 above).</p> <p>(e) Please confirm the fate of the removed water, i.e. whether this water is used in quarrying operations or discharged within the site. If the water is discharged, please confirm the location of the discharge and describe the measures that are in place to avoid, remedy or mitigate adverse effects on the receiving environment as a result of the discharge.</p> <p>(f) Please confirm whether the diversion of groundwater into the open excavation, as well as the diversion of run-on water via perimeter clean water diversion system, meets any relevant permitted activity rules in a regional plan, or whether this activity requires a resource consent (water permit).</p> <p>(g) Please confirm whether the taking of accumulated water from the open excavation meets any relevant permitted activity rules in a regional plan, or whether this activity requires a resource consent (water permit).</p> <p>(h) Please confirm whether the discharge of water taken from the open excavation meets any relevant permitted activity rules in a regional plan, or whether this activity requires a resource consent (discharge permit).</p> <p>(i) If a resource consent is required for any of the above activities, please provide a full assessment of effects on the environment of each activity.</p>
2.3	<p>The quarry pit will excavate into the groundwater table, which would create a drawdown of the water table from surrounding soil profiles.</p> <p>(a) Based on the baseline information requested above, please provide and assessment of the potential drawdown effects created by the pit on any springs, stream flows or aquifer levels, as well as vegetation that may become deprived of groundwater within the rooting zone.</p>
2.4	<p>As addressed further below, the risk of leachate discharging into land below the liner and subsoil drainage system has not been adequately addressed. There is also a risk of clean water accumulating in the quarry excavations to become cross-contaminated by leachate escaping one of the completed landfill cells via, either through cracks and fissures in the quarry rock or via overland flow.</p> <p>(a) Please confirm if water accumulating in active quarry excavations will be tested prior to pumping it out and discharging it elsewhere on the site.</p>
	Dust Discharges from Proposed Quarry
2.5	<p>The application is for expansion of the existing hard rock quarry that has been operating at the site for some time. Quarry operations usually handle (i.e. extraction, quarrying, mining, processing, screening, conveying, blasting, or crushing) and store bulk solid materials (rock, fines, etc.). The application has focused on the discharges of dust and particulates from the proposed landfilling activities; however, no assessments were provided against the rules in the Canterbury Air Regional Plan relevant to quarrying activities (also see questions in Section 7 below).</p>

	<p>(a) In addition to Question 1.1 above, please confirm compliance with Rules 7.35 (handling of bulk solid materials) and 7.36 (storing of bulk solid materials) of the CARP.</p> <p>(b) Please also confirm if blasting is carried out at the site and if so, please provide further details on frequency of that activity.</p>
2.6	<p>The LMP addresses dust discharges from the proposed landfilling activities. However, no description of dust mitigation measures for the proposed quarrying activity has been provided.</p> <p>(a) Please provide further details on how dust discharges are managed during rock extraction and handling to ensure effects beyond the site boundary are not offensive or objectionable.</p> <p>(b) Please confirm whether rock crushing will occur within the quarry site and if so, what mitigation measures will be in place to ensure effects beyond the site boundary are not offensive or objectionable.</p>
3	LANDFILL DESIGN
	Engineering Review
3.1	<p>The technical review of the landfill engineering design by Tonkin & Tylor Limited has raised a number of questions in relation to the proposed lining system, leachate collection system, leachate management, final cap, stormwater management and landfill gas management.</p> <p>(a) Please provide responses to all question in Section 6 of the attached <i>CRC214073 Landfill Compliance Review Woodstock Quarries Limited</i> letter, dated 31 May 2021, and address all the issues identified.</p> <p>Please note that the attached questions may be similar or overlap with the other questions asked below, which were asked specifically by Environment Canterbury staff. Where questions are similar or overlap, please refer in your responses to the below questions to the responses provided for the external engineering design review.</p>
	Drainage Water/Groundwater Management
3.2	<p>A sub-liner drainage system is proposed to capture and transport groundwater away from the landfill to protect the liner from uplift and prevent intrusion of ground water into the landfill.</p> <p>(a) Please confirm the expected groundwater inflow volumes, considering both downward inflow from surrounding water bearing strata as well as the upward hydraulic gradient in some areas of the site (i.e. artesian flows entering the underdrainage system from below) and confirm that the sub-liner drainage system has been, or will be, sized to accommodate these inflows.</p>
3.3	<p>The application recognises there may be issue with artesian pressures beneath the liner, and water may accumulate in the pit. While the water inflow into the landfill pit is proposed to be addressed through the subsurface drainage system, there has been no consideration</p>

	<p>of contingency measures in the event that the system fails or becomes unreliable over time.</p> <ul style="list-style-type: none"> (a) Please provide more details on the measures in place to ensure the sub-surface drainage system will operate effectively. (b) Please confirm any contingency measures to be put in place in the event that the sub-liner drainage system fails or becomes less effective over time (please also see Question 5.13 below on the risk). (c) Please provide an assessment of actual and potential effects as a result of significant groundwater inflow in the event that the sub-liner drainage system is no longer working effectively. This assessment should include a consideration of saturating the landfill toe bund and shaped wedge at the back wall, which could result in destabilisation of the entire contaminant containment system and the overlying landfill cells.
3.4	<p>The subsurface drainage system underlying the landfill cells will provide a secondary protection in event of liner breach.</p> <ul style="list-style-type: none"> (a) Please provide further information around lining system settlement and failure including quantity of leachate that might theoretically be released in the event of a minor, moderate, major or catastrophic liner failure. (b) Please confirm if the underdrainage system will be sufficient to capture all (or majority) of leachate if liner is compromised for all of the above scenarios. (c) Please confirm if a third level of protection has been considered such as filling and sealing existing cracks and fissures, specifically if the sub-liner drainage system may be sealed in future (see questions below).
3.5	<p>Groundwater discharged via the subsurface drainage system is proposed to be diverted into the leachate collection and storage system in the event that conductivity or pH levels exceed the trigger level.</p> <ul style="list-style-type: none"> (a) Please confirm the basis for the proposed conductivity and pH trigger levels to indicate potential leachate contamination of the underdrainage system and confirm why no numeric trigger levels have been proposed. (b) Please provide justification to only monitor conductivity and pH and no other parameters described in the proposed conditions. (c) Please confirm how water will be diverted into the leachate collection and storage system. Will this occur automatically or is manual operation of the diversion system required? (d) Please confirm the fate of leachate that reaches the subsurface drainage system in the event that the diversion system failure or there being no capacity in the leachate collection and storage system.
3.6	<p>The Engineering Report states that as subsoil drains provide a potential pathway for any leachate seepage through the lining system the drains will be progressively sealed when they are no longer required (e.g. when groundwater inflows cease). If groundwater inflows cease and subsoil drains are sealed, the secondary protection system ceases to function, and this may provide a pathway for leachate in the event of a future liner failure.</p>

	<p>(a) Please clarify what is meant with ceasing groundwater inflows into the landfill pit. Is this as a result of the hydraulic gradient reversing or as a result of the placed fill blocking the inflow, or both?</p> <p>(b) Please confirm the likelihood of groundwater inflows ceasing and provide examples of other landfills in a similar geological setting where a subsoil drainage system was required.</p> <p>(c) Please confirm how the subsoil drains would be sealed and whether this will be permanent.</p> <p>(d) Please confirm if progressively sealing the subsoil drainage system would increase the risk of a subsequent liner breach discharging into underlying cracks and fissures.</p>
	Stormwater Management
3.7	<p>Run-on water is proposed to be managed via a perimeter clean water diversion system that is to designed to accommodate a 1% AEP rainfall event. Plans show cross-sections of the upgradient perimeter road and drains along the lower perimeter road along the toe bund. The AEE states further that flows will follow natural drainage paths in a downhill direction, and that the contour of the land surrounding the landfill is such that this system will largely reflect that which occurred on the site prior to quarrying. However, the Engineering Report states that an open channel drain on the outside of the road will divert stormwater to the stormwater treatment ponds. Overall, it is unclear how the proposed system will operate and how a sloped vehicle track and drainage channels around the entire perimeter of the landfill site will divert water from up to and including a 1% AEP rainfall event away from the site and allow the water to follow natural drainage patterns without diverting the water downslope along the vehicle tracks. From the existing quarry roads, it was already evident that stormwater has been concentrated into certain areas and these areas have experienced beech tree dieback.</p> <p>(a) Please provide more detailed plans for the perimeter clean water diversion system, including further cross-sections at key locations where there is a stormwater catchment above the perimeter road (e.g. northern and north-western areas of the site).</p> <p>(b) Please confirm where run-on water will discharge to.</p> <p>(c) Please confirm secondary flow paths in the event that the 1% AEP rainfall event is exceeded. Would water drain towards the quarry/landfill footprint?</p> <p>(d) Please confirm if and how changes to rainfall intensities and peak rainfall depths over time as a result of climate change will be taken into account for sizing the perimeter clean water diversion system (it is noted that HIRDS v3 was references in the Engineering Report, but this has been superseded by HIRDS v4 and v4 is also used to estimate maximum precipitation events in the Hydrogeology Report).</p> <p>(e) Please confirm catchment size above the perimeter clean water diversion system.</p> <p>(f) Please confirm whether subsurface flows (i.e. after rainfall has infiltrated) would still enter the quarry/landfill pit as it appears to do currently.</p> <p>(g) Please provide further details on the functionality of the perimeter clean water diversion system and how this is system is to mimic natural drainage patterns. In</p>

	<p>doing so, please also confirm whether run-on water will be diverted to a specific location and provide a detailed assessment of effects on the environment for the location that the water will be discharged to. Please also confirm what measures will be in place to avoid scouring and erosion in the areas where water discharges from the drain.</p> <p>(h) Please confirm what measures will be put in place to avoid adverse effects on local flora as a result of concentrating potentially large volumes of water into areas that have historically not been saturated.</p> <p>(i) If a resource consent is needed for the diversion of run-on water in the perimeter clean water diversion system (see Question 2.2 (f)), please provide a full assessment of actual and potential adverse effects of diverting water and discharging it in different locations than where it would naturally flow. The assessment should include consideration of adverse effects on springs, stream flows or aquifer levels, as well as effects on nearby aquatic and terrestrial ecosystems.</p>
3.8	<p>Stormwater and water collected in the underdrainage system is proposed to be discharged to a two-stage sedimentation pond and then to land via a restricted outflow or overflow channel and energy dissipator (which includes scour protection works of concrete, rock or timber construction. The sedimentation pond is proposed to be designed to retain the flows from a 10% AEP storm event, with an overflow structure that will be able to safely pass a 1% AEP storm event to an extreme precipitation event containment pond shown on the site plans. The infiltration area is located on a steep slope and is currently densely vegetated. Further, given the existing landform at the discharge point, water may flow overland and discharge to the stream at the valley floor.</p> <p>(a) Please confirm the working volume of the proposed two pond system considering the entire contributing catchment (including run-on water diverted into the ponds via the perimeter road drains) and a worst case scenario runoff event (i.e. what is the pond volume required to accommodate runoff from the contributing catchment when soils are frozen or waterlogged during a 10% AEP rainfall event). Rainfall intensities and depths derived from HIRDS v4 and a relative concentration pathway of 8.5 should be used for this assessment.</p> <p>(b) Please confirm if the ponds will be constructed above or below the natural ground level and what the proposed “dam works” will include. Please note that damming of water may be subject to further approvals required, including resource consents and building consents.</p> <p>(c) Please confirm whether the two ponds will be lined and what the ‘sediment removal zone’ consists of at the base of the ponds.</p> <p>(d) Please confirm the critical duration storm event that these stormwater system components will be designed for.</p> <p>(e) Please also confirm how the discharge from the underdrainage system has been incorporated to the pond volume requirements, i.e. what would the maximum flows from the underdrainage system be during the 10% AEP rainfall event.</p> <p>(f) Please confirm what the discharge rates will be from the restricted outflow.</p>

	<ul style="list-style-type: none"> (g) Please provide further details on the size and location of the extreme precipitation event containment pond and how water will be diverted to the pond. (h) Please provide further details of the energy dissipation area and how scouring and erosion will be avoided as a result of the discharge. This should also include further information on the proposed scour protection works and any inspection and maintenance requirements. (i) Please provide a detailed description of the proposed discharge infiltration area and how this will operate in practice. (j) Please confirm the suitability of the proposed discharge infiltration area in light of the topography of the area. What are the risks associated with the attempt to discharge potentially large volumes of water into land on a steep slope? Would the discharge result in increased sediment runoff to surface water bodies at the valley floor? (k) Please confirm infiltration rates for discharge area to confirm whether water discharged from the ponds would infiltrate and not run overland to stream. Please also confirm whether a factor of safety has been used in the design of the infiltration area. (l) Please provide a detailed assessment of the proposed discharge on the local fauna. This assessment should include whether the vegetation in and below the discharge area is suitable for soils becoming saturated from the discharges. (m) Please provide an assessment of actual and potential effects of any overland flow discharging to the Woodstock Stream at the valley floor. This should include an assessment of likely discharge volumes that could emanate in the stream and how the additional volumes would affect the stream's capacity to convey. (n) Please provide further information on the secondary flow paths in events exceeding the 1% AEL (e.g. the 0.4% AEP rainfall event described in the Hydrogeology Report). (o) Please provide further details on the required inspections and maintenance of the entire stormwater disposal system.
3.9	<p>Stormwater monitoring is proposed in the draft LMP and proposed conditions at a location downstream of the existing vehicle crossing of Woodstock stream (Location SW01 shown on Drawing E2). No monitoring of groundwater quality is proposed, although the main receiving environment is described to be groundwater.</p> <ul style="list-style-type: none"> (a) Please confirm why Location SW01 was chosen for surface water quality monitoring and how the location would be representative to determine whether or not the discharges to the stream some distance upstream would have resulted in adverse effects closer to the discharge point. (b) Please confirm if ongoing monitoring will also be carried out in the sediment ponds or at the pond outlets. (c) Please confirm why monitoring is only to occur twice per year and during low flow conditions and why sampling has not been tied to rainfall events.

	<p>(d) Please provide justification why no groundwater quality monitoring is proposed, although stormwater and water from underdrainage system are proposed to be discharged primarily onto and into land.</p>
3.10	<p>The Erosion and Sediment Control Guideline 2007 (ESCG) are quoted in the proposed conditions and these guidelines are proposed to be used to design the sedimentation ponds. The ESCG has been superseded and also is a guideline designed for construction sites, not necessarily operational sites; however, it is acknowledged that many measures included in these guidelines would be appropriate to manage soil erosion and sediment discharges from the proposed quarry operation. Further, the proposed measures are largely dependent on the long-term maintenance of the sediment ponds so that they remain effective, including monitoring and maintenance procedures.</p> <p>(a) Please confirm why the ESCG was used for the design of the sediment ponds and whether there are more appropriate guidelines that can be used to design and size the sedimentation ponds, specifically in relation to the underdrainage system and operational stormwater discharges from landfill operations.</p> <p>(b) Please confirm how stormwater discharge will be managed across the entire quarry and landfill site in order to avoid creation of channels and water ruts and protect exposed soils from erosion, all of which could result in sediment discharges and slope stability issues.</p> <p>(c) Please provide further information on specific erosion and sediment control measures to be utilised for each stage of works, as well as for storing the stripped overburden material (including volumes), including how those measures will be maintained long term and any monitoring proposed. This should include a draft erosion and sediment control plan or a more detailed stormwater management for the existing and proposed activities at the site.</p>
3.11	<p>The AEE states that any groundwater entering the area of the quarry/pit not utilised for landfill purposes will be discharged to the swale and stormwater ponds. Further, if groundwater in the underdrainage system is found to be contaminated by landfill leachate, the contaminated ground water is proposed to be diverted to the leachate system and disposed of accordingly.</p> <p>(a) Please confirm what groundwater will be used for in the landfill operation and confirm whether the intended uses will be consumptive in nature.</p> <p>(b) Please confirm if and how a liner leak will be remediated to ensure that groundwater from the underdrainage system does not have to be diverted to the leachate system on a permanent basis.</p> <p>(c) If the groundwater use is consumptive for any of the above reasons, please provide an assessment of this activity against the relevant regional plan provisions. If a resource consent is required, please provide an assessment of actual and potential effects of the consumptive groundwater take.</p>
	<p>Liner System</p>

3.12	<p>The liner does not isolate the entire pit as the walls are not proposed to be lined and the walls will be lined with free draining material that would direct any leachate downwards. It is considered that this provides a potential area of contact of leachate and groundwater.</p> <ul style="list-style-type: none"> (a) Please provide justification for the proposed free-draining material to be used instead of lining the side walls, including examples where such a system has been implemented successfully. (b) Please provide an assessment of the potential contaminant flow paths through cracks and fissures in the side walls and on the benches. (c) Please confirm the risk of leachate and potentially additional rainfall water backing up in the funnel shaped free-draining material if base near the underlying bench or a lower bench is not as free-draining as required, and also where accumulated leachate and rainwater could escape to. (d) Please confirm whether leachate can migrate down the free-draining layer along the walls and reach the clay wedge, and then bypass the underlying liner if this is not adequately sealed to the rock face.
3.13	<p>It appears from drawings provided with the application that the toe bund is only approximately 700 mm tall.</p> <ul style="list-style-type: none"> (a) Please confirm and back up with calculations whether the liner sump is deep enough to manage all potential volumes of leachate and groundwater inflows from the side walls.
3.14	<p>The landfill is expected to start operation in cells while quarry works continue.</p> <ul style="list-style-type: none"> (a) Please confirm what the effect of nearby quarry works and specifically blasting activities will be on the properties of rock mass beneath and adjacent to the operative and completed landfill cells, and the integrity of the liner.
	Leachate Management System
3.15	<p>The application does not detail any contingency measures in place in the event that there is a failure of the pump-back system for the leachate.</p> <ul style="list-style-type: none"> (a) Please describe what contingency measures will be in place to address any issues with the pump-back system. (b) Please confirm the operational capacity available to store leachate until pump failures are repaired. (c) Please also confirm whether leachate will be pumped back into the landfill cells in perpetuity or if this will occur only for a limited time period.
3.16	<p>The side wall leachate filter/drainage system will also allow any groundwater draining from the cut face to be captured in the leachate system. Given the groundwater inflows from side walls will flow into the landfill cells and is managed in the leachate collection system, the groundwater inflows would be consumptive in nature, which has not been considered in the application.</p>

	<p>(a) Please confirm likely groundwater inflow volumes from the side walls and confirm the leachate system will be designed to accommodate these flows.</p> <p>(b) Please confirm whether climate change has been, or will be, taken into account when designing the leachate collection system.</p> <p>(c) Please confirm how the system would likely behave and be operated in a significant rainfall event such as the one experienced recently.</p> <p>(d) Please provide an assessment of this activity against the relevant regional plan provisions. If a resource consent is required, please provide an assessment of actual and potential effects of the consumptive groundwater take.</p>
3.17	<p>The proposed resource consent conditions and LMP state that leachate may be treated on site.</p> <p>(a) Please provide further information on how leachate will be treated and what the fate of the treated leachate (and treatment by-products or wastes) will be.</p>
4	WASTE ACCEPTANCE
	Waste Acceptance Criteria (WAC)
4.1	<p>The application states that hazardous and medical waste is proposed to be accepted for deposition at the proposed landfill. Further, the proposed conditions state that the landfill will accept treated hazardous and medical wastes as 'Special Wastes' subject to an approval process.</p> <p>The WasteMINZ technical guidelines define 'hazardous waste' and state that (emphasis added) "<i>Hazardous waste contains contaminants such as heavy metals and human-made chemicals, <u>at levels high enough to require treatment to render them acceptable for landfill disposal</u></i>".</p> <p>(a) Please confirm whether hazardous waste that exceeds the proposed WAC in Appendix D of the WasteMINZ Guidelines will be treated at the site to render it acceptable for the proposed landfill.</p> <p>(b) If these waste streams are treated on-site, please confirm where and how hazardous wastes will be treated and otherwise handled.</p> <p>Further, Attachment 4C of the Landfill Management Plan (LMP) describes which waste materials are prohibited from acceptance at the proposed landfill. This includes radioactive materials and pharmaceutical waste (such as infectious substances).</p> <p>(c) Please confirm whether infectious substances and radioactive material will be deposited at the proposed landfill, and how those materials, if accepted, are proposed to be handled.</p>
4.2	<p>Emerging contaminants contained in the waste streams (e.g. PFAS/PFOS, etc.) to be deposited at the proposed landfill and their actual or potential effects on both the landfill engineering and receiving environments have not been considered.</p> <p>(a) Please confirm how emerging contaminants will be considered in the waste acceptance.</p>

	<p>(b) Please provide concentration ranges of emerging contaminants present in the proposed waste streams, their leaching characteristics, and an assessment of the potential consequences of accidental release.</p> <p>(c) Please provide a monitoring programme suitable to detect known emerging contaminants in landfill leachate and discuss how new contaminants will be added to the monitoring programme.</p>
4.3	<p>In the waste acceptance schedules, it is indicated that “Soil, rock, gravel, sand, silt, and clay” can be accepted on the basis of visual inspection only. Due to the anticipated level of containment in the proposed landfill, perhaps this is acceptable, but highly contaminated soils are often indistinguishable from less-contaminated soils.</p> <p>(a) Please provide further information on the potential for highly contaminated soil from a site not considered a source of ‘Special Waste’ (e.g., a contaminated site not listed as such on the Listed Land Use Register) to be accepted and to generate leachate that may not comply with the waste acceptance criteria (WAC) in the ‘Special Wastes’ acceptance criteria?</p>
4.4	<p>Some soils may be considered a ‘potentially hazardous material’ and so should be subjected to Toxicity Characteristic Leaching Procedure (TCLP) analysis, as detailed the WasteMINZ technical guidelines.</p> <p>(a) Please confirm whether TCLP analysis will be carried out or will have been carried out at the source site for soils arriving at the site.</p> <p>(b) Please describe the process in place to confirm the adequacy of TCLP analysis and subsequent acceptance of soils.</p>
4.5	<p>Polycyclic aromatic hydrocarbons (PAHs) are not included in the waste acceptance criteria.</p> <p>(a) Please confirm whether or not PAHs or PAH-contaminated soils will be accepted at the proposed landfill.</p> <p>(b) If PAHs or PAH-contaminated soils are to be accepted, please confirm if there will be a maximum allowable concentration as well as the method used to determine the maximum allowable concentration.</p>
4.6	<p>It is not clear whether or not hydro-vac (or ‘sucker truck’ waste) or road sweepings will be accepted at the proposed landfill and these waste streams are not explicitly mentioned in the waste acceptance schedules.</p> <p>(a) Please confirm if these waste streams are to be accepted at the proposed landfill.</p> <p>(b) If sucker truck waste is accepted, please confirm the potential for that material to be putrescible/biodegradable, as well as otherwise hazardous.</p> <p>(c) If road sweepings are to be accepted, please confirm the potential for this waste material to generate hazardous leachate.</p>
4.7	<p>It is noted that the proposed WAC align with WasteMINZ Class 1 landfill WAC, yet the proposed liner system differs from that required under WasteMINZ for Class 1 and Class 2 landfills.</p>

	(a) Please provide further information on how the proposed liner system and associated other engineered systems will perform appropriately with the proposed Class 1 landfill WAC.
4.8	<p>The LMP states that Staff will be provided with specific training to be able to identify acceptable and unacceptable Landfill materials.</p> <p>(a) Please confirm what the 'training' will entail.</p> <p>(b) Please provide further details on the processes in place to ensure staff will be able to carry out this function.</p>
4.9	<p>Visual inspections are proposed to determine content by load for vegetative matter and untreated wood.</p> <p>(a) Please provide detail on how the amount of vegetative material (limited to 3%) and untreated wood (limited to 1%) will be assessed visually in waste acceptance.</p> <p>(b) As these materials are in some sense putrescible, please confirm why contents exceeding the above percentages are not explicitly noted as an exception in the LMP Schedule 4C under 'putrescible, organic wastes'.</p>
	Waste Acceptance and Handling
4.10	<p>The LMP states that <i>"any material not specified as acceptable must demonstrate that it is not leachable, degradable, putrescible, combustible, hazardous, liquid, or unsafe to be accepted at the landfill"</i>.</p> <p>(a) Please confirm what controls will be in place to ensure this requirement can be met.</p> <p>(b) Please confirm who will be making decisions on whether or not material is suitable for acceptance.</p>
4.11	<p>Special Wastes will be accepted at the landfill subject to an approval process that requires the issuing of a Special Waste Permit. Special Waste is being described as solid waste requiring special handling or testing or certification procedures. No information about the approval process, how this waste is to be handled, tested or certified has been provided.</p> <p>(a) Please describe process of approving waste material as Special Waste and issuing a Special Waste Permit.</p> <p>(b) Please confirm how Special Wastes will be handled, tested and certified.</p> <p>(c) Please confirm what 'certification' means in that context and who will be carrying out the certification, including qualifications required to be held by the certifier.</p>
4.12	<p>Any landfill material or soil deposited at the site that is required to be sampled and analysed for the appropriate contaminants at the source sites.</p> <p>(a) Please confirm who will be sampling the source material, including qualifications required to be held by the person carrying out the sampling.</p>
4.13	<p>The waste acceptance process described in the LMP appears to be relatively high level and does not provide sufficient details that provide the certainty needed for an operation of such scale and nature.</p>

	<p>(a) Please provide more detailed information on the proposed waste acceptance process, including further detail of how each step of the process will be implemented in practice.</p> <p>(b) Please provide a flow chart for the entire waste acceptance process to assist with the clarity of the process.</p>
4.14	<p>Imported fill will be inspected for moisture content. Imported fill that is visibly wet, has the appearance of mud, or that does not readily break apart due to the presence of moisture will be laid aside and not inspected until dry.</p> <p>(a) Please confirm how moisture content will be determined and how it can be ensured that the measured moisture content is representative of the entire load.</p> <p>(b) Please provide more information about the nature, location and size of the laydown area and what measures will be in place to ensure the material reaches the required low moisture content (i.e., will the material be covered, etc.?).</p> <p>(c) Please confirm if leachate from the laydown areas will be collected and how the laydown area will be managed during rainfall.</p> <p>(d) Please provide an assessment of actual and potential effects from temporary storing the imported fill on the laydown area until it is dry.</p>
4.15	<p>Soils displaying evidence of contamination will either be set aside for chemical testing or rejected.</p> <p>(a) Please provide further explanation of what 'will be set aside' means in this context. This should include the time period required for soils to be tested.</p> <p>(b) Please confirm where and how these soils will be tested and who will be making the determination on the acceptability of the materials and describe the processes involved.</p> <p>(c) Please confirm how soils 'set aside' will be managed until such time that test results have been received (refer to Questions 4.14 (b) to (d) above and provide similar information and assessments).</p> <p>(d) Please confirm the fate of soils unacceptable/unsuitable that have been 'set aside' at the site. It is noted that the carrier of the materials is unlikely to still be present at the site when test results are received.</p>
4.16	<p>If prohibited substances are suspected or confirmed at the tip-head the area shall be marked and the area closed off and prohibited substances are to be removed.</p> <p>(a) Please confirm who will be inspecting the tip areas for prohibited substances, including the training the persons carrying out this task have received, and any other qualifications required to be held.</p> <p>(b) Please confirm the fate of the prohibited substances removed from the tip areas, given the internal transport from the receiving area to tip areas will be carried out by landfill staff and not the carrier that transports the material to the site.</p>
4.17	<p>In record keeping requirements under the LMP, it is noted that "The physical address of the land the material was sourced from" will be recorded. We note the importance of recording the original source site, not the sorting facility or waste transfer site. If there is no</p>

	<p>information on the provenance of material other than the address of the sorting or transfer facility, it is recommended that the material be rejected.</p> <p>(a) Please confirm how recording of the source site will be addressed for material that comes via a sorting facility/waste transfer site.</p> <p>(b) Please confirm what mechanisms are in place to ensure the material from the sorting facility/waste transfer site will indeed contain only the material from the source site listed on the records.</p>
4.18	<p>The LMP described the record keeping requirements for all material accepted on site shall be kept.</p> <p>(a) Please confirm why the landfill cell into which material is deposited is not recorded.</p>
4.19	<p>There is a lack of clarity in requirements (if any) for daily and intermediate cover requirements.</p> <p>(a) Please confirm if there will be any requirements for soil used as daily or intermediate cover, in terms of contaminant concentrations.</p> <p>(b) Will daily cover be tested to ensure compliance with the WAC?</p>
5	ENVIRONMENTAL RISK ASSESSMENT
5.1	<p>During the review of the Environmental Risk Assessment report similarities to risk assessment carried out for the Auckland Regional Landfill at Dome Valley were noted (see https://www.aucklandcouncil.govt.nz/ResourceConsentDocuments/48BUN60339589RiskManagementAssessment.pdf).</p> <p>(a) Please confirm if the risks identified for the proposed landfill were assessed on the basis of the information provided with the application and that these are not based on a different landfill.</p> <p>(b) Please confirm whether there are any additional or different risks that need to be considered for the proposed landfill.</p> <p>(c) Please confirm whether the pre and post mitigation risk scores are specific to this site and have not been adopted from other landfills with potentially different environmental settings and associated risks.</p>
5.2	<p>Under Risk Item 1.1 a number of engineering and design controls are proposed to be in place to ensure the stormwater ponds are constructed adequately.</p> <p>(a) Please confirm if regular inspections during operation, closure and aftercare periods will occur to ensure that the ponds will remain in a good condition.</p>
5.3	<p>Risk Item 1.2 addresses the stormwater treatment standard and includes the use of flocculants (if required) as mitigation measures to lower sediment concentrations in the discharge. Water treatment chemicals are considered a contaminant and generally require resource consent under Rule 5.100 of the LWRP.</p> <p>(a) Please confirm whether resource consent will be sought to discharge residual water treatment chemicals to land or water.</p>

	<p>(b) If water treatment chemicals will be used, please provide further information on how these will be used, including any bench testing and dosing requirements. Please also provide a draft chemical treatment plan.</p>
5.4	<p>Under Risk Item 1.4 geotechnical assessments are proposed to identify high risk areas requiring stability measures.</p> <p>(a) Please confirm if ongoing inspections will be carried out of such areas and of any measures used, specifically following extreme weather events.</p>
5.5	<p>Risk Item 1.5 addresses the risk of runoff of contaminants from refuse entering the stormwater ponds and discharging from the ponds.</p> <p>(a) Please confirm why the pre-mitigation scenario was assessed as having a moderate impact and what assessment criteria were used to arrive at this conclusion.</p> <p>(b) Please confirm if this risk assessment represents a minor, moderate, major or significant discharge of contamination to the stormwater ponds and provide a risk rating for each of these scenarios.</p> <p>(c) Please confirm the post-mitigation risk rating for the above scenarios.</p>
5.6	<p>Several Risk Items describe the failure of the liner or the leachate collection and disposal system and how this is proposed to be mitigated.</p> <p>(a) Please provide detailed information on the potential volumes and quality of leachate that could be released during the various stages of the operation under Risk Items 2.1, 2.3 to 2.11 and 2.15.</p> <p>(b) Please qualify the likelihood of any of these events occurring at the various stages of the landfill (during operation, closure and aftercare of the landfill) and duration that each event could last.</p> <p>(c) Please confirm the potential ecological receptors that could be affected and what the level of risk would be associated with each event. Please also confirm what contaminants of concern are likely to exceed relevant acute and toxic water quality guidelines for each event.</p>
5.7	<p>Risk Item 2.2 addresses unforeseen leachate production, describing prolonged rainfall leading to an increase in leachate generation. The main mitigation described are daily, intermediate and final cover installation and the use of clean water diversions. However, the proposed mitigation does not consider the rate of saturated flow through cover materials or leachate production from open landfill cells that have not been covered.</p> <p>(a) Please provide more information regarding the management of unanticipated leachate production from accepted materials (e.g., unintentionally-accepted putrescible waste, wastewater treatment plant sludge, and other 'Special Wastes', etc.).</p> <p>(b) Please provide more information regarding what an unforeseen leachate production event is, including a description of what could give rise to such an event.</p> <p>(c) Please quantify potential frequency of unforeseen leachate production events.</p>

	<p>(d) Please confirm what event could result in unacceptable ecological impacts and what potential contaminants of concern could result in adverse effects on which sensitive ecological receptors.</p>
5.8	<p>A large number of controls and mitigation measures are proposed to manage the risk associated with leachate migrating to groundwater and surface water. However, all liners are likely to leak at some stage during their lifespan (as stated in the Engineering Report) and not all leachate would be captured in the underdrains and be subject to electrical conductivity monitoring in the stormwater pond inlet. While the Engineering Report discusses the possibility to model leakage through the lining system, no attempt has been made to calculate the potential leakage that could bypass the underdrainage system and no assessment of potential environmental effects of such leakage has been provided by way of a fate and transport analysis. Further, the proposed resource consent condition and Landfill Management Plan (LMP) do not appear to appropriately address this risk (e.g. the only monitoring in the receiving environment is proposed to be in Woodstock Stream and only twice per year, but no information has been provided to confirm this would be the only receiving environment as a result of a liner breach).</p> <p>(a) Please provide a fate and transport analysis to predict and assess potential flow paths from the landfill in the event of a liner breach or toe bund failure or any other leachate discharge that would not be captured by the underdrainage system.</p> <p>(b) Please provide baseline information of groundwater and surface water quality in all locations that could be receiving environments to a discharge below the subsoil drainage system.</p> <p>(c) Please confirm whether the resource consent conditions and LMP appropriately address the risk of leachate bypassing the subsoil drainage system, including how a liner breach would be detected and what actions would be implemented as a result of a liner breach.</p> <p>(d) If additional groundwater and/or surface water monitoring is proposed, please confirm locations of sampling locations.</p>
5.9	<p>Risk Items 2.12 and 2.13 address cover failures and state that the cover is unlikely to fail on a scale that would present issues for leachate management.</p> <p>(a) Please confirm whether the risk assessment is associated with the daily cover, the intermediate cover or the final cover.</p> <p>(b) Please confirm whether a seismic event has been considered in determination of the pre and post-mitigated risk scenario.</p> <p>(c) Please confirm if weekly cover inspections will continue during the closure and aftercare periods.</p> <p>(d) Please clarify how issues identified in inspections will be addressed during closure and aftercare.</p>
5.10	<p>Risk Item 2.14 described leachate breakouts through the cover and discharge to the stormwater system.</p> <p>(a) Please confirm in what areas of the landfill and in what form a leachate breakout would be most likely.</p>

	<p>(b) Please confirm whether leachate breakout could destabilise the cover, thereby increasing the risks assessed under Risk Items 2.12 and 2.13.</p>
5.11	<p>Risk Item 2.15 assessed the risk from slope movement within placed waste resulting in waste outside liner containment or a tear in the liner beneath placed waste.</p> <p>(a) Please confirm the likely/potential scale of such occurrences and the mechanism of damage (e.g. size of liner tear, amount of waste deposited outside of cell, etc.).</p> <p>(b) Please provide more information regarding the actions that will or can be taken in response to such a containment breach in order to repair the breach (if this is possible) and/or mitigate potential effects.</p>
5.12	<p>Risk Item 2.17 states that subsoil drains are designed to exclude sediment from entering the pipe or accumulating within the pipe.</p> <p>(a) Please confirm the likelihood of the free-draining material surrounding the subsoil drains to blind (i.e. becoming less transmissive or blocked) over time?</p> <p>(b) Please confirm whether blinding could result in the same consequences as a blocked subsoil drainage pipe.</p> <p>(c) Please confirm whether a factor of safety been applied to the subsoil drainage system design to account for blinding.</p> <p>(d) Please confirm how it can be ensured that the subsoil drainage will operate effectively (as required) over the operational, closure and aftercare periods, and beyond.</p>
5.13	<p>Under Risk Item 2.19 it is considered likely that the method of reticulation would result in leachate running into the stormwater system.</p> <p>(a) Please provide a consideration of alternative stormwater system and leachate system designs to prevent or further limit leachate discharging to the stormwater system.</p> <p>(b) Please confirm what measures will be taken to remediate any leachate being discharged to the stormwater system. Will the leachate accumulating in the stormwater ponds be removed? How would a compromised cell liner be remediated permanently (if required)?</p> <p>(c) Please confirm whether the stormwater treatment system is appropriate to cope with the small amounts of leachate entering the stormwater system or whether alternative treatment is necessary in the event that conductivity and pH measurements indicate a liner failure.</p> <p>(d) Please confirm whether the upward groundwater hydraulic gradient could result in the leachate leaking through compromised parts of the liner to be flushed out with the drainage water, potentially accelerating leachate flow from cells.</p>
5.14	<p>The risk assessment identifies risks associated with a system/material failure, toe bund failures or compromise of leachate collection system, which could result in a discharge of leachate to receiving groundwater and/or surface water environments. The post-mitigation risk is reduced as a result of engineering controls and monitoring. However, the appropriateness of the WAC in that context and whether changes to the WAC are required</p>

	<p>to further reduce the risk has not been addressed (e.g. for Risk Items 2.3, 2.7, 2.15, 2.16 and 2.17), specifically for worst case scenario failures of the liner, toe bund, or leachate collection system.</p> <ul style="list-style-type: none"> (a) Please confirm whether a liner, toe bund or leachate collection system failure has been considered when developing the proposed WAC for this landfill. (b) Please confirm what the cumulative effects would be of small amounts of leachate discharges from the landfill over time as a result of small defects or failures of the liner, toe bund or leachate collection system. (c) Please confirm whether and how the WAC will be appropriate to protect downgradient receiving environments in the event of a worst case scenario liner, toe bund or leachate collection system failure.
5.15	<p>The pre-mitigation impact of a subsurface fire (Risk Item 5.1), a surface landfill fire (Risk Item 5.2) or a fire migrating to adjacent forest or bush areas (Risk Item 5.4) was rated as major. However, fires can have catastrophic effects and given the local topography of the site and access to water, catastrophic (5) may be a more appropriate pre-mitigation impact score. Further, subsurface fires can last for a long period, requiring large amounts of water to manage and extinguish.</p> <ul style="list-style-type: none"> (a) Please confirm how an impact score of major (4) was arrived at for these risks. (b) Please confirm whether a water truck will be appropriate as an immediate response to a fire. (c) Please confirm what other sources of water supply will be available to combat a fire at the landfill site. <p>It is also noted that earthworks machinery used to combat fires will need to be operated by on-site staff and that firefighting training and skills will be necessary to combat fires without risking human health and safety.</p> <ul style="list-style-type: none"> (d) What are the firefighting training requirements for staff? (e) Will trained staff always be present on site during operation? (f) What are the contingencies if a fire breaks out outside of operating hours?
5.16	<p>The risk of a subsurface fire (Risk Item 5.1) or a fire migrating to adjacent forest or bush areas (Risk Item 5.4) to still be moderate post-mitigation. The proposed controls and mitigation measures seek to reduce or address effects if a fire were to occur; however, they provisions do not directly address any significant effects to the ecological values of the site and surrounding environments that may occur as a result of a fire.</p> <ul style="list-style-type: none"> (a) Please confirm whether the inclusion of provisions to address any significant effects to the ecological values of the site and surrounding environments is warranted and how mitigating effects from a fire would be achieved.
5.17	<p>Risk Item 5.19 describes a moderate risk pre-mitigation and low risk post mitigation to surface water/aquatic ecosystems and terrestrial ecosystems in terms of pests and diseases introduced as a result of the landfilling activity. Further, a number of other Risk Items describe risks to surface water/aquatic ecosystems and terrestrial ecosystems, including risks in relation to sediment discharges (Risk Items 1.4, 1.6 and 1.8). Lining system/material failures, toe bund failures or compromise of leachate collection system</p>

	<p>and handling systems have not been assessed in terms of risk to surface water/aquatic ecosystems and terrestrial ecosystems, noting that leachate discharges into land may emanate in nearby surface water bodies.</p> <p>(a) Please confirm what criteria were used in the risk assessment to assess the levels of risk to surface water/aquatic ecosystems and terrestrial ecosystems under Risk Items 1.4, 1.6, 1.8 and 5.19.</p> <p>(b) Please confirm the level of risk pre-mitigation and post mitigation for lining system failures in relation to the relevant acute and chronic water quality criteria, Numeric Attribute State as outlined in the NPS Freshwater Management 2020, the dissolved oxygen saturation, as well as bioaccumulation and secondary toxicity effects accounted for when assigned low risks.</p> <p>(c) Please confirm the sensitive ecological receptors that would be impacted by one of the above risks.</p> <p>(d) Provide a quantitative ecological risk assessment to answer questions.</p>
5.18	<p>The technical review by Tonkin & Tylor Limited of the environmental risk assessment provided with the application has raised a number of questions in addition to the above.</p> <p>(a) Please provide responses to all question in Section 3 of the attached <i>CRC214073 Landfill Compliance Review Woodstock Quarries Limited</i> letter, dated 31 May 2021.</p> <p>Please note that the attached questions may be similar or overlap with the questions asked above. Where questions are similar or overlap, please refer in your responses to the above questions to the responses provided for the external engineering design review.</p>
6	ECOLOGY
6.1	<p>It is not clear whether the landscaping bund area and extraction areas B and D have been considered within the AEE.</p> <p>(a) Please confirm if the Ecological Impact Assessment (EIA) has considered the Landscape Bund Area and the Extraction Areas B and D.</p>
6.2	<p>Paragraph 118 of AEE concludes no significant indigenous vegetation or habitats within or near the site and that an ecological assessment (presumably the EIA provided by NZ Ecology) confirms this. However, this is not clear from the EIA. The EIA does note that the structure, composition and extent of habitats were mapped (Section 2.2) for the purposes of the herpetofauna assessment. This may inform the AEE's conclusion.</p> <p>(a) Please provide mapping of vegetation and habitats and an assessment of the ecological significance of vegetation and habitats against Canterbury Regional Policy Statement criteria for ecological significance¹.</p> <p>(b) Please assess the proposal's effects on the ecological values identified by the assessment in (a) above.</p>

¹ Wildland Consultants. 2013. Guidelines for the application of ecological significance criteria for indigenous vegetation and habitats of indigenous fauna and wetlands in Canterbury. Contract Report No. 2289c prepared for Environment Canterbury. Available from council online document library

6.3	<p>Paragraph 13 of AEE notes the confirmation of wetlands by the EIA downstream of the disposal area and concludes that no direct linkage occurs between the current or proposed landfill site with these wetlands. However, the Woodstock Stream would appear linked hydraulically to these wetlands and the EIA notes that this would need confirmation (Section 3.1). The EIA further indicates that wetland vegetation is present within the disposal area of beech dieback.</p> <ul style="list-style-type: none"> (a) Please confirm whether the disposal area within beech die back area is a wetland (EIA, Section 3.1, Figure 6). (b) Please provide an assessment of the hydrological connection between the landfill area (where groundwater is taken, diverted and discharged elsewhere) and confirmed wetland areas. If a hydrological connection exists, please provide an assessment of effects of the proposal in its entirety on these areas.
6.4	<p>It was evident during the site visit that water discharging in the location of the proposed discharge area would likely emanate in the stream below.</p>
6.5	<p>During site visit it was explained that water from Woodstock Stream flows through and around the dug-out pond area near south of the stream vehicle crossing, and that the stream or spills out over the far side of it.</p> <ul style="list-style-type: none"> (a) Please confirm whether the pond will remain in place for future quarry and/or landfill operations. (b) Please confirm whether any the formation and ongoing operation of the pond requires any resource consents. (c) Please provide an assessment of effects of diverting water through the dug-out pond, considering effects on both water quantity and quality.
6.6	<p>Paragraph 120 of the AEE concludes that the proposal will unlikely increase pests in the area due to the proposed landfill not providing a food source or habitat for pest species. However, the EIA recommends a site-specific pest animal survey should be completed to obtain baseline information on the number and diversity of pests present at the site. The pest survey is also part of the proposed conditions.</p> <ul style="list-style-type: none"> (a) Please confirm why the EIA recommends the pest animal survey be completed and whether there is a risk to increase pests at the site although no putrescible and household waste is proposed to be accepted at the landfill. <p>Further, the environmental risk assessment provided with the application states that there is likely to be pests on site and that this could have a moderate impact. A pest control plan is proposed to be implemented if there is an increase in vermin at the site. The pest control measures are also referred to in the proposed conditions; however, it is not clear what these measures entail.</p> <ul style="list-style-type: none"> (b) Please provide the draft pest control plan or a more detailed description of the mitigation and management measures to be put in place in case pest species increase at the site. (c) Please confirm if the pest control plan will align with any existing pest management programme on the adjoining properties.

6.7	<p>The EIA notes that habitat within the expansion area is not suitable for lizards with example of habitat typical of the area shown in Figure 10. While we agree that past vegetation clearance would have altered habitats, there appears to have been grassland habitats prior to scrub/shrubland cover, which may have supported a grass skink population, which can persist within small areas within wider disturbance areas, and then disperse.</p> <p>(a) Please confirm what the level of confidence is for the area shown in Figure 10 not to provide Canterbury grass skink habitat. A further survey may be required to confirm this, or additional information on the survey that has been carried out to confirm the effort was reasonable (i.e. information on survey conditions at the time (temperature, cloud cover, precipitation, previous day conditions, etc.; time spent searching; the extent of search (e.g. track-log); high quality photographs of site incl. geo reference information; etc.).</p> <p>(b) Please provide an assessment of actual and potential adverse effects on the following lizard species as a result of the proposed activities:</p> <ul style="list-style-type: none"> (i) Species listed in EIA: Southern Alps gecko (<i>Woodworthia</i> “Southern Alps”; Not Threatened); McCann’s skink (<i>Oligosoma maccanni</i>; Not Threatened). (ii) Other species potentially present: Canterbury grass skink (<i>Oligosoma polychroma</i> clade 4; At Risk - Declining). (iii) Species less likely to be present but possible: Spotted skink (<i>Oligosoma lineoocellatum</i>; Nationally Vulnerable); Jewelled gecko (<i>Naultinus gemmeus</i>; At Risk - Declining). <p>(c) Please describe any mitigation that will be employed.</p>
6.8	<p>The EIA further recommends a lizard monitoring program is implemented to determine the presence of lizards within the ‘expansion area’ (excluding area shown in Figure 10). Any Lizard Management Plan (LMP) or monitoring plan would entail alignment with a Department of Conservation wildlife permit (an LMP template is available online).</p> <p>(a) Please confirm whether the recommended lizard monitoring programme (e.g. scoping surveys for presence of lizards) will be implemented at the site and whether this will form part of the resource consent conditions.</p> <p>(b) Please confirm whether a copy of the LMP will be sent to Environment Canterbury.</p> <p>(c) Please confirm contingency provisions where LMP outcomes are not met and how this will be addressed in the resource consent conditions.</p>
6.9	<p>The EIA recommends a ‘site-specific Aquatic Monitoring Program for the Woodstock Stream’.</p> <p>(a) Please clarify that the water quality monitoring program aligns with the proposal regarding any dispersion area of water off the quarry/landfill, and capable of detecting adverse effects of the activity on the water resources.</p> <p>(b) Please clarify how the monitoring program will allow management to address detected adverse effects.</p>
7	AIR QUALITY

7.1	<p>The technical review by Tonkin & Tylor Limited of the air quality assessment provided with the application has raised a number of questions in addition to the above.</p> <p>(a) Please provide responses to all question in Section 4 of the attached <i>CRC214073 Landfill Compliance Review Woodstock Quarries Limited</i> letter, dated 31 May 2021, including:</p> <ul style="list-style-type: none"> (i) The extent that gas generation may occur and how potential odorous hydrogen sulphide (H₂S) will be managed; (ii) An assessment of air quality effects associated with the combustion of the generated landfill gas; (iii) An assessment of the Frequency, Intensity, Duration, Offensiveness and Location (FIDOL) prepared in accordance with Schedule 2 of the CARP and the Ministry for the Environment <i>Good Practice Guide for Assessing Odour</i>.
7.2	<p>Questions 1.1 and 1.5 above request further information and an assessment of the discharges of dust from quarrying activities against the relevant CARP rules.</p> <p>(a) If the permitted activity rules cannot be complied with, please provide a full assessment of actual and potential adverse effects of the handling and or storage of bulk solid materials. As raised in the technical review by Tonkin & Tylor Limited (Section 4 – Review of effects on air quality assessment in AEE), this should include a qualitative FIDOL assessment of potential dust effects undertaken in accordance with the Second Schedule of the CARP and the MfE <i>Good Practice Guide for Assessing Dust</i>, taking account of local wind conditions that have the potential to propagate dust discharges from the site.</p> <p>(b) If a resource consent is required, please provide proposed consent conditions that reflect the operation of the quarry in terms of key dust management measures.</p>
8	CONSULTATION
8.1.	<p>The application states that consultation with the Department of Conservation and Mahaanui Kurataiao Limited has commenced.</p> <p>(a) Please provide an update on the outcome of consultation efforts made with the above parties.</p> <p>(b) Please confirm if any other parties such as neighbouring property owners and/or occupiers have been consulted.</p>
9	BOND
5.19	<p>The risk assessment appears to describe the current risks and how these are to be mitigated and controlled while the landfill is operational and within the closure and aftercare stages. However, waste materials will be buried at the site in perpetuity and future risks after the 20 to 30 years of aftercare have not been considered.</p> <p>In most instances, landfills are (partially) owned and operated by local councils or publicly owned entities, which provides some certainty that adverse effects will be addressed even after the aftercare period. A bond is proposed by the applicant to ensure appropriate stewardship and ongoing management of the landfill site in the event of an adverse event</p>

	<p>or default by the consent holder up to the completion of the aftercare period. The bond period will be a minimum of 25 years and can be extended if a risk assessment carried out 25 years after landfill closure indicates that the landfill continues to pose a threat to the environment.</p> <p>To assess the likelihood of the necessity to exercise the bond, further information is needed:</p> <ul style="list-style-type: none"> (a) Please confirm how and by who the site will be monitored and managed post-aftercare period. Please provide more information regarding the extent of monitoring and mitigation necessary post-closure and post-aftercare. (b) Please confirm whether the leachate collection system still remain in place and what the ongoing maintenance and management will be. (c) If the leachate collection system is no longer actively managed following the closure and/or aftercare period, please confirm the risk of the system to create preferential pathways for contaminant transport. (d) Please confirm what the risk of a major liner breach would be post-aftercare (e.g. from a significant earthquake) and what the remedial actions and/or mitigation options would be to address the liner breach. (e) Please confirm what the risk of a major capping layer breach would be post-aftercare (e.g. from a significant earthquake) and what the remedial actions and/or mitigation options would be to address the liner breach. (f) Please confirm the risks of contaminant release from leachate generation due to post-aftercare the liner or cap breach. In doing so, please confirm whether the waste is likely to have stabilised sufficiently to pose a low risk post-aftercare, or whether a liner or cap breach could remobilise contaminants in the now stabilised waste.
9.1.	<p>The technical review by Tonkin and Taylor Limited recommends that the bond conditions be streamlined and updated to provide a tighter scope and better focus on the key issues.</p> <ul style="list-style-type: none"> (a) Please provide updated bond conditions that are line with recent research and development of the principles of landfill bonds elsewhere in New Zealand.

Environment Canterbury
PO Box 345
Christchurch
8140

Attention: Nick Reuther

Dear Nick

CRC214073 Landfill Compliance Review Woodstock Quarries Limited

Tonkin & Taylor Ltd (T+T) has been appointed by Environment Canterbury (ECan) to undertake a compliance review of consent application CRC214073 for a proposed landfill at 513 Trig Road, Woodstock, Oxford, Canterbury, made by Woodstock Quarries Ltd. The compliance review will be used to assist ECan in its assessment of the application.

1 Documents reviewed

The compliance review was undertaken based on the 11 documents sent to T+T via your Onedrive file transfer system on 3 May 2021, list below.

- WQL-ECan Landfill Application.
- Record of Title.
- Drawings.
- Geology Report.
- Hydrogeology Technology Report.
- Engineering Assessment.
- Environmental Risk Assessment.
- Draft landfill Management Plan.
- Rules Assessment Summary.
- Proposed conditions of consent.
- Landfill Rehabilitation Video.

2 Scope of work

The scope of work undertaken was as described by the naming convention and general scope outlined in the email from ECan dated 3 May 2021. The assessment comprised a compliance review to assess the general adequacy of the proposal as detailed in the application and the assessments undertaken by the applicant, with the aim being to determine whether there is sufficient information provided to allow the potential effects of the proposed works to be adequately assessed.

This review is “high level” and is aimed at identifying significant omissions or areas where further information from the applicant may be required, or technical questions that may need further elaboration. Our review is not at the level of a responding officer’s report, or evidence and should not be used in those contexts.

The work included the following specifically requested elements to compliance review level:

- Review findings of the geology report.
- Review of proposed landfill engineering design and confirm adequacy of proposed engineering works.
- Review of environmental risk assessment report and high-level review of bond condition (general adequacy of proposed condition).
- Review of effects on air quality assessment in AEE.
- High level review of AEE to ensure nothing was missed.
- Review of proposed consent conditions and mitigation measures.

The review is split into two main stages as described below.

- **Stage 1: Initial review (this report)**
 - Task 1. High level review by each of our specialist technical services to confirm if additional information is required, and to note initial questions and concerns that we may have of the provided documentation. Due to the time limitations the high-level review was only able to identify fundamental omissions.
 - Task 2. Following the above review, compile a brief letter report summarising our comments, this report.
- **Stage 2: Final assessment and reporting (to be completed at a later date)**
 - Task 1. Review of applicant’s responses, to confirm if adequate additional information has been provided.
 - Task 2. Preparation of a final advice report, highlighting any outstanding technical concerns, comments and recommendation to ECan.
 - Task 3. Review of proposed bond condition and confirm whether the proposed bond condition adequately addresses the risks identified.

The sections that follow set out our initial review of the supporting reports and other documents provided as part of the application for resource consents. The main aim in each case is to confirm the completeness of the information provided and to indicate and whether further information is necessary to enable processing of the application.

A summary of the further information requested is provide in the table in Appendix A.

3 Environmental risk

Waste types and leachate

- 1 The site is intended to accept construction and demolition (C&D) wastes and contaminated soils. Other proposed waste types include Wastewater Treatment Plant (WWTP) sludges and asbestos, both of which are proposed to be accepted under controlled conditions. The site will not accept Municipal Solid Waste (MSW, putrescible waste). Nevertheless, it is implied that some of the wastes accepted may have some putrescible component and the landfill is likely a hybrid between a normal MSW landfill and a dedicated C&D waste fill. This has implications for site management and the design of the landfill containment system, see Section 6 of this report. Can the applicant confirm if this assessment is correct?

- 2 Provided there is adequate control on the levels of organic/inorganic contamination in the industrial wastes and contaminated soils to be accepted, as referred to in the application, then the expectation will be that modest volumes of relatively weak leachate will be produced. Likely these can be dealt with by removal by tanker and leachate recirculation as described in the reports. Hence leachate contamination risk at the site can likely be effectively managed. Appropriate management measures accompanied by a suitable monitoring programme will be necessary to ensure that contaminated soil wastes that are accepted at the site meet relevant criteria and that dilution of contamination by waste mixing on site is avoided. Has this been addressed in the Landfill Management Plan?
- 3 The application indicates that potential adverse effects from the landfill will be less than minimal due to the fully-contained nature of the design and the remote location of the site and absence of nearby sensitive receptors. However, we note:
 - a The applicant has not adequately identified the nearest groundwater or surface water abstraction points to justify this view or adequately defined likely migration flow paths to key down-gradient receptors such as the Waimakiriri River and the plains aquifer system. This is a key adjunct to the engineering containment and leachate quality discussions and should be included in the documentation.
 - b Similarly, the applicant does not appear to consider the presence of adjacent reserve land as being a potential receiving environment. It is noted that this land could be impacted by dust, litter, noise and (possibly) leachate leakage, although the implication in the report is that it will not be impacted as access is constrained by difficult terrain. These possible impacts should be dealt with in the documentation.
- 4 The application does consider the potential for leachate to discharge to groundwater by loss of liner integrity or some other means (e.g., loss of containment of leachate collection storage tanks). However, in our view the monitoring and contingency measures proposed to monitor groundwater quality (as an indicator of leachate breakout) are lacking in detail, lacks a baseline assessment, does not provide an adequate or justified monitoring programme and does not assess a sufficiently broad range of potential contaminants. Similarly, the contingency actions lack detail in terms of how issues would be identified and what remedial options exist. These aspects need to be addressed in the documentation.
- 5 The applicant has not considered the significance of asbestos as a potential contaminant in air (given no cap on asbestos content is proposed). Inappropriate management of asbestos-containing waste could result in effects beyond the site boundary – albeit in an area with limited public access/use. The landfill management plan is lacking in detail regarding how asbestos will be managed and needs to be updated to clarify this.
- 6 It is unclear how containment of activities with the potential to cause contamination will be achieved – for example refuelling/fuel storage, bin storage will not be protected by the active landfill cell. The documentation should be updated to clarify this aspect.
- 7 The applicant proposes to recirculate leachate, but has indicated a possibility that there could be treatment and discharge to land outside of the landfill footprint. This would require additional assessment/justification on behalf of the applicant. If discharge to land is required the documentation should be updated to reflect this.

Broader comments on environmental risk

- 8 A generic risk assessment has been undertaken, broadly following the framework set out in ISO 14001. This is set out in the Environmental Risk register table included as part of Appendix 7. Risks are categorised by the nature of the potential release and Risks are rated based on a desktop assessment, with mitigation then considered. Not unexpectedly, and in line with findings at similar sites including to an extent the Kate Valley landfill within the Canterbury region, the most significant risks to be addressed are:

- a Containment system integrity.
- b Sediment discharges.
- c Landfill fire.

Consideration of the significance of these key risk factors is further assessed below in the context of the site's waste acceptance profile, setting and engineering and operational control measures.

Environmental risk and engineering setting

- 9 The site is physically isolated, with a large separation to neighbouring occupied properties evident from a review of aerial photos. Therefore, the risks associated with management issues such as operations noise, odour, litter and landfill gas are all expected to be low, however the adjacent DOC land could be seen as having an intrinsic sensitivity. Landfill gas (LFG) generation is also expected to be low given the waste types proposed to be collected, and in addition an appropriate LFG control system is allowed for in the design.
- 10 The site is steep-side and is located within the greywacke foothills of the southern alps, up-gradient of the extensive Canterbury Plains alluvial groundwater system. The site is in a relatively high seismic risk environment, but as is the case at Kate Valley, engineering can largely mitigate this risk other than for circumstances where a direct fault rupture occurred within the actual landfill footprint, or the liner system fails for other reasons.
- 11 The site is located in an environment that is subject to strong north-westerly winds at times, and with a relatively low annual rainfall (<1000 mm/yr). The site will experience dry and windy periods over the summer months and will accept a significant proportion of C&D wastes: hence consideration of landfill fire risk is relevant.

Operational risk factors

- 12 As is the case at most C&D waste dominant landfill sites, the greatest operational risk is expected to be fire. The waste mass is forecast to be dominated by C&D waste, with a significant proportion of waste timber. Hence the biggest risk to the site, in terms of both the containment system and the potential for off-site risk, is likely to be a significant landfill fire (either on the surface or deep seated).
- 13 A significant fire at the site could result in discharges of smoke and contaminated surface water, as well as potentially compromising the liner system, particularly the geosynthetic components. A wider-spread fire originating from a blaze on site is also possible. The Landfill Management Plan should therefore include specific fire management and control measures. One key measure to be incorporated in the design, is the use of a cellular filling pattern with soil bunds separating zones of filling to limit the spread of any fire in woody waste materials. Also, the filling sequence should avoid the incorporation of any wood waste in the bunds themselves and ensure that no waste containing wood, plastic or other potentially combustible materials is placed within 5 m of the liner.

Sediment discharge

- 14 Sediment is to be managed through the implementation of erosion and sediment controls, and by the channelling of stormwater into a settlement pond system before being discharged to land. Stormwater discharge will need to be managed such that channels are not created/soils exposed to erosion by the concentration of stormwater flow, which could result in sediment discharge and slope stability issues. The suitability of this system is largely dependent on the long-term maintenance of the sediment ponds so that they remain effective, including monitoring and maintenance procedures. The reports all refer to a site-

specific erosion and sediment control plan being prepared for each stage of work, how will long term maintenance and monitoring be managed?

Landfill bond

- 15 The imposition of a landfill Bond is appropriate. Given the site's risk profile, this should address both operational risks (essentially firefighting), as well as closure and aftercare costs. The Bond condition currently proposed derives from the Kate Valley Bond condition. Some of this wording can be used as many of the clauses are relevant. However, we suggest that in line with recent research and development of the principles of such Bonds elsewhere in New Zealand, the condition can now be streamlined and updated somewhat to provide a tighter scope and better focus on the key issues. The recently proposed Auckland Regional Landfill Bond structure is appropriate, with a strong focus in this case on landfill fire risk being a key consideration during the operating phase. The cost of early closure and aftercare could be assessed in the same way as is proposed at ARL.

4 Review of effects on air quality assessment in AEE

- 16 The site proposes receiving C&D wastes (including gypsum containing wall board), and under some conditions may receive organic wastes in the form of municipal wastewater treatment plant sludges (as described above). Accordingly, it is possible that the site will give rise to the production of landfill gas, including odorous hydrogen sulphide (H₂S). The proposal includes provision for the installation of a gas collection system with the control of the landfill gas through either flaring or firing of the gas in a generator. This is appropriate, although it is unclear to what extent gas generation may occur and further clarification should be sought in this regard including how the potential H₂S will be managed.
- 17 No assessment of air quality effects associated with the combustion of the generated landfill gas has been provided. However, we consider the potential adverse effects of combustion emissions are likely to be very low given:
 - a The significant separation distances to the nearest sensitive receiver (2.3 km).
 - b The proposed controls and draft resource consent conditions proposed by the Applicant covering waste acceptance criteria, odour control and daily cover, landfill gas collection, monitoring and destruction.
 - c Based on our experience with air quality assessments of LFG combustion for much larger municipal landfills where there is a high rate of LFG generation.
- 18 Overall, the risk of odour impacts at the location of sensitive receivers is expected to be low given the isolated location of the proposed landfill and significant separation distances to the nearest houses (in the order of 2.3 km). However, these impacts require an assessment of the Frequency, Intensity, Duration, Offensiveness and Location (FIDOL) that should be prepared in accordance with Schedule 2 of the Canterbury Air Regional Plan (CARP) and the Ministry for the Environment (MfE) Good Practice Guide for Assessing Odour. This should include consideration of meteorological exposure for the nearest sensitive receptors, taking into account any downslope drainage flows from the landfill location.
- 19 The application describes the continued quarrying of aggregate. However, details of the quarry operation are not provided, nor assessed in terms of rule requirements of the CARP. Discharges to air from quarry operations typically require a resource consent to discharge to air under the CARP, depending on their annual extraction rate, processing plant capacity (t/hr) and stockpile storage volumes. Accordingly, details of the proposed quarry operation should be provided and reviewed against the rule requirements of the CARP to confirm whether consent is required for this activity. If consent is required, the application should provide a qualitative FIDOL assessment of potential dust effects undertaken in accordance with the Second Schedule of the CARP and the MfE Good Practice Guide for Assessing Dust. This

should take account of local wind conditions that have the potential to propagate dust discharges from the site. If consent is required, consent conditions should also reflect the operation of the quarry in terms of key dust management measures.

5 Geology

Overall Comment on the Geology Report

The Geology report provides an appropriate level of investigations, drawing on rock exposures in the existing quarry and on current knowledge of the seismic hazard. It has been prepared by an appropriately qualified person with extensive experience in engineering geology. Appropriate kinematic analysis has been carried out on the likely rockfall mechanisms from the proposed cut rock slopes. Consequently, the geology report forms a sound basis for providing inputs to the design of the landfill. Our comments on the report address the following perceived issues:

- a Apparent inconsistencies between sections of the report or with the wider application.
- b Concerns about the proposed highwall cut profile, the proposed 2 m bench width and implications for “safety in design” in terms of controlling rockfall.
- c Long-term maintenance of the landfill drainage system to prevent the uncontrolled build-up of groundwater within the landfill body.
- d Long-term maintenance of the capping layer as the landfill body settles over time.
- e The practicality of building some of the drainage related geotechnical details shown on the design drawings.

The specific comments from the review are listed below.

Specific Comments on the Geology Report and Geotechnical Details on the Drawings

- 20 Section 31 of the AEE application notes that there will be large areas of artesian water pressures under the liner, which will require an underdrain system. In the Geology Report Figure 13 it shows water filling the quarry to unknown depth, indicating that the pit void is not self-draining and there is the potential for water to build up in the landfill materials if drainage is ineffective. Has the impact of artesian water pressures on the proposed liner system, if the under-drainage system malfunctions post-closure, been evaluated in terms of containment of contaminants and long-term stability of the landfill body?
- 21 Section 62 of the AEE application states that fresh greywacke would be suitable for use as a low permeability liner and for capping or drainage layers. This is unlikely to be the case. Possibly the author should be referring to the overlying weathered greywacke which is likely to be more soil-like and may prove suitable as a low permeability layer? Fresh greywacke material is likely to be a crushed rock and to form a high permeability product, which would also not be compatible with the proposed geosynthetic liners.
- 22 Several sections of the report suggest that the proposed bench with of 2 m in the cut highwalls may prove insufficient to control the release of rockfall from a safety perspective. Those sections of the report referring to the cut slope design and require clarification of amendment are provided below:
 - a The Geology report, Figure 6, shows greywacke bedding, which the caption states is dipping “approximately 40-45 degrees to the right” into the face with conjugate joints dipping at 45-50 degrees into the pit. This seems at variance with statements in Section 3.1.3 of the report where the bedding dip is “(commonly > 80°)” which would give a conjugate joint set dip set of 10 degrees. Drawing 02 and 03 in Appendix 2 show cut slopes on the section that are much steeper than 45 degrees with minimal bench width. Figure 13 in the Geology report shows cut batter slopes in fresh greywacke that

appear to be dictated by the bedding angles. Later comment suggests the issue of the cut highwall designs needing further work to confirm the proposed design profiles in each wall. As the angle that the slopes can be cut at is key to landfill airspace, stability and operations, this aspect requires clarification.

- b In Section 5.5 of the Geology Report the first paragraph states that the quarry walls will be cut at an unstated angle (presumably dictated by rock defect dip in each wall) with 10 m high inter-bench heights and a 2 m bench. Firstly, this gives an overall angle of 79 degrees which is steeper than the Joint sets J1 and J3 in Table 1 of the Geology report and those shown in Figure 6. Depending on wall vs Joint orientation rock blocks underlain by J1 and J3 will daylight in the proposed cut face and are likely to be unstable as indicated in Appendix C. This could lead to local cut slope failure and represent a danger of rockfall to site staff. Has this risk been considered in the selection of bench width design?
 - c The cross-sections in Drawing B4 illustrate the proposed cut wall slopes. The scale is uncertain but one of the cut walls may be 80 m high if the height intervals are 10 m. This highlights the potential safety issue and the need to ensure the rockfall risk is adequately managed for staff safety. One example from open cast NZ coal mines, is the use of a highwall profile with a 15 m inter-bench height and 8 m bench width to manage rockfall and to provide maintenance access. This gives an overall wall angle of 62 degrees. This angle may better manage both wedge and toppling failure types at Woodstock.
 - d The kinematic analyses of the joints and cut slope interactions presented in Appendix C of the Geology report highlight that a high number of failure possibilities for the East and South wall for both wedge sliding and toppling failure modes reinforcing the importance of a sound design cut profile.
- 23 Overall, considering the above points, the applicant should either reconsider or further justify the proposed cut slope profile, particularly with respect to the design cut slope angles and 2 m inter-bench width to ensure consistency with the geological defect orientations, the adequacy of the proposed bench width and its ability to control rockfall from a safety perspective.
- 24 Is the stripped overburden material stockpiled around the quarry area an instability threat to the landfill, and to the safety of people working in the pit area?

6 Landfill engineering design

The application is for a landfill for the disposal of predominantly C&D waste and contaminated soils. The details of the waste acceptance described are consistent with a Class 2 Landfill as described in the WasteMINZ Technical Guidelines for Disposal to Land (the Guidelines). The proposal as described is generally consistent with the requirements for a Class 2 Landfill as described in the Guidelines which require that the landfill be sited in areas of appropriate geology and have an engineered liner, leachate collection system, groundwater and surface water monitoring and may include a landfill gas collection system where gas will be produced.

Lining system

In relation to the lining system we suggest the following clarifications are required:

- 25 The applicant should provide a clear statement of the key design performance objectives and how these will be met by the design. This needs to include the rationale for the level of containment required for the landfill and how this will be achieved and should address the location, the nature of the underlying geology and potential receptors of any leachate leakage. The Engineering Technical Report describes a Type 1 landfill lining system as a baseline. It needs to be clearly stated why this is considered necessary in relation to risks

- posed by the landfill. Specific comment should be provided with reference to Section 4.4, Geology, of the WasteMINZ Technical Guidelines.
- 26 The report describes two possible lining systems that could be used at Woodstock. Lining system A comprises two polymer coated GCLs with 300 mm of low permeability compacted clay between. Please specify the target permeability for the compacted clay layer, and evidence that the selected permeability could be achieved in this situation without damage to the underlying GCL. Please provide details of examples of where such a lining system has been used successfully.
 - 27 Lining system B comprises 1.5 mm HDPE overlying a polymer coated GCL over compacted general fill. The section on Drawing B4 showing progressive filling of the waste shows a steep fill face, drawn at a slope of 45 degrees and in the order of 40 m high. Please provide details of:
 - a The expected interface friction angle between the HDPE and the polymer coating on the GCL.
 - b How the front face of the fill will be managed (slope, height, etc), recognising the relatively low interface friction surface in the lining system.
 - c Demonstration (calculations) that the internal fill slope shown on Drawing B4 will be stable, particularly given the expected low interface friction surface on the base of the landfill.
 - 28 The lining systems described differ from the lining systems recommended in the WasteMINZ Technical Guidelines for a Class 2 landfill or a Class 1 Landfill. Please provide evidence that these alternatives are equivalent to the recommended lining systems for Class 2 or provide a rationale as to why they don't need to be. As part of this, it should be clarified what lining standard is being targeted (Class 1 or Class 2) and why.
 - 29 Section 4 of the Engineering Technical Report only describes proposed lining systems A or B. However, on inspection of the drawings it becomes clear that these lining options are only proposed for the floor of the landfill and that no lining system is proposed on the side slopes. This third option (side slopes) also needs to be described under lining systems with suitable technical justification as to why the sidewall lining system that is proposed is considered appropriate in the context of the landfill Class and the performance being targeted. This should also deal with the weathered and unweathered section of the subgrade that will be exposed during the quarrying.
 - 30 The geological report describes a high groundwater level surrounding the landfill. Please provide details of the expected groundwater inflow through the unlined side slopes of the landfill and the expected impact of this on the liner system, leachate containment, leachate quantities and the overall design of the leachate management system.
 - 31 No leachate leakage calculations have been provided. Both the quantity and quality of leachate seepage are important inputs to determining the potential effect of operating a landfill at this location. We would expect to see identification of receptors and contaminant transport modelling as part of the application, but this is not evident in the documents reviewed. (Note, review of the hydrogeological report is outside our scope).
 - 32 There is no information provided regarding the seismic performance of the landfill, particularly in the partially filled condition as discussed in Item 2c. The application must adequately define the seismic environment and the level of ground shaking to be provided for in the design. The Engineering Report then needs to describe how the design accommodates this identified seismic conditions. This is particularly relevant for interim filling scenarios like the one shown in Drawing B4.

Leachate collection system

- 33 Section 4.5 point 1 describes lining systems having a grade no less than 1.4%. Section 4.2.2 states that the minimum longitudinal floor slope will be 2%. Please clarify what is proposed, recognising that international best practice is typically based on a minimum grade of 2%.
- 34 On the side slopes Drawing C02 Section D01 and Drawing C03, Section K01 shows the fill placed at a slope of approximately 4V:1H with drainage aggregate placed between the fill and the quarry wall. How will it be possible to place the 500 mm minimum thick free draining layer as the waste will not be able to stand at the angle shown until the drainage layer can be placed? The waste is likely to ravel or slip into the void left for the drainage material, requiring it to be re-excavated. Please also provide information regarding how any leachate collected in the drainage layers against the side wall will be drained from the landfill.
- 35 There is no filtration/separation geotextile layer shown between the waste and the leachate collection layer on the base of the landfill and up the side slopes. Any leachate flow will tend to carry fines from the waste into the drainage layer and cause physical clogging, which will eventually prevent the layer from providing a drainage path for leachate, causing a build-up of leachate in the landfill and potentially leading to short term stability issues and long-term capping settlement and groundwater contamination issues.
- 36 Drawing C03, Section K01 shows leachate drainage aggregate placed on a steep slope (approx. 1V:1.5H) at the toe of the side wall. Please provide details of how this will be achieved as veneer stability calculations are likely to show that this layer will not be stable on this slope.

Final Cap

- 37 Capping details are shown on Drawing 24734/02, however no dimensions (thicknesses) are shown to allow for technical evaluation. The clay layer is specified with a permeability of 2.5×10^{-10} m/s. Given that there is likely to be a condition that requires the design to be in accordance with the application, is the applicant happy that this permeability be the specified permeability for the cap? In conjunction with the leakage calculation described in Item 5 above, what cap details have been assumed in the leakage modelling?

Stormwater treatment

- 38 Please provide details of the basis for sizing of the stormwater treatment ponds, and the expected performance of these ponds. What sediment load from the site has been used for determining downstream effects?
- 39 Section 7.4.2 states that water for dust suppression will be sourced primarily from the sedimentation ponds on site. Please advise the design demand for water for dust suppression and demonstrate that this quantity of water will be available from the ponds.

Leachate management

- 40 Section 6.1.4 notes that an evaporator may be used for leachate disposal. Please confirm whether this consent application includes a leachate evaporator, with associated assessment of effects, or whether you propose that this will be subject to a separate application at a later date.

Landfill gas management

- 41 Similar to the above, Section 5 notes that LFG destruction will be achieved using a flare or electricity generation. Please confirm whether both of these options are included in this application.

Conditions

- 42 We would expect to see consent conditions that specify the key components of the landfill including the lining system, capping and leachate collection. Currently, a condition requires that detailed designs are forwarded to Canterbury Regional Council. A review/approval process also needs to be specified and consideration given to appointing a peer review panel to provide an overview of the landfill design and operation on behalf of Canterbury Regional Council.

7 Site visit

A site walkover by T+T representative P. Abernethy of the proposed landfill area with ECan representatives was held on 27 May 2021. Any further points that require clarification following from the site visit will be included in the Stage 1 summary table to follow.

8 Applicability

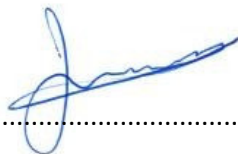
The sole purpose of this report and the associated services performed by T+T is to undertake a limited review of, and comment on, the documents listed in Section 1 of this letter ("Reports") prepared by Scope Resource Management Limited ("Principal Consultant") in accordance with the scope of services set out in the contract between Environment Canterbury (ECan) and T+T. That scope of services, as described in this letter, was developed with ECan.

T+T's compliance review is a form of peer review, undertaken on a level-of-effort basis, to provide comment to assist the ECan in its decision making in relation to the Report's compliance with the requirements specified in the scope of services. The responsibility for the Reports remains fully with the Principal Consultant and T+T's review does not constitute a means by which that responsibility can be passed on to T+T. This letter has been prepared on behalf of, and for the exclusive use of, T+T's client, ECan, and is subject to, and issued in accordance with, the provisions of the contract between T+T and the ECan. T+T accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by :



Jonathan Shamrock
Senior Civil/Environmental Engineer

Reviewed by:



Tony Kortegast
Executive Leader - Strategic Projects

Approved by



Tim Morris
Project Director

JOSH

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Appendix A: Request for information summary

Date: 31 May 2021
Project Name: Woodstock Quarries
Application No: CRC214073
TT Job No: 1016234

1 Comments and Responses

Tonkin & Taylor Ltd (T+T) has been appointed by Environment Canterbury (ECan) to undertake a compliance review of consent application CRC214073 for a proposed landfill at 513 Trig Road, Woodstock, Oxford, Canterbury, made by Woodstock Quarries Ltd. The compliance review will be used to assist ECan in its assessment of the application

The compliance review was undertaken based on the 11 documents sent to T+T via your Onedrive file transfer system on 3 May 2021, list below.

- WQL-ECan Landfill Application.
- Record of Title.
- Drawings.
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- Engineering Assessment.
- Environmental Risk Assessment.
- Draft landfill Management Plan.
- Rules Assessment Summary.
- Proposed conditions of consent.
- Landfill Rehabilitation Video.

The sections that follow set out our initial review of the supporting reports and other documents provided as part of the application for resource consents. The main aim in each case is to confirm the completeness of the information provided and to indicate and whether further information is necessary to enable processing of the application.

Item	Comment	Response
1	The provided information indicates that some of the waste accepted may have some putrescible component and the landfill is likely a hybrid between a normal MSW landfill and a dedicated C&D waste fill. Can the applicant confirm if this assessment is correct? Or provide clarification of the waste types.	
2	The monitoring and contingency measures proposed to monitor groundwater quality (as an indicator of leachate breakout) are lacking in detail, lack a baseline assessment, does not provide an adequate or justified monitoring programme and does not assess a sufficiently broad range of potential contaminants. Please provide information to resolve these matters.	
3	The applicant does not appear to consider the presence of adjacent reserve land as being a potential receiving environment. It is noted that this land could be impacted by dust, litter, noise and (possibly) leachate leakage. Please provide information to justify how the adjacent land will not be adversely affected.	
5	The applicant has not considered the significance of asbestos as a potential contaminant in air. The landfill management plan is lacking in detail regarding how asbestos will be managed. Please provide an updated landfill management plan containing sufficient information to demonstrate how asbestos will be managed.	
6	It is unclear how containment of activities with the potential to cause contamination will be achieved – for example refuelling/fuel storage, excess leachate volume, bin storage area. Please provide information to resolve these matters	
7	Reporting and the site walkover discussed a bin lay down area. Please provide further detail and drawings of the proposed bin lay down area, including detail of how any generated stormwater, or leachate, dust will be managed.	
8	The applicant proposes to recirculate leachate, but has indicated a possibility that there could be treatment and discharge to land outside of the landfill footprint. Please provide further information to clarify this process, proposed treatment and discharge locations along with assessment/justification of how adverse effects will be controlled.	

9	<p>As is the case at most C&D waste dominant landfill sites, the greatest operational risk is expected to be fire. We do not believe the current The Landfill Management Plan adequately addresses this. Please update to include specific fire management and control measures.</p>	
10	<p>The suitability of the erosion and sediment control system is largely dependent on the long-term maintenance of the sediment ponds and collection system so that they remain effective, including monitoring and maintenance procedures. The reports all refer to a site-specific erosion and sediment control plan being prepared for each stage of work, please provide further detail on how the long-term maintenance and monitoring be managed? Including post closure.</p>	
11	<p>The landfill Bond should address both operational risks (essentially firefighting), as well as closure and aftercare costs.</p> <p>The current Bond condition currently proposed derives from the Kate Valley Bond condition. Some of this wording can be used as many of the clauses are relevant. However, we suggest that in line with recent research and development of the principles of such Bonds elsewhere in New Zealand, the condition can now be streamlined and updated somewhat to provide a tighter scope and better focus on the key issues. The recently proposed Auckland Regional Landfill (ARL) Bond structure is appropriate, with a strong focus in this case on landfill fire risk being a key consideration during the operating phase. The cost of early closure and aftercare could be assessed in the same way as is proposed at ARL.</p>	
12	<p>The site proposes receiving C&D wastes (including gypsum containing wall board), and under some conditions may receive organic wastes in the form of municipal wastewater treatment plant sludges. Accordingly, it is possible that the site will produce landfill gas, including odorous hydrogen sulphide (H₂S).</p> <p>The proposal includes provision for the installation of a gas collection system with the control of the landfill gas through either flaring or firing of the gas in a generator.</p> <p>Please provide clarification as to what extent gas generation may occur including how the potential H₂S gas will be managed.</p>	

13	In order to quantify the risk of odour impacts a Frequency, Intensity, Duration, Offensiveness and Location (FIDOL) assessment should be prepared in accordance with Schedule 2 of the Canterbury Air Regional Plan (CARP) and the Ministry for the Environment (MfE) Good Practice Guide for Assessing Odour. This should include consideration of meteorological exposure for the nearest sensitive receptors, taking into account any downslope drainage flows from the landfill location.	
14	As the quarry will be operating concurrently with the landfill operations, details of the proposed quarry operation should be provided and reviewed against the rule requirements of the CARP to confirm whether consent is required for this activity. If consent is required, the application should provide a qualitative FIDOL assessment of potential dust effects undertaken in accordance with the Second Schedule of the CARP and the MfE Good Practice Guide for Assessing Dust. This should take account of local wind conditions that have the potential to propagate dust discharges from the site. If consent is required, consent conditions should also reflect the operation of the quarry in terms of key dust management measures	
15	<p>Section 31 of the AEE application notes that there will be large areas of artesian water pressures under the liner, which will require an underdrain system. In the Geology report Figure 13 it shows water filling the quarry to unknown depth, indicating that the pit void is not self-draining and there is the potential for water to build up in the landfill materials if drainage is ineffective.</p> <p>Please provide clarification on how the impact of artesian water pressures, or high ground water conditions, on the proposed liner system has been addressed, including if the under-drainage system malfunctions post-closure, in terms of containment of contaminants and long-term stability of the landfill body?</p>	
16	<p>Section 62 of the AEE application states that fresh greywacke would be suitable for use as a low permeability liner and for capping or drainage layers. This is unlikely to be the case. Possibly the author should be referring to the overlying weathered greywacke which is likely to be more soil-like and may prove suitable as a low permeability layer?</p> <p>If fresh angular greywacke material is proposed for use please clarify how the geosynthetic liner product will be protected from this angular rock material.</p>	

17	The geology reporting highlights the risk of rockfall both small and large scale. Please provide further clarification on how this will be managed in terms of landfill worker safety, overall slope stability, adopted benching profiles and protection of the landfill liner.	
18	Weathered rock is located above the hard greywacke rock, however proposed excavation profiles do not appear to take into consideration this weather rock with the same 10 m high 2 m width benching profiles adopted. Please provide technical justification and analyse for this design.	
19	The stripped overburden material is to be stock piled on site for use as capping material. Please provide clarification of the expected volume, location and that adequate safe stockpile locations have been allowed for as part of the site design.	
20	The applicant should provide a clear statement of the key design performance objectives and how these will be met by the design. This needs to include the rationale for the level of containment required for the landfill and how this will be achieved and should address the location, the nature of the underlying geology and potential receptors of any leachate leakage. The Engineering Technical Report describes a Type 1 landfill lining system as a baseline. It needs to be clearly stated why this is considered necessary in relation to risks posed by the landfill. Specific comment should be provided with reference to Section 4.4, Geology, of the WasteMINZ Technical Guidelines.	
21	The report describes two possible lining systems. Lining system A comprises two polymer coated GCLs with 300 mm of low permeability compacted clay between. Please specify the target permeability for the compacted clay layer, and evidence that the selected permeability could be achieved in this situation without damage to the underlying GCL. Please provide details of examples of where such a lining system has been used successfully.	

22	<p>Lining system B comprises 1.5 mm HDPE overlying a polymer coated GCL over compacted general fill. The section on Drawing B4 showing progressive filling of the waste shows a steep fill face, drawn at a slope of 45 degrees and in the order of 40 m high. Please provide details of:</p> <ul style="list-style-type: none"> a The expected interface friction angle between the HDPE and the polymer coating on the GCL. b How the front face of the fill will be managed (slope, height, etc), recognising the relatively low interface friction surface in the lining system. c Demonstration (calculations) that the internal fill slope shown on Drawing B4 will be stable, particularly given the expected low interface friction surface on the base of the landfill. 	
23	<p>The lining systems described differ from the lining systems recommended in the WasteMINZ Technical Guidelines for a Class 2 landfill or a Class 1 Landfill. Please provide evidence that these alternatives are equivalent to the recommended lining systems for Class 2 or provide a rationale as to why they don't need to be. As part of this, it should be clarified what lining standard is being targeted (Class 1 or Class 2) and why.</p>	
24	<p>Section 4 of the Engineering Technical Report only describes proposed lining systems A or B. However, on inspection of the drawings it becomes clear that these lining options are only proposed for the floor of the landfill and that no lining system is proposed on the side slopes.</p> <p>This third option (side slopes) also needs to be described under lining systems with suitable technical justification as to why the sidewall lining system that is proposed is considered appropriate in the context of the landfill Class and the performance being targeted in terms of expected leakage rates. This should also take into consideration the weathered and unweathered section of the side slopes that will be exposed during the quarrying.</p>	
25	<p>The geological report describes a high groundwater level surrounding the landfill. Please provide details of the expected groundwater inflow through the unlined side slopes of the landfill and the expected impact of this on the liner system, leachate containment, leachate quantities and the overall design of the leachate management system.</p>	

26	<p>No leachate leakage calculations have been provided for the landfill liner system. Both the quantity and quality of leachate seepage are important inputs to determining the potential effect of operating a landfill on the surrounding environment.</p> <p>Please provide details of leachate leakage calculations, identified receptors and contaminant transport modelling as part of the application.</p>	
27	<p>There is no information provided regarding the seismic performance of the landfill site.</p> <p>Please provide detail of the seismic environment and the level of expected ground shaking to be provided for in the design. Additionally, describe how the design accommodates the identified seismic conditions and any associated ground movement. This is particularly relevant for interim filling scenarios like the one shown in Drawing B4.</p>	
28	<p>Section 4.5 point 1 describes lining systems having a grade no less than 1.4%. Section 4.2.2 states that the minimum longitudinal floor slope will be 2%. Please clarify what is proposed, recognising that international best practice is typically based on a minimum grade of 2%.</p>	
29	<p>File 24734 Drawing 02A Section D01 and Drawing 03, Section K01 shows the fill placed at a slope of approximately 4V:1H with drainage aggregate placed between the fill and the quarry side wall.</p> <p>Please provide further clarification on how this will be constructed.</p> <p>Please also provide information regarding how any leachate collected in this drainage layers against the side wall will be drained from the landfill.</p>	
30	<p>The leachate drain systems does not appear to provide adequate protection from fine grain material, that can lead to physical clogging and which will eventually prevent the layer from providing a drainage path for leachate, causing a build-up of leachate in the landfill and potentially leading to short term stability issues and long-term capping settlement and groundwater contamination issues.</p> <p>Please provide technical justification for this design.</p>	
31	<p>Drawing C03, Section K01 shows leachate drainage aggregate placed on a steep slope (Approx. 1V:1.5H) at the toe of the side wall. Please provide details of how this will be achieved along with any support stability calculations.</p>	

32	<p>Capping details are shown on File 24734 Drawing 02, however no dimensions (thicknesses) are shown to allow for technical evaluation. Please provide the proposed capping dimensions and layer material types.</p> <p>The clay layer is specified with a permeability of 2.5×10^{-10} m/s. Given that there is likely to be a condition that requires the design to be in accordance with the application, please confirm that this permeability be the specified permeability for the clay cap material?</p> <p>In conjunction with the leakage calculation described in Item 26 above, what cap infiltration details have been adopted in the leakage modelling.</p>	
33	<p>Please provide details of the basis for sizing of the stormwater treatment ponds, and the expected performance of these ponds. What sediment load from the site has been used for determining downstream effects?</p>	
34	<p>Section 7.4.2 states that water for dust suppression will be sourced primarily from the sedimentation ponds on site. Please advise the design demand for water for dust suppression and demonstrate that this quantity of water will be available from the ponds, including consideration of seasonal conditions.</p>	
35	<p>The proposed stormwater dispersion zone is located in steep terrain, with the potential for overland flow into the down gradient stream. Please clarify how surface erosion will be managed.</p>	
36	<p>The site walkover discussed a low permeability borrow area for final capping material. Please provide a drawings outlining the proposed borrow area including final profiles, expected volume and supporting laboratory data to confirm the suitability of this material.</p>	
37	<p>Section 6.1.4 notes that an evaporator may be used for leachate disposal. Please confirm whether this consent application includes a leachate evaporator, with associated assessment of effects, or whether you propose that this will be subject to a separate application at a later date. .</p>	
38	<p>Section 5 notes that LFG destruction will be achieved using a flare or electricity generation. Please confirm whether both of these options are included in this application.</p>	

39	We would expect to see consent conditions that specify the key components of the landfill including the lining system, capping and leachate collection. Currently, a condition requires that detailed designs are forwarded to Canterbury Regional Council. A review/approval process also needs to be specified and consideration given to appointing a peer review panel to provide an overview of the landfill design and operation on behalf of Canterbury Regional Council.	
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