



05 October 2020

Bruce Halligan
Principal Consents Officer
Environment Southland
Private Bag 90116
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Our ref: 12533703//

Your ref:

Dear Bruce

AB Lime Landfill - RMA Consent Consent Application Geotechnical Peer Review- Section 92 Responses

1 Introduction

GHD Ltd has been engaged by Environment Southland to undertake technical peer review of the Resource Consent Application APP-20202200 , APP -205862-01-V2 by AB Lime Ltd. The application is seeking new consents with a key element being removal of the cap on annual waste volume of 100,000 tonnes per year and to facilitate receiving waste from across the South Island. AB Lime is not proposing to change the footprint, the final volume, or capacity of the landfill. The changes effective through this consent will allow the landfill to be filled at an increased rate, should AB Lime choose to do so.

2 Scope of work

The agreed scope of work is to provide technical peer Review of Resource Consent Application APP-20202200 , APP -205862-01-V2 by AB Lime, and provision of written feedback and recommendations as to whether the content of the document is technically robust and comprehensive, and whether any additional information is required.

This technical review focuses on the following elements of the application document:

- Geotechnical information included in the application
- Seismic information included in the application
- Supporting draft management plan content relevant to the above elements
- Feedback on draft conditions proposed as part of the application relevant to the above elements

The GHD review shall be framed and presented suitable for inclusion in a report to decision makers and on the basis that all relevant content is likely to be disclosable in accordance with the relevant provisions of the Local Government Official Information and Meetings Act 1987.

We note that Riley Consultants have been engaged to undertake a review with a landfill engineering focus. At the request of the applicant, GHD and Rileys have agreed not to overlap review effort for the geotechnical component of landfill engineering. The GHD geotechnical focus is:-

- Geotechnical investigations

- Karst geology and limestone
- Foundation conditions and remediation
- Slope stability (except the open landfill working face and capping)
- Groundwater and hydrogeology – groundwater underdrains
- Seismic assessment
- Geotechnical aspects of construction

The GHD review which included Section 92 questions was issued on 20 July 20 to Environment Southland and was combined with section 92 requests from the other technical specialists. This was forwarded to AB Lime in August 2020 and the response was provided in a combined response document dated 2 September 2020.

This letter presents GHD's review of the section 92 responses and final review conclusions on the consent application.

3 Documents Reviewed

This review is based on the following documentation:

- AB Lime Limited Resource Consent Application. Resource Consent Application to Southland District Council and Environment Southland. Prepared By Jacobs Dated 29 May 2020 Ref IZ000400-LFC-NP-RPT-0001 | 1.
- AB Lime Limited Resource Consent Application. Resource Consent Application to Environment Southland. Prepared By Jacobs Dated 2 September 2020 Ref IZ000400-LFC-NP-RPT-0006 | 1

In addition, GHD has been provided access to historic documents held by Council from 2014 to 2020 via the Objective Connect work space.

4 Section 92 Information Requests and commentary

The basis for many of the GHD queries (GHD letter to Environment Southland dates 20 July 20) was to gain an understanding of the expected groundwater regime post closure and the need for underdrainage on the side walls as groundwater recharges. The Section 92 response has provided the original (2002) detailed groundwater assessment in support of the response. This has provided much needed background on the expected groundwater behaviour and has provided a strong technical basis for the question responses.

The discussion below provides commentary and closure to the geotechnical and seismic engineering Section 92 queries.

1. **Section 92 question:-**Please provide a groundwater recharge model post closure of the landfill and a discussion of how the groundwater flows through the limestone e.g. defect and bedding controlled, in order to establish the behaviour of groundwater in the limestone once the landfill is complete and to support an understanding of the need for side wall underdrainage.

GHD Commentary:- A groundwater recharge model has not been provided. However, the Geology and Hydrogeological Report dated June 2002 by Sinclair Knight Merz indicates that the final landfill with its low permeability liner, capping, and leachate collection system will create a shadow effect for rainfall infiltration into the limestone. This suggests that there will be reduced rainfall recharge in the vicinity of the landfill. As a result the post closure groundwater levels are expected to be beneath the existing quarry floor.

We consider this to be suitable justification for no or minimal side wall underdrainage.

There is no outstanding Section 92 issue.

2. **Section 92 question:-**In view of the outcomes of query 1) above, please provide details of how groundwater underdrainage on the side walls will be addressed if it is shown that recharge will impact the side walls in order to ensure that there will be adverse impact on the liner.

GHD Commentary:- This has been adequately addressed in question 1 above.

There is no outstanding Section 92 issue.

3. **Section 92 question:-**Please provide an up to date groundwater draw down zone of influence assessment and an assessment of effects related to this zone of influence in order to ensure that the drawdown zone of influence has no adverse effect outside of the property boundary.

GHD Commentary:- The Geology and Hydrogeological Report dated June 2002 by Sinclair Knight Merz indicates that the drawdown impact will extend to about 750m from the site. As this information was available for the original consent application and the consent was issued with this impact identified and understood, GHD agrees that the proposed change in landfilling rates will not result in any change in this impact.

There is no outstanding Section 92 issue.

4. **Section 92 question:-**Please provide a methodology on how the groundwater draw down zone of influence will be monitored over time, in order to ensure that the potential for adverse effects is being addressed.

GHD Commentary:- Given the information presented in the Geology and Hydrogeological Report dated June 2002 by Sinclair Knight Merz around drawdown and impact, GHD agrees that the proposed change in landfilling rates will not result in any change in this impact.

There is no outstanding Section 92 issue.

5. **Section 92 question:-**Please provide the technical specification for area 15 in order for this reviewer to review the details of karst remediation specifics.

GHD Commentary:- GHD acknowledges that Area 15 is currently consented. However the intent of the question was to use this area as an example of how karst discovery is treated and remediated. The requested document has been provided and there are no further concerns.

No further information is required.

6. **Section 92 question:-**Please amend drawings 1017 and 1018 to consistently show the requirements of underdrainage for the side wall. In the event that a review of the recharge model and the likely groundwater impact of the side wall liner, please amend the drawings to consistently show any revised design.

GHD Commentary:- GHD acknowledges that sidewall underdrainage may not be required with the recharge shadow effect (as discussed in question 1 above). We are comfortable that if seepage is observed appropriate underdrainage will be installed.

No further information is required.

7. **Section 92 question:-**Please provide quantitative slope stability documentation, either from the original consent application or newly developed ground models for all required load cases and the changed groundwater regime now and post closure in order to allow satisfactory review of landfill stability.

GHD Commentary:- Thank you for providing the stability memo for Area 13 (SKM memo entitled Area 13 Embankment Stability Analysis dated 9 July 2013). This memo covered the slope stability of the embankment portion of the cell. We have no concerns with the memo or the conclusions.. This piece of work did not utilise an elevated groundwater level for the post closure case. However, we now understand that groundwater is expected to remain depressed post closure. Thus post closure stability is not expected to be impacted by groundwater recharge.

No further information is required.

8. **Section 92 question:-**Please provide an identification methodology, risk assessment and mitigation for buried tomos under the floor of the landfill in order to understand the quantum of this potential risk on the landfill.

GHD Commentary:- Discussion has been provided around the expected low likelihood of karst features beneath the floor of the liner in the Jacobs Section 92 response. We understand that the observational approach is used during construction to find and identify karst. Given the low likelihood of voids below the floor this approach is valid.

No further information is required.

9. **Section 92 question:-**Please provide a reason as to why engineering geological mapping is not a written requirement on the limestone side walls in order to understand if there is the potential for defect related groundwater seepage.

GHD Commentary:- The Jacobs Section 92 response indicates that logging and as-built of any features identified during subgrade preparation is now included in the updated landfill management plan (section 9.1.1). We believe this should address any features observed on the side walls.

No further information is required.

5 Consent conditions commentary

With regard to the conditions in the Southland District Council land use consent 60/3/02/138/1, this review has no concerns with the proposed amendments or conditions.

With regard to the conditions in the Environment Southland Discharge Permit AUTH-201346-V3, this review has no concerns with the proposed amendments or conditions.

With regard to the conditions in the Environment Southland Discharge Permit 201347, AUTH -20586101-v1, this review has no issue with the proposed amendments or condition

6 Conclusions

The proposed increase in filling rate will have no adverse effects on any of the geotechnical and seismic engineering issues or the proposed consent conditions.

7 Limitations

This report has been prepared by GHD Limited for Environment Southland and may only be used and relied on by Environment Southland for the purpose agreed between GHD and Environment Southland as set out in Section 2 this report.

GHD otherwise disclaims responsibility to any person other than Environment Southland arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. GHD accepts no responsibility for other use of the data.

The advice tendered in this report is based on information obtained from other parties. Their investigation locations, tests points and sample points are not warranted by GHD in respect to the ground and groundwater conditions that may be encountered across the site. It is emphasised that the actual characteristics of the subsurface materials may vary significantly between adjacent test points and sample intervals and at locations other than where observations, explorations and investigations have been made. Subsurface conditions, including groundwater levels and contaminant concentrations can change with time. This should be borne in mind when assessing the data. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change. It should be noted that because of the

inherent uncertainties in subsurface evaluations, changed or unanticipated ground and groundwater conditions may occur that could affect total project cost and/or execution. GHD does not accept responsibility for the consequences of significant variances in the conditions and the requirements for execution of the work.

The drill hole or test pit logs, cone penetration tests, laboratory tests, geophysical tests and similar work performed and recorded by others has been used by GHD in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

An understanding of the geotechnical site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances which arise from the issue of the report which have been modified in any way as outlined above

Please do not hesitate to call the undersigned with any queries.

Sincerely
GHD Limited



Debbie Fellows
Technical Director - Geotechnical
029 3551310



Nick Eldred
Technical Director - Geotechnical



**TECHNICAL REVIEW OF FURTHER
RMA SECTION 92 RESPONSES
FOR APPLICATION APP-20202200,
APP-205862-01-V2
BY AB LIME LIMITED**

Engineers and Geologists

TECHNICAL REVIEW OF FURTHER RMA SECTION 92 RESPONSES FOR APPLICATION APP-20202200, APP-205862-01-V2 BY AB LIME LIMITED

Report prepared for: Environment Southland
Southland Regional Council

Report prepared by: Steven Price, Principal – Engineering Geologist



Report reviewed by: Marcus Herrmann, Principal – Contaminated Land



Report approved for issue by: Arthur Amputch, ONZM, Technical Director, CPEng



Report reference: 200239-C

Date: 17 November 2020

Copies to:

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Southland Regional Council	
Mr Bruce Halligan	Electronic copy
Riley Consultants Ltd	1 copy

Issue:	Details:	Date:
1.0	Technical Review of Further RMA Section 92 Responses	17 November 2020

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- Appendix B: Review of Applicant’s Proposed Draft Resource Consent Conditions

TECHNICAL REVIEW OF FURTHER RMA SECTION 92 RESPONSES FOR APPLICATION APP-20202200, APP-205862-01-V2 BY AB LIME LIMITED

1.0 Introduction

Riley Consultants Ltd (RILEY) has undertaken a technical review of responses provided by Jacobs New Zealand Ltd (Jacobs), dated 23 October 2020, following a request by Environment Southland (ES) for further information in support for the application for landfilling under Section 92 (S92) of the Resource Management Act.

RILEY previously undertook a technical peer review of landfill engineering aspects of the above-named resource consent application for ES as our client in accordance with the Services Schedule of Consultancy Contract No. A565139 for Professional Services. Results of that review and associated queries requesting further information were outlined in the RILEY Technical Peer Review letter RILEY Ref: 200239-A, dated 20 July 2020. RILEY subsequently undertook a review of initial S92 responses prepared by Jacobs with review and commentary presented in our letter, dated 1 October 2020 (RILEY Ref: 200239-B). This technical review (RILEY Ref: 200239-C) should be read in conjunction with the two previous RILEY reports.

As instructed by ES, the scope of this review includes:

- The review of appropriateness/robustness of the further S92 Responses.

The technical review of the S92 Responses also considered current best practice for municipal solid waste landfills and whether the relevant elements of the proposal meet the requirements of the New Zealand 2018 WasteMINZ Technical Guidelines for Disposal to Land ('WasteMINZ Guidelines 2018').

For this report, RILEY has referred to information provided by ES (received 1 November 2020), namely the second S92 Response to Environment Southland (AB Lime Limited, Jacobs Ref: IZ000400-LFC-NP-RPT-0007 | 1, 23 October 2020) and appended updated report and drawings (prepared by Jacobs) along with monitoring reports (prepared by AB Lime).

All items reviewed and commented on follow the numbering convention and sequence used in the RILEY Technical Peer Review Letter (RILEY Ref: 200239-A, dated 20 July 2020) and in the Jacobs S92 response document (23 October 2020).

2.0 Technical Peer Review – Commentary and Review of S92 Responses

With regard to the applicant's S92 Response commentary toward the requests for further information, our formal responses are as follows. The question numbering is consistent with that adopted through the review process commencing with the initial RILEY technical review letter of 20 July 2020 (RILEY Ref: 200239-A) and the latest Jacobs response.

Queries where no further information has been requested have been briefly summarised for completeness.

2.1 Landfill Capacity and Lifespan (Q1 – Q6)

2.1 - 2.6. Responses accepted – no further information requested.

2.2 Site Traffic (Q7 – Q14)

2.7 – 2.14. Responses accepted – no further information requested.

2.3 Landfill Operations (Q15 – Q35)

2.15. Response accepted – no further information requested.

2.15 – 2.20.

EHS Support NZ Ltd has undertaken the technical peer review of the S92 responses for items 2.16 to 2.20 inclusive. The applicant is referred to Pages 2-8 of the EHS Support NZ Ltd Memo, which is included in full as Appendix A.

EHS Support NZ Ltd proposes the following new conditions for the land disposal consent.

- The Landfill Operations Management Plan shall be updated in accordance with Schedule x and submitted to ES for approval by 30 June 2021.
- Any updates or changes to the Landfill Operations Management Plan shall be submitted to ES for written approval before they become operational.
- An annual review of the waste acceptance criteria and prohibited items shall be undertaken and the findings of the review shall be submitted to ES by 30 June each year.
- All new waste acceptance criteria must be submitted to ES for written approval before the waste is accepted.

2.21 and 2.22. Response accepted – no further information requested.

Commentary: The response has outlined that stockpiling is unlikely to be required based on calculated volumes prior to 2037. If stockpiling is required, the Applicant states that there is on-site facility and any effects can be dealt with under existing land use consent 60/3/02/138/1.

2.23 – 2.27. Responses accepted – no further information requested.

Commentary: The response outlined modifications to the temporary capping that will likely require greater diligence in placement and formation of the capping. It is implied this greater diligence will reduce creation of over-steepened faces as has occurred in the past. This will be a compliance matter.

2.28. Response accepted – no further information requested.

Commentary: The response states the temporary cap could exceed three months in duration and will be seeded as per the Operations Plan and WasteMINZ Guidelines.

2.29. Response partially accepted - please refer response to 2.66.

Commentary: The applicant states any increase in temporary capping will offset daily and intermediate capping, therefore given the temporary capping's reduced permeability relative to daily and intermediate cover, the applicant considers this will reduce overall rainfall infiltration and presumably leachate generation.

RILEY considers that with no limit on waste, the rate of landfill expansion may be greater than predicted under existing consent limits and therefore, growth in leachate generation, despite better management and capping, may still increase.

Please refer to our response for 2.66.

2.30a. Response accepted – no further information requested.

Commentary: The response outlines the information in the Geotechnical Memo (text and drawing 1017) have been updated to be consistent, with maximum placed gradient of 1V:3H and expected post settlement gradient of 1V:4H.

2.30b. Response accepted – no further information requested.

Commentary: The response states that the Geosynthetic Clay Liner (GCL) can be placed up to 1V:2H without stability issue, and that a sentence in the Landfill Cap Design Report regarding supplier approval to place at 3.5H:1V is 'misleading' as to the actual maximum gradient of placement. The response goes on to state there have been no issues to-date with installing the GCL on slopes of 1V:2H and with respect to the final surface, the WasteMINZ Guidelines allow up to 1V:3H; therefore, no quantitative stability analyses are required.

The supplier guidelines provided by the Applicant do not have any limitations on maximum gradient of placement.

The response addresses a potential contradiction between the Landfill Capping Design Report and other design and construction information.

2.31 – 2.33. Responses accepted – no further information requested.

2.34a. Response accepted – no further information requested.

Commentary: The response demonstrates no effective loss in permeability with 12.5% elongation of the GCL.

2.34b. Response accepted – no further information requested.

Commentary: The response states the previous estimated 18% elongation as likely unrealistic, revising this to 10% as being expected. States X800 and X1000 is precluded in favour of stronger X2000.

We note that a revised Landfill Capping Design Memo has not been provided with respect to the revised GCL grade, however, the LOMP has been updated for the X2000.

2.35. Response accepted – no further information requested.

2.4 Landfill Gas (Q36 – Q58)

EHS Support NZ Ltd has undertaken the technical peer review of the S92 responses for items 2.36 to 2.58 inclusive. The applicant is referred to Pages 8-15 of the EHS Support NZ Ltd Memo, which is included in full as Appendix A.

EHS Support NZ Ltd summarises their concerns over landfill gas as follows:

From the limited information provided by the applicant, it is clear that the current operation and management of the landfill gas does not comply with the NES (Air Quality), and as such, would be regarded as a **prohibited activity**. The applicant **has not demonstrated** that the gas collection and flaring system can be operated in such a way that the NES (Air Quality) will be complied with. Also, there are several serious issues with the current operation of the gas control system including:

1. the number of low temperature flare events;
2. high levels of oxygen within the gas extraction wells and gas collection system, which could potentially indicate that a flammable atmosphere exists within the landfill;
3. the lack of detail design calculations demonstrating that the proposed gas collection system is designed appropriately to handle the maximum gas volumes predicted by Jacobs;
4. a significant amount of generic information pertaining to the landfill gas collection system currently installed at the site, particularly the spacing of the gas collection wells;
5. indication of areas of high surface emission rates in excess of the NES (Air Quality) maximum concentration of 5,000 ppm (v/v). This also may indicate that there are areas of the cap where air may ingress into the landfill, and
6. the failure to have a backup flare installed at the site, despite it being a requirement of the NES (Air Quality) since 2004 and AB Lime has missed the date (July 2020) to install the flare initially specified in the application.

Therefore, it is imperative for AB Lime to improve the performance of the current LFG collection system and to bring this system into compliance before allowing an increase in the volume of waste that can be disposed of within the site, which will alter the LFG regime at the site. EHS Support recommends that AB Lime should demonstrate that for a period of at least one-year they are able to operate the gas collection system in full compliance with the NES (Air Quality) Regulations 26 and 27 and the site's Landfill Gas Management Plan. The independent reviewers' compliance report on the design and performance of the gas collection system will need to be certified by a suitably qualified independent consultant who is not involved in either the monitoring or design of the landfill gas collection system.

2.5 Landfill Leachate (Q59 – Q67)

2.59. Response accepted – no further information requested.

2.60. Response accepted

Commentary: The majority of groundwater monitoring, leachate quality and annual peer review reports dating back to 2004 have now been provided. Please refer to 2.74.

2.61. Response accepted – no further information requested.

2.62. Response accepted – no further information requested.

2.63. Response accepted – no further information requested.

2.64. Response accepted – no further information requested.

2.65. Response partially accepted – corrections requested to Landfill Leachate Technical Memo.

Commentary: The applicant has provided the full leachate production quantity in 2019 (24,058 tonnes) within Figure 8. However, RILEY notes that the average leachate production quantity from 2015 to 2019 is 17,103 tonnes, not 11,248 tonnes. Please correct this in Figure 8 and amend the Landfill Leachate Technical Memo to reflect the fact that annual leachate volumes are not decreasing (as has already been acknowledged in the applicant's previous response).

2.66. Response not accepted – new consent condition proposed.

The applicant has been asked to provide evidence to support their conclusion that leachate volumes are expected to decrease if the consent application to allow no waste limits is granted.

The applicant's response states that leachate generation is directly related to rainfall infiltration. They consider that infiltration may occur more frequently within the area of temporary capping, but this will be offset by decreases in application of intermediate and daily cover. They conclude the net effect is that less rainfall infiltration is expected, and therefore, less leachate overall will be produced.

Commentary: It is correct that leachate generation is related to rainfall infiltration levels, which can be reduced through the improvement measures the applicant intends to apply, i.e. reducing the area of active landfill face to 1,000m², improving temporary capping, reducing daily and intermediate cover, and increasing slope steepness should assist in reducing infiltration. However, the initial application of some of these measures in recent years (as outlined in the Landfill Leachate Technical Memo/LLTM) has identified no corresponding leachate generation decrease. Leachate production also relates to other factors, including the volume and type of waste buried and the moisture content of the waste itself.

The volumes of leachate generated to-date show an upward trajectory, likely to be the case due to increased volumes of buried waste, landfill filling and capping practices to-date. As identified in the LLTM, years with heavier rainfall overall will naturally also have had an impact.

Given the increasing trend in leachate volumes to-date, RILEY does not consider that sufficient evidence has been provided to support the conclusion that leachate volumes will reduce if the consent application involving removal of waste limits, is granted. As such, the following suggested consent condition is proposed:

The applicant shall implement the measures identified in the Landfill Operations Management Plan (LOMP) and related technical reports in an effort to mitigate against water infiltration into the landfill and will continue to monitor annual leachate quantities produced. If leachate quantities have shown a continued upward trend over the next three years, the applicant will carry out a review of the LOMP at that point to identify practices requiring change or addition, then provide these to Environment Southland for review and approval prior to updating the LOMP accordingly.

2.67. Response partially accepted – further information requested.

Commentary: Thank you for the references to the drawings in Appendix F.

Q.2.67a. For further clarification relating to the original question, please confirm what design elements have been incorporated or will be incorporated to enable cleaning (rodding, jetting, CCTV access points) of the leachate pipelines.

2.6 Site Stormwater (Q68 – Q72)

2.68 - 2.70. Responses accepted – no further information requested.

2.71a and b. Response accepted – no further information requested.

Commentary: The response outlines that the capped area of landfill will not change from the existing consented version, therefore, the peak stormwater flow will not change.

This is accepted, provided the stormwater system is appropriately designed and sized for the completed landfill or any interim area.

2.72. Response accepted – no further information requested.

2.7 Groundwater Quality (Q73)

2.73. Response accepted – no further information requested.

2.8 Monitoring (Q74)

Commentary and Questions

2.74. Response partially accepted – amended consent conditions proposed.

The applicant has now provided the majority of requested monitoring and peer review reports.

Commentary: To-date, environmental lower-response limit/warning (TL1) criteria and environmental upper-response limit/alarm (TL2) criteria have been exceeded in the only current downgradient monitoring well as follows: elevated sulphate, manganese, nickel, and ammoniacal nitrogen concentrations exceeding TL1 ‘warning’ criteria; copper and zinc concentrations exceeding TL2 ‘alarm’ criteria. Maximum concentrations of copper and zinc parameters at this well have been recorded at 0.048g/m³ (48µg/L) for copper and 0.067g/m³ (67µg/L) for zinc, which exceed ANZECC Guidelines for 80% protection of freshwater species by factors of 19.2 and 2.1, respectively.

The fact that there is only one down-gradient monitoring well (SKM108) has been correctly identified by the applicant as an issue requiring addressing. The Groundwater Quality Technical Memo (GQTM) recommends that *“two further down-gradient monitoring wells are installed at the site, either close to or on the southern boundary to give greater confidence in measuring potential offsite discharges.”* The GQTM also advises intended locations for these wells, however, the consent condition proposed by the applicant (refer Condition 28) is not consistent with these statements.

It is agreed that better down-gradient monitoring information is required in order to determine what degree of environmental impact the landfill will have on receiving groundwater sources should the consent application be approved. Installation of two new down-gradient wells is an appropriate method to ensure a more representative data set going forward.

Recommended changes to consent Conditions 28 and 42 have been made to align with the intent expressed by the applicant in the GQTM, and in the most recent groundwater monitoring report provided (January – June biannual monitoring report).

2.9 Landfill Rehabilitation and Aftercare (Q75 – Q77)

2.75. Response accepted – no further information requested.

2.76. Response accepted – no further information requested.

Commentary: The response states the pine trees are planted along the screening bund, not proposed for the mounds on the landfill.

This is accepted and clarifies any potential misinterpretation of the LCLRAP report wording.

2.77. Response accepted – no further information requested.

Commentary: The response outlines the triggers as provided in Condition 35 of consent AUTH-201346-V3. These relate to inspection of vegetation die off, cap cracking, differential settlement, leachate break out. The consent condition has a quantitative limit of 5,000ppm of methane for gas emission.

It is uncertain how the differential settlement is assessed/measured and what is acceptable.

It is accepted that existing conditions of consent will not need to be altered due to increased waste acceptance and those provided address key aspects.

2.10 Environmental Management (Q78)

2.78. Response accepted – no further information requested.

2.11 Others (Q79 – Q90)

2.79. Response accepted – no further information requested.

Commentary: The response states that the liner can be placed at a 1V:2H slope and steeper, however, it is not their intention to place it steeper due to ease of installation and safety.

No justification is presented for it being satisfactory at steeper angles, however, it is mentioned in other S92 responses that GCL has been successfully installed at 1V:2H within the existing landfill and no issues are expected.

2.80 – 2.85 Responses accepted – no further information requested.

2.86. Response accepted – no further information requested.

Commentary: The response states the LOMP has been updated to include Elcoseal installation guidelines, including cap penetration details.

A check of the supplied revised LOMP shows this has been updated and the additional information provided addresses the query.

2.87. Response accepted – no further information requested

2.88. Response accepted – no further information requested.

Commentary: The response outlines the final cap design will be subject to review by an independent peer reviewer and approval by ES. Quantitative stability analyses will only be undertaken if determined necessary. This is captured in proposed revised consent Condition 10 and it is expected that should quantitative stability analyses be required this would be requested by the reviewers.

2.89. Response accepted – no further information requested.

Commentary: The response indicates the GCL supplier (presumably Geofabrics) has indicated ooze will not be an issue with X2000 product due to stronger fabric.

In the absence of evidence suggesting otherwise, this is accepted.

2.90. Response accepted – no further information requested, proposed condition amendment.

Commentary: The response outlines that the contour drains 'will reduce' the requirements for the drainage layer. If, during detailed design and the cap trial it is evident that a drainage layer is required, this will be considered for incorporation.

Consideration can be given for specific incorporation of this aspect into proposed Condition 10. For example:

During trial of the final cap layer the need for a drainage layer shall be considered. Evidence with regard its necessity and design should be supplied to Environment Southland and the Independent Peer Reviewer.

3.0 Review of the Applicant's Proposed Draft Resource Consent Conditions

RILEY and EHS Support specialists have reviewed the extensive original and proposed draft conditions provided by Jacobs. Our review and commentary on the applicant's proposed draft resource consent conditions, including the recommendation of new consent conditions where relevant, is available in Appendix B.

4.0 Limitation

This report has been prepared solely for the benefit of Environment Southland as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Recommendations and opinions in this report are based on third party supplied information. The nature and continuity of conditions are inferred, and it must be appreciated that actual conditions could vary considerably from the assumed model.

APPENDIX A

***EHS Support NZ Ltd
Memo:
Review of AB Lime
Limited Application
Further Response to
Section 92 Questions,
16 November 2020***

MEMO

To: Arthur Amputch - Riley Consultants Limited

From: Andrew Rumsby - EHS Support New Zealand Limited

CC: Marcus Herrmann - Riley Consultants Limited

Date: 16 November 2020

Re: Assessment of AB Lime application for consent to dispose of solid waste onto and into land – landfill gas and waste acceptance issues

Introduction

As set out in EHS Support New Zealand Limited's ("EHS Support") proposal/scope of work dated 14 July 2020, I have reviewed the technical aspects of the application to remove the limit for the amount of solid waste acceptance per year at AB Lime Landfill (10-20 Kings Bend, Winton).

The scope of this review work is limited to the following issues:

- landfill gas (collection, flaring and risk assessment), and
- waste acceptance criteria.

The review has focused on the following:

- Identifying areas of sufficient detail have been provided, or
- If there has been insufficient information provided within the Section 92 response, and
- Whether sufficient information has been provided by the applicant to indicate if the gas collection is, or likely to be, designed and operated in accordance with Regulations 26 and 27 of the Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (herein referred to as NES (Air Quality)).

As per the agreed-upon EHS Support scope of work, I have focused on the proposed and potential effects on landfill gas generation, migration, and air emissions as well as associated on-site and off-site effects. There is some overlap with other reviewers who are investigating potential health effects from differing exposure pathways (air discharges) and/or Riley Consultants Limited/EHS Support reviews of the site's proposed design and management controls. I have noted where overlaps occurred.

This review is limited to the application of new consents for the discharge to land and discharge to air. Although, in assessing whether the gas collection system is designed and operated in accordance with the NES (Air Quality), EHS has taken into account past performance history of the site.



Outline of the Application

The applicant has proposed to apply for a new discharge permit to replace AUTH-201346-v3 which removes the limit of 100,000 tonnes of solid waste onto or into land per annum (p9 of Resource Consent Application to Southland District Council and Environment Southland – IZ000400-LFC-NP-RPT-0001 | 1 dated 29 May 2020). The applicant believes that increasing or removing the current annual maximum volume limit will only have a minor impact on the actual or potential effects on the environment. The applicant has also stated that removing the cap on the maximum annual volume of solid waste that can be accepted into the AB Lime Landfill will provide it with the flexibility to accept waste from extreme events (e.g. Bonamia parasite infection) and to accept waste from a wider range of locations (i.e. southern region of the South Island).

The applicant is not proposing to change the footprint, the final area, or the capacity of the landfill.

AB Lime Landfill Operations Management Plan

The applicant has provided a Landfill Operations Management Plan (LOMP) which meets most of the minimum requirements outlined within the draft Technical Guidelines for Disposal to Land¹. However, EHS Support notes that none of the management plans supplied outlined staff responsibilities and training. The LOMP, as well as all subsequent plans (i.e. Health and Safety Plan [HASP], Emergency Response Plan, Landfill Gas Management Plan, Landfill Leachate Management Plan and the Site Stormwater Management Plan), should be updated to include a section on staff responsibilities, minimum training requirements and management structure.

EHS Support also believes that Section 4 and Section 5 of the LOMP (i.e. waste acceptance criteria, prohibited items and special waste) also need to be revised (see Waste Acceptance Criteria section below).

EHS Support has not reviewed the landfilling operations, nuisance control, slope stability, contaminated land procedures and groundwater monitoring sections of the LOMP as these sections are covered by other reviewers.

Waste Acceptance Criteria

Waste acceptance criteria are designed to ensure that materials placed within a landfill do not cause adverse effects on the environment or human health. The challenge of modern landfills is that new chemicals (so-called emerging contaminants that include pharmaceuticals, personal care products, surfactants, plasticizers, fire retardants, pesticides, agrichemicals, and nanomaterial) are present within many waste streams. Therefore, waste acceptance criteria need to be developed, taking into consideration not only the lifetime of the consent or the operating life of the landfill but the fact that some of the chemicals may be environmentally hazardous for long periods. The life expectancy of engineering and containment measures for a sanitary landfill is limited, with estimates varying between decades and centuries (UNEP, 2012²). The period of the life of polybrominated diphenyl

¹ WasteMINZ. 2018. Draft Technical Guidelines for Disposal to Land.

² UNEP. 2012. Guidance on best available techniques and best environmental practices for the recycling and disposal of articles containing polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants.



ethers (PBDEs), per- and polyfluoroalkyl substances (PFAS) and other persistent toxic chemicals in landfills have been modelled (e.g. Danon-Schaffer, 2010³), and it has been found that the threat of some persistent organic pollutants (POPs) to the environment will outlive the engineering containment of the landfill (UNEP, 2012⁴). Therefore, it is essential to set limits on what material can be deposited into the landfill and minimise the amount of persistent toxic compounds that are deposited in them to reduce the likelihood of harm to future generations.

³ Danon-Schaffer. 2010. Investigation of PBDEs in Landfill Leachates from Across Canada. Environmental Management and Sustainable Development. 3. 74. 10.5296/emsd.v3i1.4855.

⁴ UNEP. 2012. Guidance on best available techniques and best environmental practices for the recycling and disposal of articles containing polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants.



Under the Stockholm Agreement, UNEP technical guidance documents (UNEP, 2011a⁵, 2015a⁶, 2015b⁷, 2015c⁸, 2017a⁹, 2017b¹⁰, 2017c¹¹, 2017d¹², 2017e¹³ and 2019¹⁴) provide guidance on establishing waste acceptance criteria for landfills to prevent highly concentrated (and potentially highly environmentally mobile) contaminants, thereby reducing the environmental risks. As New Zealand is a signatory to the Stockholm Agreement and has international treaty obligations, it is important that Section 4 and Section 5 of the Landfill Operations Management Plan reflect these requirements.

The application has accepted that the AB Lime Landfill operation plan should be updated to give reference to the following three documents:

⁵ UNEP. 2011a. Technical guidelines for the environmentally sound management of wastes consisting of elemental mercury and wastes containing or contaminated with mercury. UNEP/CHW.10/6/Add.2/Rev.1 31 October 2011.

⁶ UNEP. 2015a. Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with hexabromodiphenyl ether and heptabromodiphenyl ether, or tetrabromodiphenyl ether and pentabromodiphenyl ether (POP-PBDEs).

⁷ UNEP. 2015b. Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with hexabromocyclododecane (HBCD). May 2015

⁸ UNEP. 2015c. Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF). May 2015

⁹ UNEP. 2017a. Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with hexachlorobutadiene (HCBd). May 2017

¹⁰ UNEP. 2017b. Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with pentachlorophenol and its salts and esters (PCP). May 2017

¹¹ UNEP. 2017c. Technical guidelines on the environmentally sound management of wastes containing or contaminated with unintentionally produced polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans, hexachlorobenzene, polychlorinated biphenyls, pentachlorobenzene or polychlorinated naphthalenes (Unintentionally produced POPs). May 2017

¹² UNEP. 2017d. Technical guidelines: technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with the pesticides aldrin, alpha hexachlorocyclohexane, beta hexachlorocyclohexane, chlordane, chlordane, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, hexachlorobutadiene, lindane, mirex, pentachlorobenzene, pentachlorophenol and its salts, perfluorooctane sulfonic acid, technical endosulfan and its related isomers or toxaphene or with hexachlorobenzene as an industrial chemical (POP Pesticides). May 2017

¹³ UNEP. 2017e. Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with polychlorinated biphenyls, polychlorinated terphenyls, polychlorinated naphthalenes or polybrominated biphenyls including hexabromobiphenyl (PCBs, PCTs, PCNs or PBBs, including HBB). May 2017

¹⁴ UNEP. 2019. General technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants (General POPs). May 2019



1. Hazardous Substances (Storage and Disposal of Persistent Organic Pollutants) Notice 2004;
2. Basel Convention Technical Guidelines for Environmental Sound Disposal of Wastes; and
3. Stockholm Convention on Persistent Organic Pollutants.

Aligning the waste acceptance criteria with these three documents will ensure that the environmental risks from emerging contaminants are managed.

However, in Section 5.3 the AB Lime Ltd LOMP proposes the following waste acceptance criteria for special waste:

(1) Elutriation criteria: TCLP test as being the lesser of:

- Trade waste Consent Limits (NZS 9201) or
- 100 times NZ Drinking water limit, or
- 1000 times the guidelines for protection of local aquatic species, or
- 1000 times the LD50 for the most sensitive local aquatic species, or
- A specific value calculated for that substance.

Or (2) Total concentration of contaminants in waste without elutriation test, is 20 times the concentration of the TCLP criteria.

While developing waste acceptance criteria based upon toxicity characteristic leaching procedure (TCLP) criteria (and total concentrations of 20 times the TCLP criteria) is in keeping with national and international best practice, the elutriation criteria purposed would not be protective for the environment, particularly for a bioaccumulative and/or persistent substance, nor would it be in keeping with the principles outlined within the Basel Convention Technical Guidelines for Environmental Sound Disposal of Wastes¹⁵. Waste acceptance criteria based upon tradewaste limits or 1,000 times the guidelines for protection of aquatic species or LD50 of aquatic species may not be protective of human health, particularly in the case of a chemical compound being a known or suspected carcinogen, developmental or reproductive toxin or highly bioaccumulative substance.

Therefore, it is recommended that the elutriation criteria are set to be the lower of:

- 100 times NZ Drinking water criteria, as this would take into carcinogenicity or development/reproductive toxicity of compounds to humans, or
- Criteria specified within the most recent Hazardous Substances (Storage and Disposal of Persistent Organic Pollutants) Notice

In cases where chemicals which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) where there are no criteria set under Schedule 2 of Auth-201346-v3 and no criteria can be established using NZ Drinking water criteria or are published within the most recent Hazardous Substances (Storage and Disposal of Persistent Organic Pollutants) Notice, then a specific criterion must be derived taking into account the potential for bioaccumulation. These site-specific criteria then should be submitted and approved in writing by Environment Southland.

¹⁵ UNEP, 2019 General technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants (General POPs). May 2019



For any other compounds which do not fall within the criteria, site specific criteria shall be developed and then submitted and approved in writing by Environment Southland.

EHS Support recommends that Section 5 of the AB Lime Limited LOMP should be revised to reflect the recommendations.

Prohibited Material

Section 4.4 of the Applicant's LOMP provides a list of materials that are prohibited from the landfill (hazardous substances), however the terminology here is challenging to interpret for a landfill operator or someone wanting to dispose of items in the landfill. It would also be difficult for a regulatory agency to enforce as specialised testing may be required to understand if a material meets the minimum degree of hazards outlined in HSNO legislation. The section of prohibited items does not include the tables of waste items which may exhibit these characteristics from the draft guidelines¹⁶ (Appendix I.1 and the CAE (2000) Landfill guidelines¹⁷ (Appendix 4)).

Also, a number of the recommendations made in Module 2 Hazardous Waste Guidelines¹⁸ for prohibiting certain items have not been explicitly included in the prohibited waste section. These include:

- Lead-acid batteries. Lead-acid batteries can be recycled in New Zealand and would be in keeping with the Basel Convention (2003 Technical Guidance for the Environmentally Sound Management of Waste Lead-acid Batteries¹⁹ which states that “landfilling, incineration and others cannot be considered as an environmentally sound management of lead wastes, not only for economic reasons but also for health and environmental reasons”.
- Used oil. Used oil would be the equivalent of waste hydrocarbons, waste mineral oils and waste hydrocarbons/water mixtures listed in the draft WasteMINZ guidelines²⁰ as substances likely to exhibit characteristics which would prohibit them for disposal into landfills. Technically the exclusion of bulk liquid waste would cover the large-scale disposal of used oil, however EHS Support believes it would be advantageous to include a specific prohibition on accepting used oil as the volume considered to be bulk liquid waste is not specified within the LOMP.

¹⁶ WasteMINZ. 2018. Draft Technical Guidelines for Disposal to Land.

¹⁷ CAE (2000) Landfill Guidelines: Towards Sustainable Waste Management in New Zealand.

¹⁸ Ministry for the Environment. 2004. Module 2 – Hazardous waste guidelines: Landfill waste acceptance criteria and landfill classification. Publication reference number: ME 510.

¹⁹ Basel Convention. 2003. Technical Guidelines for the Environmentally Sound Management of Waste Lead-acid Batteries. <http://www.basel.int/Portals/4/Basel%20Convention/docs/pub/techguid/tech-wasteacid.pdf>

²⁰ . WasteMINZ. 2018. Draft Technical Guidelines for Disposal to Land.



- Refrigerators, freezers, and air conditioning units, unless they have been degassed and lubricating oil has been removed. This then will align with Table 10 of Recycling WEEE guidance²¹.
- PCB wastes. Equivalent to draft guideline²² categories M100 Polychlorinated biphenyls (PCBs) and/or polyterphenyl (PCTs) and/or polybrominated biphenyls (PBBs) and category M110 Equipment containing PCBs and/or PCTs and/or PBBs and M120 Solvents and materials contaminated with PCBs and/or PCTs and/or PBBs as substances likely to exhibit characteristics which would prohibit them for disposal into landfills.

It would be advisable to expand this list of prohibited items to include:

- Lithium-ion batteries (due to environmental toxicity concerns around cobalt and the potential for lithium-ion batteries to cause landfill fires). Recycling lithium-ion batteries, in particular, reduces energy consumption, reduces greenhouse gas emissions and results in 51.3 percent natural resource savings when compared to landfilling (Boyden *et al.*, 2016²³).
- Mercury-containing batteries, mercury lamps and elemental mercury-containing wastes. Mercury can be extracted from these items in Australia. Prohibiting these items would be in keeping with the industrial product stewardship programmes within New Zealand, New Zealand obligations under the Minamata agreement, as well as adopting the recommendations for environmentally sound disposal of mercury wastes outlined in the United Nations Environment Programme (UNEP) guidance²⁴.
- Used tyres. Used tyres contain elevated concentrations of a number of hazardous and persistent toxic compounds and the Ministry for the Environment is funding a number of initiatives for end-of-life use of used tyres. This would be in keeping with the recommendations in the *Basel Convention Technical Guidelines on the Identification and Management of Used Tyres*²⁵ which states that “direct disposal of end-of-life tyres in landfills is to be used only where economically viable alternatives for the materials or energy recovery are not available”.
- Phenols and phenol derivatives. The draft guidelines²⁶ also indicate that phenols and phenol derivatives including chlorophenols waste may not be suitable for disposal at a Type 1 landfill. Therefore, waste acceptance criteria should be developed for phenols and phenol derivatives.

²¹ Ministry for the Environment. Recycling WEEE. <https://www.mfe.govt.nz/publications/waste/waste-electrical-and-electronic-equipment-guidance-collection-reuse-and-recycli-5>

²² WasteMINZ. 2018. Draft Technical Guidelines for Disposal to Land.

²³ Boyden et al. 2016. The Environmental Impacts of Recycling Portable Lithium-Ion Batteries. *Procedia CIRP*. 48. 188-193. 10.1016/j.procir.2016.03.100.

²⁴ UNEP (2011) Technical Guidelines for the Environmentally Sound Management of Wastes Consisting of Elemental Mercury and Wastes Containing or Contaminated with Mercury.

²⁵ Basel Convention Working Group. 1999. *Basel Convention Technical Guidelines on the Identification and Management of Used Tyres*.

²⁶ WasteMINZ. 2018. Draft Technical Guidelines for Disposal to Land.



As the applicant is seeking a 35-year term for the duration of the new consent, it is important that waste acceptance criteria (including items which are prohibited from being disposed of at the landfill) are reviewed annually to ensure that the waste acceptance criteria are current with Ministry for the Environment recommendations, HSNO requirements, Basel Convention Technical Guidelines for Environmental Sound Disposal of Wastes, as well as best industry practice. The findings of the review shall be reported to Environment Southland and the LOMP shall be updated with any changes to the waste acceptance criteria.

Recommended Consent Condition associated with Waste Acceptance Criteria and LOMP

EHS Support proposes the following new conditions for the land disposal consent.

- The Landfill Operations Management Plan shall be updated in accordance with Schedule x and submitted to Environmental Southland for approval by 30 June 2021.
- Any updates or changes to the Landfill Operations Management Plan shall be submitted to Environment Southland for written approval before they become operational.
- An annual review of the waste acceptance criteria and prohibited items shall be undertaken and the findings of the review shall be submitted to Environmental Southland by 30 June each year.
- All new waste acceptance criteria must be submitted to Environmental Southland for written approval before the waste is accepted.

Gas Collection System

The applicant has proposed using the gas collection system and the gas management system similar to what is currently being used, though we do note some improvement in reporting the data and how the ISM (Instantaneous Surface Monitoring) survey is undertaken.

EHS Support has reviewed the most recent information (2018 to 2020) on the performance of the gas collection system, landfill cap and the landfill flare. It is clear from reviewing annual monitoring reports 4 and 5 from 2020 as well as the AB Lime Landfill Gas Flare Monitoring Report that the current operation of landfill gas collection and flaring does not comply with the National Environmental Standards (NES) for Air Quality Regulations 26 and 27. In particular:

- No backup flare has been installed.
- The temperature of the flare does periodically drop below 750 degrees Celsius (°C) (and 600°C for short periods of time).
- ISM data provided within AB Lime Landfill Annual Monitoring Report 5-2020²⁷ indicates that surface emissions from part of the landfill exceed 5,000 ppmv.

²⁷ AB Lime Monitoring Report 5 -Annual report. Report Date- July 2020.



Reviewing the information for monitoring the gas composition within the gas wells (provided within AB Lime Landfill Annual Monitoring Report 5-2020²⁸) it is clear that the well field is poorly balanced which results in high concentrations of oxygen and residual nitrogen being extracted from the landfill and flared. The extracted gas has a low caloric value, and this causes the low temperature flaring events. Therefore, the cause of the non-compliance of the landfill with the NES (Air Quality) is an operational rather than a design matter associated with the gas collection system. The applicant has not provided any calculations or detail design drawings indicating that the blowers and gas collection are sized appropriately to cope with the increased volume of gas. Clause 27 (3) of the NES (Air Quality) requires a backup flare be installed and this has been a requirement for the landfill since 2004 when the Resource Management (National Environmental Standards for Air Quality) Regulation 2004. As of November 2020, AB Lime has not installed a backup flare, nor proven a definitive timeframe for one to be installed (the deadline in the application of July 2020 has been missed and no further date has been provided). Regulation 27 of the NES (Air Quality) requires gas to be flared via a backup flare any time the principal flare is not operating (including when it is undergoing maintenance). However, at this site, there is no backup flare, and it is unclear what happens when the main flare is undergoing maintenance or if there was a failure which renders the principal flare non-operational.

The applicant's consultant has indicated that the NES (Air Quality) requirement does not apply to the application, because:

- (a) The National Environmental Standards for Air Quality Regulation 2004 was gazetted after Consent 201351 was granted, and
- (b) The applicant's consultant is not applying for a new air discharge consent.

The applicant's consultant is incorrect on two counts:

- (1) The original resource consent condition for consent 201351 required the flare to operate at a minimum combustion temperature above 750°C (i.e. the original consent condition was compliant with regulation 27(2f) of the NES (Air Quality) 2004).

The memorandum was issued by Environment Southland on 16 December 2010 (after the NES (Air Quality) 2004 was gazetted). The memorandum does not appear to revoke or change consent condition 18 (e) but appears to state no enforcement action would take place. In 2010 Environment Southland would not have been able to legally alter a consent to allow an activity prohibited by the NES (Air Quality).

- (2) In Section 12.1 (page 9 of the Resource Consent Application) the applicant has applied for a new air discharge permit to replace air discharge permit AUTH-201351.

The only part of resource consent 201351 which would overrule the NES (Air Quality) is the fact that Condition 20(b) allows that the maximum emission at the surface of landfill areas with intermediate or final cover shall not exceed 5.0 percent by volume. The applicant has in fact applied to change that condition to bring it in line with Regulation 26 (2a).

Condition 18(e) required the minimum temperature of the flare to be above 750°C (which is in line with the NES (Air Quality) Regulation 27 (2f)). However, within the AB Lime Landfill Annual

²⁸ Ibid.



Monitoring Report 4-2020²⁹ the average flare temperature is reported, and no comment is made if the flare was below 750°C or how often that occurred within a month. In December 2019, the average temperature of the flare was below 750°C, however when examining the AB Lime Gas Flare – temperature graph there also appear to be low temperature events in March 2019, August 2019, October 2019, November 2019, February 2020, May 2020 and June 2020. As stated earlier, the problem with low temperature gas flare events appears to be the operation of the gas collection system by AB Lime Landfill, not something that is intrinsic to the design of the flare. Some of the low temperature events may also be related to maintenance activities, but details on maintenance events and how long the flare was shut down is not provided in the Annual Monitoring Report. The AB Lime Landfill Annual Monitoring Report 4-2020 also shows the residue nitrogen in the flare is very high (commonly between 30 and 60 percent). This indicates that together with the high oxygen concentrations (generally greater than 4 percent oxygen and sometimes higher than 10 percent oxygen) a large amount of air is being sucked into the gas collection system. This is resulting in the low flare temperatures.

An inspection of Gas Well Composition data shows many gas wells (A-04, B-02, B-04, E-02, SW201, SW202, SW203, SW401, SW402, SW404 and SW502) have periodic episodes where the oxygen concentration is above 10 percent. When oxygen concentrations exceed 12 percent v/v and methane concentrations are present at sufficient quantities then a flammable atmosphere exists either within the gas well or within the landfill. This increases the risk that a landfill fire could occur and is not in keeping with industry best practice. Due to the fact the flow and gas pressure are not reported within the Annual Monitoring Report it is impossible to determine if the reason for the high concentrations of oxygen (and residual nitrogen) are due to over-extraction of the gas or poor well head design. The high concentrations of oxygen indicate that air is being drawn into the gas collection system, resulting in the high residual nitrogen levels at the flare, which in turn results in the low temperature flare events observed at the site. Another disadvantage of drawing air into the landfill is that it may inhibit anaerobic decomposition of the waste, resulting in poor gas production and in the worst case resulting in aerobic areas within the landfill.

The AB Lime Landfill Annual Monitoring Report 4-2020 indicates that well E-02 is currently positioned too close to the open face and the air could be infiltrating (or being sucked into the landfill by the gas extraction system) into the landfill. Continued operation of this well is not advised as it does result in a flammable atmosphere within the landfill and increases the risk of a landfill fire occurring at the site (as well as low temperature flare events).

Based upon the information supplied (LOMP, Landfill Gas Management Plan (LGMP) or the Landfill Gas Monitoring Plan) there appears to be no formal requirement to undertake an annual inspection using infrared thermography to check the well heads and gas collection pipework for leaks. The Landfill Gas Management Plan should be updated to require this inspection on an annual basis. EHS Support believes these checks are necessary due to the high concentrations of residual nitrogen reported within the flare and the inability of the applicant to prove information on the reasons for the cause of low temperature flare events. Within the landfill gas technical memo, supplied as part of the application, landfill gas leakage via the gas extraction wellhead or aboveground landfill gas header pipework were identified as potential issues. The low temperature flare events appear to have been an ongoing issue with the site for at least 10 years and even within the most recent 2020 annual monitoring report there is evidence of still ongoing low temperature events (below 750°C).

²⁹ AB Lime Monitoring Report 4. Annual Report -Report Date – July 2020.



Section 5 of the Landfill Gas Management Plan needs to be updated to include limits for the residue nitrogen and oxygen levels with gas extraction wells as well as measuring pressure.

In addition to the well field adjustment criteria specified in Section 5.4.2.2 of the LGMP clear instructions need to be given that, if residual nitrogen exceeds 20 percent or oxygen concentrations exceeds 3 percent, then gas extraction must be reduced. If reducing the pressure does not reduce the nitrogen and/or oxygen concentration or the well has high flow rate but no pressure, then an inspection needs to be undertaken to determine if there is a leak in the well head or an insufficient seal around the gas extraction well.

The well field adjustment criteria should also state that, if the residue nitrogen exceeds 40 percent or oxygen concentrations exceed 6 percent, then the extraction well should be shut down as too much air is being drawn into the gas extraction system (and potentially into the landfill).

The Landfill Gas Management Plan does provide suitable trigger values for carbon monoxide and the detection of a landfill subsurface fire. Carbon monoxide concentrations in excess of 1,000 parts per million (ppm) (v/v) strongly indicate that a fire is burning within the landfill. Carbon monoxide concentrations above 100 ppm (v/v) are not as conclusive but should be investigated. However, a fire investigation plan should be part of the Landfill Gas Management Plan and the emergency response plan should identify the equipment, level of training and staff duties in case of a landfill subsurface fire.

The applicant has stated that no radius of influence testing has been undertaken at the landfill and instead the gas collection system has been designed based on the rule of thumb outlined in the draft Technical Guidelines for Disposal of Waste to Land³⁰. It should be noted that the WasteMINZ 2018 guidelines are not a gas collection design manual and therefore their recommendations may not be appropriate for all situations. EHS Support recommends that radius of influence testing in accordance with the United States Environmental Protection Agency (USEPA) Method 2E is undertaken to design optimum well placement and can assist identifying areas where air may be entering the landfill or sealing issues around the wellhead.

Detail design information on the gas collection system including well abstraction rates, pipe sizing, friction loss calculations, blower sizing etc. was not provided with the application. EHS Support believes that the gas collection system design should be independently peer reviewed and certified by a suitably qualified chartered engineer who has experience in the design and construction of landfill gas collection systems, before the cap on the amount of solid waste received by the landfill is removed.

EHS Support believes the issues around the design and operation of the gas collection system need to be addressed and AB Lime Landfill needs to demonstrate that it can effectively operate the gas collection system before any consideration can be given to removing the annual filling rate.

Recommended Consent Conditions associated with Gas Collection System and Gas Management Plan

Proposed resource consent conditions for Air Discharge Consent:

³⁰ WasteMINZ. 2018. Draft Technical Guidelines for Disposal to Land



1. The radius of influence investigation to determine optimal location of gas extraction wells is undertaken within 12 months of granting this consent.
2. The detail design review is undertaken on the gas collection system and blower sizing to verify that there is sufficient capacity in the gas collection system. This information should be reviewed and approved by a suitably qualified/chartered professional engineer with experience in landfill gas collection system design appointed by Environment Southland.
3. Conduct an inspection of the gas collection system and well heads using infra-red thermography to identify any leakage from the gas extraction wellheads or above ground landfill gas header pipework by 30 June 2021.
4. Ensure that a backup flare design in accordance with the NES (Air Quality) Regulation 27 (3) is installed at the site before 30 June 2021.
5. The principal flare must be operated at all times, unless it has malfunctioned or is shut down for maintenance.
6. The backup flare must be operated if, and only if, the principal flare is not operating.
7. An updated Landfill Gas Management Plan must be submitted to and approved in writing by Environmental Southland before 30 June 2021.

Proposed resource consent conditions for the Land Discharge Consent:

1. The filling rate of solid waste onto or into land shall be limited to 100,000 tonnes of solid waste per annum until an independent, suitably qualified and experienced/chartered engineer has certified that AB Lime has demonstrated that for a period of at least one year they are able to operate the gas collection system in full compliance with the NES (Air Quality) Regulations 26 and 27 and the Landfill Gas Management Plan. The LGMP must be submitted by the reviewer and approved by Environment Southland before the cap of waste accepted is removed.

Landfill Capping and Surface Emissions

The gas monitoring plan submitted by AB Lime has detailed gas monitoring protocols which are based upon international best practice, and the proposed trigger values are in accordance with the NES (Air Quality) and other international guidelines.

Surface ISM results presented within the Annual 2020 Monitoring Report 5 indicates that surface emissions from the landfill are consistently higher than the 5,000 ppm v/v limit within the NES (Air Quality) Regulation 26 (2a). However, as the information within the annual report lacks vital details (such as a plan showing the location of exceedances, where temporary and final cover are located, meteorological conditions at the time of monitoring and the estimated total area where surface emissions are likely to exceed 5,000 ppm (v/v)) it is impossible to determine if the landfill is designed and operated in such a way that it could comply with the NES (Air Quality) Regulation 26 (2a).

The level of information provided within the Annual Monitoring Report is insufficient in many cases to determine compliance or non-compliance with the NES (Air Quality) Regulations 26 and 27. The protocols and recommendations within the SKM landfill gas monitoring plan or the Jacobs Gas Monitoring plan do not contain suitable recommendations on what information should be required to be reported to Environment Southland. The Landfill Gas Monitoring Plan should be updated to require the minimum level of information that should be reported in the gas monitoring reports; minimum information should include:



- Site plan showing where monitoring was undertaken,
- Time and date of monitoring,
- Meteorological conditions when monitoring was undertaken (including weather conditions and barometric pressure),
- Copy of raw data,
- Calibration certificates for instruments used and details of gas bump tests undertaken on the day of monitoring to verify instrument was functioning correctly; and
- Report of visual inspection of the cap, gas extraction or monitoring well (as applicable).

Landfill Gas Migration/Boundary Gas Monitoring

During the Section 92 process, EHS Support requested further information from the applicant to justify the current spacing of the six landfill gas monitoring probes. The number and spacing of the current landfill gas monitoring probes do not meet international best practice guidelines (i.e. CIRIA C665, Environment Agency LFTGN-03 (2005) or Victoria BPEM (2015) siting, design, operation and rehabilitation of landfills). All these guidelines suggest that the maximum gas bore spacing should be between 50 to 150 metres (depending on a variety of factors), which indicates that there may be too few gas perimeter monitoring wells. In response to the Section 92 requests, the applicant has stated that the current design (sidewall liner plus gas control system) eliminates the possibility of landfill gas migration outside of the boundary of the landfill. The applicant states that the six existing gas migration wells have been monitored for the past 15+ years and have not detected landfill gas migration and the bore logs for some of wells suggest they have been constructed incorrectly. However, sufficiently detailed records of the landfill gas monitoring data have not been provided to the reviewer. The Annual 2020 Monitoring Report 5 was provided, and inspection of the data does indicate that landfill gas has been detected in LFG1-LFG3 and LFG6 & 7 periodically. This indicates that landfill gas can escape beyond the side liner/gas control system at several different locations.

The applicant states that risk assessment should be the primary tool determining minimum borehole placement. EHS Support agrees with that statement, however no formal risk assessment has been presented which suggests what an adequate borehole spacing should be (the only suggestion put forward is that it should be greater than 50 metres) and Jacobs supplied a copy of a condition of a Waikato Regional Council consent for Hampton Downs landfill indicating 100-metre spacing for a landfill in a different geological (less gas permeable) setting. The preliminary site investigation supplied by the applicant indicates that the limestone within and surrounding the landfill has variable hydraulic characteristics and there is some secondary permeability within the limestone caused by cavities. EHS Support is concerned as filling advances and with the higher rate of filling that there is an increased risk of landfill gas migration.

EHS Support asked the applicant to provide an estimate of the maximum distance of landfill gas migration and the applicant has provided information within the ATSDR (Agency for Toxic Substances and Disease Register) landfill gas primer. The ATSDR landfill gas primer indicates that landfill gas migration could migrate up to 1,500 feet (457 metres) from a landfill. This estimate is similar to the 500 metres estimated with Victoria (2015) BPEM for landfills and EA (2004) LFTGN 03. Therefore, in the absence of any other evidence on maximum possible landfill gas migration distance, the worst-case migration distance is assumed to be 500 metres. Based upon information supplied by the applicant and review of aerial photographs, there are buildings and structures within 500 metres of the landfill. While the buildings and structures are owned by AB Lime, off-site landfill gas migration can still pose a risk to them. EHS Support believes that a landfill gas conceptual site model (which takes into account possible migration pathways via the limestone) should be used to



assess the integrity and suitability of the perimeter landfill gas monitoring wells. The number and spacing of perimeter landfill gas monitoring shall be reviewed annually and increased as needed as landfilling continues. The landfill gas conceptual site model shall be used to assess potential on-site and off-site receptors that could be at risk from migrating landfill gas. EHS Support believes that given the duration of the consent applied for (35 years) that an ongoing process is required to assess the current and future number and spacing of landfill gas migration wells.

Also, the lateral liner is an integral part of the design to prevent lateral migration of landfill gas. It is important to ensure that a constructed quality assurance plan (CQA) is prepared and certified by a suitably qualified and experienced professional engineer.

The CQA plan should cover:

- Description of responsibilities, qualification and obligations for each party involved in the CQA process,
- Proposed level of supervision and quality control,
- Verification process and review of quality control certificates from the manufacturers,
- Testing methods to be utilised to demonstrate construction quality,
- Verification process of the geomembrane handling,
- Rejection criteria of the geomembrane sheets,
- Details of actions to take to ensure that field panels and seam orientation and joining meet design specifications,
- Verification process of the geomembrane installation around areas of protrusions and penetrations,
- Nature of the non-conformance and its level of effect on the project,
- Methodology to determine if a detected non-conformance is an isolated incident or a recurring problem,
- How amendments to procedures to prevent future occurrences of the non-conformance will be implemented,
- Nature of corrective action to be applied to rectify non-conformance, and
- Procedures and persons to be notified of the non-conformance and corrective measures.

The CQA plan must be submitted to Environment Southland for approval, and at the end of construction a CQA report must be submitted to Environment Southland. The CQA report must demonstrate that all requirements of the project specifications and CQA plan have been complied with and certified by a professional engineer.

Recommended Consent Conditions Associated with Landfill Gas Migration and Boundary Monitoring

The following resource consent conditions should be included in the air discharge consent:

- The spacing and number of landfill gas monitoring bores shall be reviewed annually by an independent reviewer. The design and location of the landfill gas monitoring probes shall be approved in writing by Environment Southland prior to the probes being installed.

The following resource consent condition should be included in the discharge to land consent.

- A Construction Quality Assurance Plan prepared by a suitability qualified and experienced engineer which meets the requirements of *Victoria EPA (2015) Best practice environmental*



*Management for siting, design, operation, and rehabilitation of landfills*³¹ shall be submitted and approved in writing by Environment Southland before any increase in filling rate occurs.

Overall Comments

From the limited information provided by the applicant, it is clear that the current operation and management of the landfill gas does not comply with the NES (Air Quality) and as such would be regarded as a **prohibited activity**. The applicant has not demonstrated that the gas collection and flaring system can be operated in such a way that the NES (Air Quality) will be complied with. Also, there are several serious issues with the current operation of the gas control system including:

1. The number of low temperature flare events,
2. High levels of oxygen within the gas extraction wells and gas collection system, which could potentially indicate that a flammable atmosphere exists within the landfill,
3. The lack of detail design calculations demonstrating that the proposed gas collection system is designed appropriately to handle the maximum gas volumes predicted by Jacobs,
4. A significant amount of generic information pertaining to the landfill gas collection system currently installed at the site, particularly the spacing of the gas collection wells,
5. Indication of areas of high surface emission rates in excess of the NES (Air Quality) maximum concentration of 5,000 ppm (v/v). This also may indicate that there are areas of the cap where air may ingress into the landfill, and
6. The failure to have a backup flare installed at the site, despite it being a requirement of the NES (Air Quality) since 2004 and AB Lime has missed the date (July 2020) to install the flare initially specified in the application.

Therefore, it is imperative for AB Lime to improve the performance of the current LFG collection system and to bring this system into compliance before allowing an increase in the volume of waste that can be disposed of within the site, which will alter the LFG regime at the site. EHS Support recommends that AB Lime should demonstrate that for a period of at least one year they are able to operate the gas collection system in full compliance with the NES (Air Quality) Regulations 26 and 27 and the site's Landfill Gas Management Plan. The independent reviewers' compliance report on the design and performance of the gas collection system will need to be certified by a suitably qualified independent consultant who is not involved in either the monitoring or design of the landfill gas collection system.

Closure

I trust the memo meets your requirements, however, should you have any queries please do not hesitate to contact the undersigned on 021 295 2284.

Kind regards,

Andrew Rumsby
Principal Environmental Chemist

APPENDIX B

***Review of Applicant's
Proposed Draft
Resource Consent
Conditions***

Reviewed by: Riley Consultants Ltd/EHS Support Ltd

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
Discharge Permit 206346-V3				
1	This consent is subject to the general conditions listed in Schedule 1 – General Conditions. Where there may be differences, or apparent conflict, between the general conditions and the conditions below, the conditions below shall prevail.	No change.	No review required - previously approved	
Limit Conditions				
2	The discharge of waste is authorised only on the areas of the site identified as the landfill footprint, as shown on drawing number AE03541-ECC-DG-0213 attached to this consent.	The discharge of waste is authorised only on the areas of the site identified as the landfill footprint, as shown on drawing number IZ000400-1000-NG-DRG-1002 attached to this consent.	Only change is drawing number. Previous drawing AE03541-ECC-DG-0213 not supplied so cannot confirm if footprint the same. Based on Jacobs' description in supporting documentation assume they are the same footprint, therefore proposed revised condition suitable.	
3	The discharge of leachate onto, or into, land (leachate leakage) is authorised only on those areas of the site identified as the landfill footprint, the leachate treatment pond and stormwater retention pond, as shown on drawing number AE03541-ECC-DG-0213 attached to this consent.	The discharge of leachate onto, or into, land (leachate leakage) is authorised only on those areas of the site identified as the landfill footprint, the leachate treatment pond and stormwater retention pond, as shown on drawing number IZ000400-1000-NG -DRG-1001 attached to this consent.	Only change is drawing number. Previous drawing AE03541-ECC-DG-0213 not supplied so cannot confirm if footprint the same. Based on Jacobs' description in supporting documentation assume they are the same footprint, therefore proposed revised condition suitable.	
4	Any recirculation, or re-injection of the landfill's leachate onto, or into, the refuse mass shall be via surface spraying onto intermediate cover, or injection directly into the refuse mass using dedicated leachate injection trenches, wells, or horizontal pipes.	No change.	No requirement to alter condition for proposed increase in waste acceptance.	
5	The volume of leachate discharged into the landfill shall be such that the leachate head on the base liner shall not exceed 300 millimetres. This level shall be managed by calculating leachate impingement rates, using estimated infiltration from rainfall, and controlling the volume of leachate sprayed onto the landfill surface or injected directly into the landfill.	No change.	No requirement to alter condition for proposed increase in waste acceptance.	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
Design Conditions				
6	<p>The leachate containment and leachate collection system for the base of the landfill, and any side slopes with a slope of approximately 2H:1V, or, less, shall consist of the following, from bottom to top:</p> <ul style="list-style-type: none"> ▪ a groundwater underdrainage system; ▪ a minimum of 1000 millimetres of compacted clay with a permeability coefficient (k) of not more than 1 x 10-9 metres per second; ▪ a 300 millimetre minimum liner protection/leachate collection layer of granular material with a permeability coefficient (k) of not less than 1 x 10-3 metres per second; or ▪ a groundwater underdrainage system; ▪ a minimum of 600 millimetres of compacted clay with a permeability coefficient (k) of not more than 1 x 10-9 metres per second; ▪ a 1.5 millimetre HDPE flexible membrane liner; ▪ a 300 millimetre minimum liner protection/leachate collection layer of granular material with a permeability coefficient (k) of not less than 1 x 10-3 metres per second; or 	<p>a) The leachate containment and leachate collection system for the base of the landfill, and any side slopes with a slope of approximately less than 2H:1V, shall consist of the following as a minimum, from bottom to top:</p> <ul style="list-style-type: none"> ▪ a groundwater underdrainage system; ▪ a minimum of 1000 millimetres of compacted clay with a permeability coefficient (k) of not more than 1 x 10-9 metres per second; ▪ a 300 millimetre minimum liner protection/leachate collection layer of granular material with a permeability coefficient (k) of not less than 1 x 10-3 metres per second; or a groundwater underdrainage system; ▪ a minimum of 600 millimetres of compacted clay soil with a permeability coefficient (k) not exceeding 1 x 10-9 metres per second; ▪ a 1.5 millimetre high density polyethylene (HDPE) flexible membrane liner; ▪ a 300 millimetre minimum liner protection/leachate collection layer of granular material with a permeability coefficient (k) of not less than 1 x 10-3 metres per second; or ▪ a groundwater underdrainage system; a minimum of 300 millimetres of compacted soil with a permeability coefficient (k) not more than exceeding 1 x 10-9 metres per second; ▪ a geosynthetic clay liner (GCL), with a minimum thickness of 5 millimetres, a permeability coefficient (k) not more than exceeding 5 x 10-11 metres per second and sufficient internal shear strength to maintain a stable configuration on slopes; ▪ a 1.5 millimetre high density polyethylene (HDPE) flexible membrane liner; ▪ a 300 millimetre minimum liner protection/leachate collection layer of granular material with a permeability coefficient (k) of not less than 1 x 10-3 metres per second or a groundwater underdrainage system; ▪ a minimum of 600 millimetres of compacted clay soil with a permeability coefficient (k) not more than exceeding 1 x 10-8 metres per second; ▪ a geosynthetic clay liner (GCL), with a minimum thickness of 5 millimetres, a permeability coefficient (k) not exceeding 5 x 10-11 metres per second; ▪ a 1.5 millimetre high density polyethylene (HDPE) flexible membrane liner; ▪ a 300 millimetre minimum liner protection/leachate collection layer of granular material. <p>b) An alternative to the above minimum specifications may be proposed and included in the Landfill Operations Management</p>	<p>The proposed condition alterations do not appear to be specifically shown in the supporting design information. However, it is noted the alterations presented do not appear to reduce proposed liner performance in any way from the previous condition.</p> <p>It is uncertain why the reference to "sufficient internal shear strength to maintain a stable configuration on slopes" is proposed to be deleted. It is likely the GCL will have sufficient internal strength, so it is understandable why it would be deleted, however is the intent to state the entire liner system has sufficient internal strength to maintain stability? This could be added as a separate line.</p>	<p>Applicant to address initial review comment.</p>
7	<p>The leachate containment system for the side slopes of the landfill, with a slope greater than 2H:1V shall consist of the following, from bottom to top:</p> <ul style="list-style-type: none"> ▪ a groundwater underdrainage system; ▪ a geosynthetic clay liner, with a minimum thickness of 5 millimetres, a permeability coefficient (k) of not less than 5 x 10-11 metres per second and sufficient internal shear strength to maintain a stable configuration on slopes; ▪ a 2.0 millimetre HDPE flexible membrane liner; ▪ a 300 millimetre minimum liner protection layer of soil or clay or granular material 	<p>a) The leachate containment system for the side slopes of the landfill, with a slope greater than of 2H:1V or greater shall consist of the following as a minimum, from bottom to top:</p> <ul style="list-style-type: none"> ▪ a groundwater underdrainage system where required; ▪ a geosynthetic clay liner, with a minimum thickness of 5 millimetres, a permeability coefficient (k) of not less than not exceeding 5 x 10-11 metres per second and sufficient internal shear strength to maintain a stable configuration on slopes; ▪ a 2.0 millimetre HDPE flexible membrane liner; and ▪ a 300 millimetre minimum liner protection layer of soil or clay or granular material. <p>b) An alternative to the above minimum specifications may be proposed and included in the Landfill Operations Management Plan subject to Independent Peer Review approval and subsequent council certification.</p>	<p>"Where required" should be defined, i.e. "beneath landfill footprint"</p> <p>The proposed alterations are consistent with the supporting documentation.</p>	<p>Applicant to address initial review comment.</p>
8	<p>The consent holder shall prepare landfill side slopes, to ensure a smooth surface appropriate for the placement of geosynthetic liner materials, to the satisfaction of the Southland Regional Council. This shall include the smoothing of rough surfaces, sealing of solution features or compaction of slopes to an appropriate bearing capacity</p>	<p>The consent holder shall prepare landfill side slopes, to ensure a smooth surface appropriate for the placement of geosynthetic liner materials, to the satisfaction of the Southland Regional Council. This shall include the smoothing of rough surfaces, sealing of solution features or compaction of slopes to an appropriate bearing capacity.</p>	<p>Proposed change accepted. Territorial authority reference irrelevant.</p>	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
9	The leachate collection system shall be designed to maintain a leachate head of less than 300 millimetres on the base liner and side liner, as demonstrated by design calculations, to the satisfaction of the Southland Regional Council, based on the expected leachate impingement rate due to rainfall and any leachate recirculation and expected clogging of the leachate collection system.	No change.	No requirement to alter condition for proposed increase in waste acceptance.	
10	Final cover and capping shall be constructed to the following minimum specification, from bottom to top, as each stage of the landfill is completed: <ul style="list-style-type: none"> ▪ 300 millimetres intermediate cover/regulating layer of compacted quarry overburden; ▪ 600 millimetres of compacted clay, overburden or soil material, with a permeability coefficient (k) of not more than 1×10^{-7} metres per second; ▪ 150 millimetres of growing medium. 	<p>a) Final cover and capping shall be constructed to the following minimum specification, from bottom to top, as each stage of the landfill is completed:</p> <ul style="list-style-type: none"> ▪ 300 millimetres intermediate cover/regulating layer of compacted knap rock; ▪ 600 millimetres of compacted clay, overburden or soil material, with a permeability coefficient (k) not exceeding 1×10^{-7} metres per second; ▪ 300 millimetres of compacted knap rock (growth layer); ▪ 150 millimetres of topsoil. or 300 millimetres minimum intermediate cover/regulating layer of compacted knap rock quarry overburden; ▪ a geosynthetic clay liner (GCL) with a permeability coefficient (k) not exceeding 1×10^{-7} metres per second; ▪ 600 millimetres of compacted clay, overburden or soil material, with a permeability coefficient (k) of not more than 1×10^{-7} metres per second; ▪ 300 millimetres of compacted knap rock (growth layer). ▪ 150 millimetres of growing medium-topsoil. <p>b) An alternative to the above minimum specifications may be proposed and included in the Landfill Operations Management Plan subject to Independent Peer Review approval and subsequent council certification</p>	GCL alternative cap doesn't appear consistent with Jacobs Landfill Capping Design memo, figure 2. Has the sequence of units been transposed?	<p>The current proposed alternative cap design does not include a drainage layer. Jacobs' comment on evaluation of the need for this will be included in the final cap design and trials. Suggest addition to condition 10:</p> <p><i>During trial of the final cap layer the need for a drainage layer shall be considered. Evidence with regard to its necessity and design should be supplied to Environment Southland and the Independent Peer Reviewer.</i></p>
11	The consent holder shall construct surface water control measures on the finished landfill surface so as to minimise erosion of the final cover.	No change.	No requirement to alter condition for proposed increase in waste acceptance.	
12	The containment system for the leachate storage pond shall consist of the following, from bottom to top: <ul style="list-style-type: none"> - a minimum of 600 millimetres of compacted clay with a permeability coefficient (k) of not more than 1×10^{-9} metres per second; - 1.5 millimetre HDPE flexible membrane liner; or <ul style="list-style-type: none"> - a minimum of 300 millimetres of compacted clay with a permeability coefficient (k) of not more than 1×10^{-9} metres per second; ▪ a geosynthetic clay liner, with a minimum thickness of 5 millimetres and a permeability coefficient (k) of not less than 5×10^{-11} metres per second - a 1.5 millimetre HDPE flexible membrane liner. <p>A telltale drain shall be installed beneath the containment system, to enable detection of leachate leakage.</p>	<p>The containment system for the leachate storage pond shall consist of the following, from bottom to top:</p> <ul style="list-style-type: none"> ▪ a minimum of 600 millimetres of compacted clay with a permeability coefficient (k) of not more than 1×10^{-9} metres per second; ▪ a 1.5 millimetre HDPE flexible membrane liner; or <ul style="list-style-type: none"> ▪ a minimum of 300 millimetres of compacted clay with a permeability coefficient (k) of not more than 1×10^{-9} metres per second; ▪ a geosynthetic clay liner, with a minimum thickness of 5 millimetres and a permeability coefficient (k) of not less than 5×10^{-11} metres per second; a 1.5 millimetre HDPE flexible membrane liner. <p>A telltale drain shall be installed beneath the containment system, to enable detection of leachate leakage.</p>	We consider there is no detriment in the condition remaining, should modifications be required to the leachate storage pond in the future under the period of the consent.	
12	The HDPE component of composite lining systems may be replaced with an alternative material, following acceptance in writing by the Southland Regional Council, where an alternative material is demonstrated to provide equivalent, or superior, performance in terms of <ul style="list-style-type: none"> ▪ puncture resistance ▪ resistance to chemical degradation; ▪ hydraulic containment; ▪ physical strength and deformation characteristics under service and seismic loads; ▪ welding and general installation; ▪ expected service life. 	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
13	Liner components comprising synthetic or geo-synthetic materials shall be constructed in accordance with the manufacturer's recommended quality assurance/quality control procedures	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
15	The containment system for the stormwater pond shall consist of the following, from bottom to top: <ul style="list-style-type: none"> • a proof rolled base surface; • a minimum of 300 millimetres of compacted clay (constructed in two uniform lifts) with a permeability coefficient (k) of not more than 1 x 10⁻⁹ metres per second; a protection layer on the base and sides of the compacted clay liner to minimise degradation, desiccation and damage due to wave action.	The containment system for the stormwater pond shall consist of the following, from bottom to top: <ul style="list-style-type: none"> • a proof rolled base surface; • a minimum of 300 millimetres of compacted clay (constructed in two uniform lifts) with a permeability coefficient (k) of not more than 1 x 10⁻⁹ metres per second; a protection layer on the base and sides of the compacted clay liner to minimise degradation, desiccation and damage due to wave action.	Applicant argues the condition has been fulfilled and therefore can be deleted. We consider there is no detriment in the condition remaining, should modifications be required to the stormwater pond in the future under the period of the consent.	Refer initial review comment, which suggests that this condition remain in place.
14	The landfill gas collection and leachate recirculation systems shall be designed to prevent puncture of the landfill liner by system components. In particular, any vertical wells or pipes installed for the collection of landfill gas, or re-injection of leachate into the landfill, shall terminate at a height above the base or side liner that will ensure that pipes, or wells, will not puncture the liner as a result of refuse settlement, or incorporate other appropriate design features that allow for expected settlement, to the satisfaction of the Southland Regional Council.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
15	The design and operation of any re-injection system shall ensure that leachate re-injection does not result in overland flow of leachate or leachate seepage, or breakout, on surface or side slopes of the landfill.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
New Condition			The LOMP should include a condition to prevent unacceptable wastes from being accepted by the Landfill including (i) Lithium batteries (ii) Persistent Organic Pollutant Waste (as defined by Hazardous Substances (Storage and Disposal of POPs) Notice 2004 (Updated 2017).	
New Condition				An annual review of the waste acceptance criteria and prohibited items shall be undertaken and the findings of the review shall be submitted to Environmental Southland by 30 June each year That the filling rate of solid waste onto or into land shall be limited to 100,000 tonnes of solid waste per annum until an independent, suitably qualified and experienced chartered engineer has certified that AB Lime has demonstrated that for a period of at least one year they are able to operate the gas collection system in full compliance with the NES (Air Quality) Regulations 26 and 27 and the landfill gas management plan. The LGMP was be must be submitted by the reviewer and approved by Environment Southland before the cap of waste accepted is removed.
New Condition				

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
New Condition				A Construction Quality Assurance Plan prepared by a suitability qualified and experienced engineer which meets the requirements of <i>Victoria EPA (2015) Best practice environmental management for siting, design, operation, and rehabilitation of landfills</i> shall be submitted and approved in writing by Environment Southland before any increase in filling rate occurs.
New Condition				All new waste acceptance criteria must be submitted to Environmental Southland for written approval before the waste is accepted.
20	For other than minor amounts of offal, the consent holder shall: ... (text continues)	No change.	Accepted.	
21	Materials contaminated with methamphetamine and/or chemicals associated with the manufacture of methamphetamine may be accepted into the landfill provided ... (text continues)	No change.	Accepted.	
22	Aluminium dross waste (AWD) and material contaminated with this waste may be accepted into the landfill provided ... (text continues)	No change.	Accepted.	
23	With the exception of medical wastes and asbestos wastes, no hazardous waste shall be accepted for disposal at the landfill. The definition of hazardous waste shall be ... (definition follows) ... Where leachable concentration or total concentration limits do not exist in Schedule 2 for a substance for which a disposal request is made, the leachable limit, following testing using the USEPA TCLP shall be set at the lesser of: a) NZS 9201 Trade Waste Bylaw limits; or b) 100 times the New Zealand drinking water standard; or c) 1000 times the ANZECC guidelines for protection of aquatic species. ... (text continues)	With the exception of medical wastes and asbestos wastes, no hazardous waste shall be accepted for disposal at the landfill. The definition of hazardous waste shall be ... (definition follows) ... Where leachable concentration or total concentration limits do not exist in Schedule 2 for a substance for which a disposal request is made, the leachable limit, following testing using the USEPA TCLP shall be set at the lesser of: a) NZS 9201 Trade Waste Bylaw limits; or b) 100 times the New Zealand drinking water standard drinking water standards to which all drinking water supplies must comply as per the Drinking-water Standards for New Zealand 2005 (revised 2008); or c) 1000 times the ANZECC guidelines for protection of aquatic species Default Guideline Values in the Australian and New Zealand Guidelines for Protection of Fresh and Marine Water Quality. ... (text continues)	Proposed changes accepted	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
Monitoring and Reporting				
24	<p>The consent holder shall maintain, to the satisfaction of the Southland Regional Council, a record of the quantities and types of waste accepted at the landfill, including the location (in three dimensions) of:</p> <ul style="list-style-type: none"> • treated hazardous wastes; and • specials wastes (as listed in the landfill management plan). <p>A copy of this record shall be forwarded to the Southland Regional Council by 1 August each year, unless otherwise agreed in writing by the Southland Regional Council</p>	<p>The consent holder shall maintain, to the satisfaction of the Southland Regional Council, a record of the quantities and types of waste accepted at the landfill, including the location (in three dimensions) of:</p> <ul style="list-style-type: none"> • treated hazardous wastes; and • specials wastes (as listed in the Landfill Operations Management Plan); and • Emergency response waste <p>A copy of this record shall be forwarded to the Southland Regional Council by 1 August annually, unless otherwise agreed in writing by the Southland Regional Council.</p>	Accepted	
25	The consent holder shall immediately notify the Southland Regional Council if any vehicle(s) is turned away from the landfill with waste that does not comply with the waste acceptance criteria detailed in conditions 18, 19, 20, 21 and 22. This notification shall include the vehicle registration number and source of the waste (if known).	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
26	<p>The consent holder shall monitor the volume of leachate withdrawn from the landfill and record this volume on a daily basis. This record shall be reported in writing to the Southland Regional Council by 1 May each year, unless otherwise agreed in writing by the Southland Regional Council.</p> <p>New condition proposed.</p>	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	Further to 2.74, the following consent condition is proposed: <i>The applicant shall implement the measures identified in the Landfill Operations Management Plan (LOMP) and related technical reports in an effort to mitigate against water infiltration into the landfill, and will continue to monitor annual leachate quantities produced. If leachate quantities have shown a continued upward trend over the next three years, the</i>
27	<p>The consent holder shall monitor the collected leachate to the satisfaction of the Southland Regional Council.</p> <p>To this end the consent holder shall monitor the dissolved oxygen levels in the leachate storage pond on a daily basis and at the inflow of the leachate pond, Site 11 as shown on drawing number 319-C-125 attached to this consent, twice a year for the following parameters: <text continues></p>	<p>The consent holder shall monitor the collected leachate to the satisfaction of the Southland Regional Council.</p> <p>To this end the consent holder shall monitor the dissolved oxygen levels in the leachate storage pond on a daily basis and at the inflow of the leachate pond, Site 11, as shown on drawing number 319-C-125 IZ000400-1000-NG DRG-1008 attached to this consent, twice a year for the following parameters: <text continues as per original condition></p>	Accepted	
28	The consent holder shall install four new downgradient groundwater monitoring wells, SKM 201, SKM 202, SKM 203 and SKM 204, as indicated on drawing number C19-3-125 attached to this consent. The final locations shall be agreed in writing with the Southland Regional Council.	The consent holder shall install four new downgradient groundwater monitoring wells, SKM 201, SKM 202, SKM 203 and SKM 204, as indicated on drawing number C19-3-125 attached to this consent if deemed necessary by the consent holder. The final locations shall be agreed in writing with the Southland Regional Council.	As we understand that the four monitoring wells in the original consent condition have already been installed, it is appropriate to delete these wells. However, the statement "if deemed necessary by the consent holder" is inconsistent with the Groundwater Quality Technical Memo (Appendix L), which states that two new downgradient groundwater monitoring wells will be installed by the applicant. Once all groundwater quality reports requested (Q 2.74) have been received, the appropriate number of downgradient monitoring wells to be required by this consent can be advised upon.	To ensure consistency with the statements made in the GQTM (Appendix L) and recent groundwater monitoring report, the consent condition should be re-worded as follows: <i>The consent holder shall install two new downgradient monitoring wells. The final locations shall be agreed in writing with the Southland Regional Council.</i>
29	The consent holder shall conduct a rising head test, or other test(s) as agreed by the Southland Regional Council, to demonstrate that any new groundwater well is working and assess the hydraulic conductivity of the in-situ ground. A water sample shall be taken from the ground and tested for turbidity to determine whether the well is clean enough to provide samples of dissolved constituents. The results of these tests shall be forwarded to the Southland Regional Council with the first set of monitoring results from the well.	The consent holder shall conduct a rising head test, or other test(s) as agreed by the Southland Regional Council (within 3 months), to demonstrate that any new groundwater well is working and assess the hydraulic conductivity of the in-situ ground. A water sample shall be taken from the ground and tested for turbidity to determine whether the well is clean enough to provide samples of dissolved constituents. The results of these tests shall be forwarded to the Southland Regional Council with the first set of monitoring results from the well.	Proposed change accepted.	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
30	The consent holder shall monitor existing water quality in existing groundwater monitoring wells SKM 104, SKM 106 and SKM 108, and proposed groundwater monitoring wells SKM 201, SKM 202, SKM 203 and SKM 204, as indicated on drawing number C19-3-125 attached to this consent, to the satisfaction of the Southland Regional Council. To this end, the consent holder shall monitor water level every month, and water quality for the following parameters four times a year: (text continues)	The consent holder shall monitor existing water quality in existing downgradient groundwater monitoring wells SKM 104, SKM 106 and SKM 108, and proposed groundwater monitoring wells SKM 201, SKM 202, SKM 203 and SKM 204, as indicated on drawing number C19-3-125 I2000-400-1000-NG-DRG-2008 attached to this consent, to the satisfaction of the Southland Regional Council. To this end, the consent holder shall monitor water level every month, and water quality for the following parameters four times a year: (no further applicant changes.)	Proposed change accepted.	
31	The consent holder shall establish baseline groundwater quality for each groundwater monitoring well, monitored in accordance with condition 28 and condition 31 of this consent, after a minimum of four groundwater sampling events. Following the establishment of baseline groundwater quality, to the satisfaction of the Southland Regional Council, the consent holder may reduce the frequency of those parameters requiring monitoring from four times a year to twice a year, (to coincide with expected groundwater maximum and minimum).	The consent holder shall establish baseline groundwater quality for each new groundwater monitoring well, monitored in accordance with condition 28 and condition 31 of this consent, after a minimum of four groundwater sampling events. Following the establishment of baseline groundwater quality, to the satisfaction of the Southland Regional Council, the consent holder may reduce the frequency of those parameters requiring monitoring from four times a year to twice a year, (to coincide with expected groundwater maximum and minimum).	Proposed change accepted.	
32	Following the establishment of groundwater level and baseline water quality in the groundwater monitoring wells SKM 201, SKM 202, SKM 203 and SKM 204, the consent holder shall prepare a report, based on information from all groundwater monitoring wells on site, proposing the most appropriate location(s) for the installation of a downgradient well, or wells, at the site boundary for ongoing groundwater monitoring. Any such wells shall be installed at the location, and at a time, agreed to in writing by the Southland Regional Council.	Following the establishment of groundwater level and baseline water quality in the groundwater monitoring wells SKM 201, SKM 202, SKM 203 and SKM 204, the consent holder shall prepare a report, based on information from all groundwater monitoring wells on site, proposing the most appropriate location(s) for the installation of a downgradient well, or wells, at the site boundary for ongoing groundwater monitoring. Any such wells shall be installed at the location, and at a time, agreed to in writing by the Southland Regional Council.	The applicant has proposed deleting this condition in its entirety. While wells SM 201 - 204 have been installed already and these should be deleted as per previous conditions, it is not clear why the remainder of the consent condition should be removed, as the referenced report to be prepared proposing locations for new downgradient wells would still be required. Additionally, condition 33 specifically references this condition in terms of new wells to be installed. Justification for deletion of this condition should therefore be provided.	Unless justification can be provided for its removal, this condition should be amended and retained, as follows: <i>The consent holder shall prepare a report, based on information from all groundwater monitoring wells on site, proposing the most appropriate locations for the installation of two new downgradient monitoring wells at the site boundary for ongoing groundwater monitoring. The report shall be provided to the Southland Regional Council and the downgradient wells shall be installed at locations agreed to in writing by the Southland Regional Council.</i>
33	The consent holder shall monitor water quality in any new groundwater monitoring well(s), installed in accordance with condition 32 of this consent, to the satisfaction of the Southland Regional Council. To this end the consent holder shall monitor water level every month, and water quality for the following parameters four times a year: ... (text continues)	The consent holder shall monitor water quality in any new downgradient groundwater monitoring well(s), installed in accordance with condition 32 of this consent, to the satisfaction of the Southland Regional Council. To this end the consent holder shall monitor water level every month, and water quality for the following parameters four times a year: ... (no further applicant changes.)	Proposed change accepted.	
34	The consent holder shall develop trigger levels for each parameter within each monitoring well downgradient of the landfill, ... (text continues)	The consent holder shall develop trigger levels for each parameter within each new monitoring well downgradient of the landfill, ... (no further applicant changes.)	Proposed change accepted.	
35	If any groundwater monitoring well is destroyed the consent holder shall replace it with a new well, in the same general location, to the satisfaction of the Southland Regional Council.	No change.	Accepted.	
36	The consent holder shall undertake a formal inspection of the landfill cap following significant storm events ... (text continues)	No change.	Accepted.	
37	The consent holder shall maintain a record of the daily discharge of leachate onto, or into, the landfill ... (text continues)	No change.	Accepted.	
38	Where electronic or pneumatic piezometers are installed to measure leachate head on the landfill liner, the consent holder shall maintain a daily record of measurements, which shall be made available to the Southland Regional Council at all reasonable times. These records shall be forwarded to the Southland Regional Council by 1 May each year.	Where electronic or pneumatic piezometers are installed to measure leachate head on the landfill liner, The consent holder shall maintain a daily record of the level of leachate in the landfill of measurements, which shall be made available to the Southland Regional Council at all reasonable times. These records shall be forwarded to the Southland Regional Council by 1 May each year.	Proposed change accepted; the applicant has explained that revision of this clause allows flexibility for the consent holder to measure the level of leachate by piezometers, pressure sensor or dip stick testing.	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
39	<p>The Southland Regional Council, after consultation with the consent holder, may commence a review of conditions 19, 20 and 21 of this consent within six months of the publication of any change in the national definition of hazardous wastes, or the publication of new national policies, regulations, standards or guidelines on landfill waste acceptance or the treatment and/or disposal of wastes with hazardous properties.</p> <p>Costs relating to the above review shall be borne by the consent holder.</p>	<p>The Southland Regional Council, after consultation with the consent holder, may commence a review of conditions 19, 20 and 21 17, 18, 20, 21, 22 of this consent within six months of the publication of any change in the national definition of hazardous wastes, or the publication of new national policies, regulations, standards or guidelines on landfill waste acceptance or the treatment and/or disposal of wastes with hazardous properties.</p>	<p>Final condition numbers referenced may change based on the S.92 review process; hence this condition should be revisited once this process has been completed.</p>	
40	<p>The Southland Regional Council, after consultation with the consent holder, may commence a review of the conditions of this consent at two yearly intervals from the anniversary date of this consent or within six months after cessation of landfilling operations at the site, in order to ensure that:</p> <p>(i) refuse acceptance criteria and discharge areas and practices are appropriate to avoid or reduce any adverse effects on the environment; and</p> <p>(ii) leachate, groundwater and surface water management systems and management practices are appropriate to avoid or reduce any adverse effects on the environment; and</p> <p>(iii) an appropriate effects monitoring programme is being undertaken.</p> <p>Costs relating to the above reviews shall be borne by the consent holder</p>	<p>No change.</p>	<p>Accepted.</p>	
Discharge Permit 201347				
1	<p>This consent is subject to the general conditions listed in Schedule 1 – General Conditions. Where there may be differences or apparent conflict between the general conditions and the conditions below, the conditions below shall prevail.</p>	<p>No change.</p>	<p>Accepted. No requirement to alter condition for proposed increase in waste acceptance</p>	
2	<p>The point of compliance for discharge of treated stormwater is the site surface discharge location 5, as shown on drawing 319-C-123 attached to this consent</p>	<p>The point of compliance for discharge of treated stormwater is the site surface water discharge location 5, as shown on drawing 319-C-123 I2000400-1000-NG-DRG-1008 attached to this consent.</p>	<p>Accepted</p>	
3	<p>No stormwater coming in contact with refuse shall be discharged as stormwater but shall be considered leachate and treated and/or disposed of accordingly.</p>	<p>No change.</p>	<p>Accepted. No requirement to alter condition for proposed increase in waste acceptance</p>	
4	<p>Site stormwater shall be treated to remove 75 percent of sediment, in accordance with TP10 guidelines in the document "Erosion and Sediment Control – Guidelines for Land Disturbing Activities", Auckland Regional Council Technical Publication No. 90, dated March 1999.</p>	<p>No change.</p>	<p>Update to Auckland Council GD01/GD05 which supersedes TP10.</p>	<p>Applicant to correct legislation reference as per initial review comment.</p>
5	<p>Following any discharge made pursuant to this consent, the D Classification standards (see Schedule 3) for the receiving waters shall be maintained ... (text continues)</p>	<p>No change.</p>	<p>Accepted.</p>	
6	<p>Groundwater from the liner underdrainage system shall be discharged to the site stormwater pond.</p>	<p>No change.</p>	<p>Accepted.</p>	
7	<p>The stormwater retention ponds shall be designed to manage a two percent AEP (Annual Exceedance Probability) design flood, with provision to pass a one percent AEP design flood.</p>	<p>No change.</p>	<p>Accepted. It is noted this condition was acceptable at the time of original consent in 2002 and the design requirement will be revisited at the time of consent expiry as this is not consistent with current requirements.</p>	
8	<p>Scour protection works of concrete, rock or timber construction shall be placed at the outlet of the stormwater treatment pond to prevent scour.</p>	<p>No change.</p>	<p>Accepted. No requirement to alter condition for proposed increase in waste acceptance.</p>	
9	<p>The consent holder shall be solely responsible for the structural integrity and maintenance of all dam works, and for any erosion control and energy dissipation works that become necessary as a result of the exercise of this consent. To this end, all channels shall be engineered to preclude excessive channel erosion at peak velocities.</p>	<p>No change.</p>	<p>The applicant notes the Quarry Management Plan will include details of works required to address the condition. Recommended the conditions stipulates this occurs. It is noted the QMP is not provided.</p>	<p>Applicant to address initial review comment.</p>

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
10	The consent holder shall monitor rainfall at rain gauge location Site 8, as shown on drawing number 319-C-125 attached to this consent, to the satisfaction of the Southland Regional Council.	The consent holder shall monitor rainfall at rain gauge location Site 8, as shown on drawing number 319-C-125 IZ000400-1000-NG-DRG-1008 attached to this consent, to the satisfaction of the Southland Regional Council. Rainfall shall be recorded on a monthly basis and reported to the Southland Regional Council by 1 May each year	We assume that rainfall can be attributed on at least a daily basis, if not more frequent, should any rainfall events need to be assessed. The condition is not clear about this.	
11	The consent holder shall continuously monitor the volume of stormwater discharge at monitoring locations Site 5, and Site 9, as shown on drawing number 319-C-125 attached to this consent, to the satisfaction of the Southland Regional Council Flow shall be recorded on a monthly basis and reported to the Southland Regional Council by 1 May each year	The consent holder shall continuously monitor the volume of stormwater discharge at monitoring locations Site 5, and Site 9, as shown on drawing number 319-C-125 IZ000400-1000-NG-DRG-1008 attached to this consent, to the satisfaction of the Southland Regional Council Flow shall be recorded on a monthly basis and reported to the Southland Regional Council by 1 May each year	Accepted. No requirement to alter condition for proposed increase in waste acceptance	
12	The consent holder shall, to the satisfaction of the Southland Regional Council, monitor surface water at monitoring locations Site 5 and Site 9, as shown on drawing 319-C-125 attached to this consent. ... (text continues)	The consent holder shall, to the satisfaction of the Southland Regional Council, monitor surface water at monitoring locations Site 5 and Site 9, as shown on drawing 319-C-125 IZ000400-1000-NG-DRG-1008 attached to this consent. (no further applicant changes)	Proposed change accepted.	
13	The consent holder shall monitor the quality of the stream sediments in the drain, upstream and downstream of the site surface water discharge (Sites 16 and 15 respectively, as shown on drawing 319-C-125 attached to this consent) ... (text continues)	The consent holder shall monitor the quality of the stream sediments in the drain, upstream and downstream of the site surface water discharge (Sites 16 and 15 respectively, as shown on drawing 319-C-125 IZ000400-1000-NG-DRG-1008 attached to this consent) ... (no further applicant changes)	Proposed change accepted.	
14	The consent holder shall monitor the flow and water quality of the groundwater discharge at monitoring location Site 13, as shown on drawing 319-C-125 attached to this consent) ... (text continues)	The consent holder shall monitor the flow and water quality of the groundwater discharge at monitoring location Site 13, as shown on drawing 319-C-125 IZ000400-1000-NG-DRG-1008 attached to this consent ... (no further applicant changes)	Proposed change accepted.	
15	The consent holder shall determine trigger levels, to indicate potential leachate contamination, ... (text continues)	No change.	Accepted.	
16	If the trigger levels for continuous pH and conductivity monitoring are exceeded at Site 5 or Site 9, ... (text continues)	No change.	Accepted.	
17	The consent holder shall determine trigger levels, to indicate leachate contamination of surface water, ... (text continues)	No change.	Accepted.	
18	If monitoring of the stormwater discharge system indicates leachate contamination ... (text continues)	No change.	Accepted.	
19	The consent holder shall determine trigger levels for each parameter monitored ... (text continues)	No change.	Accepted.	
20	If the results of monthly monitoring at Site 13, ... (text continues)	No change.	Accepted.	
21	Any groundwater found to be contaminated with leachate shall be treated and/or disposed of as leachate.	No change.	Accepted.	
Water Permit 201348				
1	This consent is subject to the general conditions listed in Schedule 1 – General Conditions. Where there may be differences, or apparent conflict, between the general conditions and the conditions below, the conditions below shall prevail.	No change.	Accepted.	
2	The taking of groundwater is authorised only from the groundwater underdrainage systems beneath the landfill footprint and leachate storage pond, as shown on drawing [drawing number to be inserted] attached to this consent.	The taking of groundwater is authorised only from the groundwater underdrainage systems beneath the landfill footprint and leachate storage pond, as shown on drawing [drawing number to be inserted] IZ000400-1000-NG-DRG-1008 attached to this consent.	Proposed change accepted.	
3	The consent holder shall monitor the quantity of groundwater taken from the groundwater underdrainage system to the satisfaction of the Southland Regional Council. ... (text continues)	No change.	Accepted.	
4	The Southland Regional Council, after consultation with the consent holder, may commence a review of the conditions of this consent ... (text continues)	No change.	Accepted.	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
Water Permit 201349				
1	This consent is subject to the general conditions listed in Schedule 1 – General Conditions. Where there may be differences or apparent conflict between the general conditions and the conditions below, the conditions below shall prevail	No change	Accepted	
2	No stormwater coming in contact with refuse shall be discharged as stormwater, but shall be considered leachate and discharged into the leachate treatment/disposal system.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
3	Clean stormwater is defined as stormwater associated with areas that are not affected by quarrying or landfilling activities. These include: <ul style="list-style-type: none"> ▪ the vegetated areas of the site that are not impacted by the quarrying or the landfill; ▪ building rooves and roadways which are not impacted by the vehicles that are exiting the landfill and quarry areas; ▪ landfilled areas that have been capped and vegetated; ▪ existing pasture surfaces above the quarry; ▪ rehabilitated areas of the quarry and landfill, as agreed in writing by the Southland Regional Council 	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
4	Clean stormwater may be diverted and channelled past working areas and to existing watercourses.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
5	Dirty stormwater is defined as stormwater associated with the quarry working area and landfill construction and working areas and site roads. These include: <ul style="list-style-type: none"> ▪ the open quarry areas and areas that contribute to these; ▪ areas where landfill construction activities are taking place; ▪ lined areas of the landfill that have not received refuse; ▪ the site operating areas including access roads travelled by vehicles leaving the quarry and landfill areas; ▪ the process water return; the wheel wash. 	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
6	All dirty stormwater to be treated and discharged off-site shall be diverted and channelled to the site stormwater pond.	No change.	The increase in acceptance of waste to the site will likely result in increased trafficking of access roads. The applicant notes some stormwater is not directed to the main stormwater treatment. Given the possible increase in stormwater contamination it is advised all dirty stormwater runoff should be directed to treatment devices consistent with the conditions of relevant consents for the site.	Applicant to address initial review comment.
7	The consent holder shall construct surface water control measures on the finished landfill surface so as to minimise erosion.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
8	Earthworks related to the activities authorised by this consent, and associated sediment control measures, shall be constructed and carried out in accordance with the principles contained within the document "Erosion and Sediment Control – Guidelines for Land Disturbing Activities", Auckland Regional Council Technical Publication No. 90, dated March 1999, or an equivalent document agreed in writing by the Southland Regional Council.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
9	Suitable scour protection of concrete, rock or timber construction shall be placed at the beginning and end of the diversion channel and, if needed to prevent scour, at intermediate locations.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
10	All diversion channels shall be designed to manage a five percent AEP (Annual Exceedance Probability) design event, and pass a 1 percent AEP design event, without erosion of diversion channels. The diversion channels shall be designed such that if this capacity is exceeded the preferential (secondary) flow path is away from the landfill.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
11	The site stormwater pond shall be designed to contain a two percent AEP event and pass a one percent AEP event via a spillway structure, without damage to the pond.	No change.	Accepted. It is noted this condition was acceptable at the time of original consent in 2002 and the design requirement will be revisited at the time of consent expiry as this is not consistent with current requirements.	
12	The stormwater culvert beneath the landfill shall have a nominal internal diameter of approximately 1200 millimetres and shall be maintained to pass a one percent AEP event. It shall be designed in general accordance with drawing number 1029-I-001, in the report "A B Lime Limited Quarry Operation and Proposed Landfill, Additional Information", dated November 1992, with an additional level of lining protection between the base of the 600 millimetre compacted clay liner and the culvert pipe to ensure any leachate leakage from the primary liner(s) drains to the groundwater underdrainage system, to the satisfaction of the Southland Regional Council. The consent holder shall construct a bund, two metres high, upstream of the operating landfill stage to protect the landfill from rain events that the culvert cannot cope with, or if the culvert fails or becomes blocked.	The stormwater culvert beneath the landfill shall have a nominal internal diameter of approximately 1200 millimetres and shall be maintained to pass a one percent AEP event. It shall be designed in general accordance with drawing number 1029-I-001 , in the report " A B Lime Limited Quarry Operation and Proposed Landfill, Additional Information ", dated November 1992- I2000400-1000-NG-DRG-1024 with an additional level of lining protection between the base of the 600 millimetre compacted clay liner and the culvert pipe to ensure any leachate leakage from the primary liner(s) drains to the groundwater underdrainage system, to the satisfaction of the Southland Regional Council. The consent holder shall construct a bund, two metres high, upstream of the operating landfill stage to protect the landfill from rain events that the culvert cannot cope with, or if the culvert fails or becomes blocked.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
13	The consent holder shall construct surface water control measures on the finished landfill surface so as to minimise erosion of the final cover. To this end, the consent holder shall design and construct benched slopes for temporary capped and rehabilitated slopes in accordance with the principles contained within the document "Erosion and Sediment Control – Guidelines for Land Disturbing Activities", Auckland Regional Council Technical Publication No. 90, dated March 1999, or an equivalent document agreed in writing by the Southland Regional Council.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
14	The consent holder shall be solely responsible for the structural integrity and maintenance of all dam and diversion works associated with the exercise of this consent, and for any erosion control and energy dissipation works that become necessary as a result of the exercise of this consent. To this end all channels shall be engineered to preclude excessive channel erosion at peak velocities.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
15	Diversion channels and cut-off drains shall be maintained to minimise the infiltration and run-off of stormwater onto the landfill from areas outside the landfill footprint.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
16	The consent holder shall, within six months of the granting of this consent, prepare a contingency plan to address damage to, or failure of the stormwater culvert, for acceptance in writing by the Southland Regional Council. This plan shall include: <ul style="list-style-type: none"> ▪ measures to repair culvert damage or leakage; ▪ contingency measures in case of culvert failure or blockage; ▪ alternative means of stormwater drainage, in case of permanent failure of the culvert; <p>alternative means of stormwater drainage in case of early closure of the landfill or quarry.</p>	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
17	The Southland Regional Council, after consultation with the consent holder, may commence a review of the conditions of this consent at two yearly intervals from the anniversary date of this consent or within 6 months after cessation of landfilling operations at the site, in order to ensure that: <p>(i) stormwater control systems and management practices are appropriate to avoid or reduce any adverse effects on the environment; and</p> <p>(ii) an appropriate effects monitoring programme is being undertaken.</p> <p>Costs relating to the above reviews shall be borne by the consent holder.</p>	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
Water Permit 201350				
1	The maximum volume of water taken shall not exceed 500 cubic metres in any 24-hour period.	No change	Accepted. Assumed no requirement to alter condition for proposed increase in waste acceptance.	
2	The consent holder shall maintain a record of the daily pumping hours (the actual number and period of hours over which water was taken) and daily water usage (total daily volume), which shall be made available to the Southland Regional Council at all reasonable times. These records shall be forwarded to the Southland Regional Council by 1 May each year.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
3	The Southland Regional Council, after consultation with the consent holder, may commence a review of the conditions of this consent in June each year or within 6 months after cessation of landfilling operations at the site, in order to ensure that: (i) Surface water take practices are appropriate to avoid or reduce any adverse effects on the environment; and (ii) an appropriate effects monitoring programme is being undertaken. Costs relating to the above reviews shall be borne by the consent holder.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance.	
Air Discharge Permit 201351				
Conditions 1-15	Out of scope			
16	A landfill gas extraction system shall be installed and operated in accordance with the details supplied in the original consent application. This system shall be installed as soon as practicable after establishment of the landfill and shall be designed to capture and combust at least 75% landfill gas emissions from the site. The gas combustion system shall destroy at least 98% of non-methane organic compounds burned.	A landfill gas extraction system shall be installed and operated in accordance with the details supplied in the original consent application. This system shall be installed as soon as practicable after establishment of the landfill and shall be designed to capture and combust at least 75% landfill gas emissions from the site. The gas combustion system shall destroy at least 98% of non-methane organic compounds burned.	Insufficient information at the moment. Awaiting responses to S92 questions 2.37, 2.38, 2.44, 2.46, 2.49. Currently no back up flare is installed, therefore system does not comply with the NES Air Quality.	
17	Out of scope			
18	Each gas extraction well shall be connected to the main gas extraction system ... (text continues)	No change.	Insufficient information at the moment. Awaiting responses to S92 questions 2.37, 2.38, 2.44, 2.46, 2.49.	
19	The enclosed permanent gas flare or other utilisation system shall have: ... (text continues)	The enclosed permanent principal gas flare or other utilisation system shall have: ... (no further applicant changes)	Proposed changes comply with requirements of NES Air Quality Section 27.	
20	(a) The concentration of methane measured in monitoring probes outside the landfill footprint shall not exceed 1.25% by volume. (b) The concentration of methane measured at the surface of landfill areas with intermediate or final cover shall not exceed 5.0% by volume.	(a) The concentration of methane measured in monitoring probes outside the landfill footprint shall not exceed 1.25% by volume. (b) The concentration of methane measured at the surface of landfill areas with intermediate or final cover temporary or permanent capping shall not exceed 5.0% 0.5% by volume.	Proposed changes comply with requirements of NES Air Quality Section 26. A condition should be inserted which requires quarterly ISM monitoring of the cap and wellheads to ensure that temporary or permanent capping does not exceed 0.5% by volume. The results of the ISM survey shall be reported to Environment Southland within 30 working days. The report must include (a) a plan showing the location of any exceedances; (b) total area of the exceedances cover; (c) outline what remedial measures have been undertaken to remediate the cap or reduce surface emissions; (d) the results of verification sampling undertaken to demonstrate the remedial measures have been effective.	Proposed changes comply with requirements of NES Air Quality Section 26. A condition should be inserted which requires monthly ISM monitoring of the cap and wellheads to ensure that temporary or permanent capping does not exceed 0.5% by volume. The results of the ISM survey shall be reported to Environment Southland within 30 working days. The report must include (a) a plan showing the location of any exceedances; (b) total area of the exceedances cover; (c) outline what remedial measures have been undertaken to remediate the cap or reduce surface emissions; (d) the results of verification sampling undertaken to demonstrate the remedial measures have been effective.
21	A walkover site inspection of the landfill shall be undertaken ... (text continues)	A walkover site inspection of the landfill shall be undertaken ... (text continues)	Accepted.	

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
22	Methane concentrations shall be measured and recorded at least once each month in at least 10 monitoring probes located outside the landfill footprint, ... (text continues)	Methane concentrations shall be measured and recorded at least once each month in at least 10 monitoring probes located outside the landfill footprint, ... (text continues)	Insufficient information at the moment. Awaiting responses to S92 questions 2.37, 2.38, 2.44, 2.46, 2.49. Likely that additional boundary monitoring well will be required.	See new consent condition below....the number of monitoring probes should increase as the footprint of the landfill increases and advice of the Independent Peer reviewer.
23	Landfill gas shall be monitored at least once each month at each extraction gas well head and at each temporary flare station. ... (text continues)	No change.	Condition should also include vacuum pressure on well head.	Condition should also include vacuum pressure, temperature and flow rate on well head.
24	Once a permanent gas flare or other utilisation system is established, landfill gas shall be monitored. The following parameters ... (text continues)	No change.	Accepted.	
25	Once a permanent gas flare or other utilisation system is established, landfill gas shall be monitored for the following parameters: (a) hydrogen sulphide concentration shall be monitored at a frequency not less than once each month (b) concentration of total non-methane organic compounds (NMOC's) shall be monitored at six-monthly intervals until December 2011, after which time the monitoring shall be undertaken annually.	Once a permanent gas flare or other utilisation system is established, The landfill gas shall be monitored for the following parameters: (a) hydrogen sulphide concentration shall be monitored at a frequency not less than once each month (b) concentration of total non-methane organic compounds (NMOC's) shall be monitored at six-monthly intervals until December 2011, after which time the monitoring shall be undertaken annually.	Proposed change accepted.	
26	Out of scope			
27	The dissolved oxygen concentration in the leachate collection pond shall be measured between 8.00 am and 10.00 am on at least two days per week to demonstrate compliance with Condition 8.	No change.	Accepted.	
28	Out of scope			
29	Out of scope			
30	A record of all monitoring undertaken in accordance with the conditions of this consent and a summary of the monitoring results shall be provided to Environment Southland annually.	No change.	Accepted.	
New Condition			That radius of influence investigation to determine optimal location of gas extraction wellheads are undertaken within 12 months of granting this consent.	
New Condition			Condition should be inserted that an annual inspection is undertaken to check for leakages in the gas collection system.	
New Condition			That a backup flare shall be installed and connected to the gas collection system by 30 June 2021.	
New Condition			That a backup flare shall be installed and operational by 30 June 2021.	
New Condition			The system for a backup flare must have (a) a flame arrestor, and (b) an automatic backflow prevention device, or an equivalent device, between the backup flare and the landfill ; and c) an automatic isolation system that ensures that, if the flame is lost, no significant discharge of unburnt gas from the flare occurs; and (d) a continuous automatic ignition system	
New Condition			The principal flare must be operated at all times unless it has malfunctioned or is shut down for maintenance.	
New Condition			A backup flare must be operated if, and only if, a principal flare is not operating.	
New Condition				That an inspection of the gas collection system and well heads using infra-red thermography to identify any leakage from the gas extraction wellheads or above ground landfill gas header pipework. The results of the inspection should be reported to Environment Southland by 30 June.

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
New Condition				That the spacing and number of landfill gas monitoring bores be reviewed annually by an independent reviewer. The design and location of the landfill gas monitoring probes shall be approved in writing by Environment Southland prior to the probes being installed.
New Condition		<p>Advice note: AS part of the independent review process, the Independent Peer Reviewer should consider and report on all matters listed in Schedule XXXX:</p> <p>Schedule XXXX: AB Lime – Landfill Gas Management System Annual Audit Requirements</p> <p>The annual audit undertaken by the Independent Peer Review Process shall address the following issues:</p> <ol style="list-style-type: none"> 1.Review of the landfill gas management system operation and performance for the preceding 12 months against the Landfill Gas Management Plan. 2.Summary of weekly/monthly inspections and maintenance of the landfill gas management system detailing key findings from inspections and maintenance work, noting repairs undertaken, system and extraction well down time, volume of landfill gas extracted weekly, condensate volume recovered weekly, flare operational details, and landfill operation/capping. 3.Summary of results and interpretation of the performance and monitoring of the landfill gas management system for the preceding 12 months including (but not necessarily limited to): <ol style="list-style-type: none"> I.Performance of individual gas wells (extraction pressures, flow rates and gas concentrations). II.Ring main/header pipe (flow rates, gas concentrations, operation pressures and recovered condensate volumes). III.Blower (flow rates, pressures, and recovered condensate volumes). IV.Gas flare (burn temperature, inlet and outlet pressures, volume discharged, hours of operation, down time, in-let and outlet gas concentrations). The Peer Reviewer should also comment on number and frequency of low temperatures, as well as the adequacy of measures undertaken to prevent future low temperature flare events. V.Design and operation of the back-up flare. VI.Provides comments on the adequacy of the design and operation of landfill gas collection system. 	<p>VII.Compliance with regulations 26 and 27 of the NES (Air Quality).</p> <p>VIII.Design, adequacy and the spacing of perimeter landfill gas. The Peer Reviewer should also provide comments whether additional monitoring wells are required taking into whether sensitive receptors (buildings/structures/workplaces) existing within 500 m of the landfill, geological conceptual site model, possibility of preferential sub-surface migration pathways to exists, design and construction of the sidewall vapour barrier and historical monitoring data.</p> <p>IX.Instantaneous Surface Monitoring, including performance against the NES (air quality) regulation 26.</p> <p>X.Perimeter landfill gas well monitoring (groundwater level data, landfill gas measurements, barometric pressure) and an assessment of the need for replacement/additional wells (changes in land use surrounding the site, landfill volume increases/areas filled, damaged wells, well construction).</p> <p>XI.Explanation of changes that need to be made to landfill gas management system, inspection, maintenance and monitoring to achieve compliance with resource consent performance requirements.</p> <p>XII.Monitoring records, field sheets, laboratory reports etc. shall be provided for data used in the audit.</p> <p>XIII.Compliance with oxygen and residual nitrogen performance criteria specific in the Landfill Gas Management Plan. The Peer Review should comment on if there is any evidence of overextraction within the landfill and the caloric value of the gas being supplied to the flare.</p> <p>XIV.Comment on the safe operation of the gas collection systems, oxygen levels within the landfill, potential risks associated with landfill fires from overextraction of LFG from the landfill.</p> <p>4.Detailed summary of the effectiveness of changes made to the landfill gas management system in the preceding 12 months and proposed changes to the landfill gas management plan and management system that will be undertaken during the following 12 months.</p> <p>5.Summary details of landfill gas resource consent non-compliances, a summary explanation of the non-compliances and proposed mitigation measures.</p>	<p>That a detail design review is undertaken on the gas collection system and blower sizing to verify that there is sufficient capacity in the gas collection system. This information should be reviewed and approved by a suitably qualified chartered professional engineer with experience in landfill gas collection system design appointed by Environment Southland.</p> <p>XIV.Comment on the safe operation of the gas collection systems, oxygen levels within the landfill, potential risks associated with landfill fires from overextraction of LFG from the landfill.</p> <p>4.Detailed summary of the effectiveness of changes made to the landfill gas management system in the preceding 12 months and proposed changes to the landfill gas management plan and management system that will be undertaken during the following 12 months.</p> <p>5.Summary details of landfill gas resource consent non-compliances, a summary explanation of the non-compliances and proposed mitigation measures.</p>
New Advice Note				
9	Out of scope			
10	Out of scope			
11	Out of scope			
12	Out of scope			
13	Out of scope			

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
14	Out of scope			
15	Out of scope			
16	Out of scope			
17	Out of scope			
18	Out of scope			
19	Out of scope			
20	Out of scope			
21	(No original condition)	The overall purpose of the EMP is to provide details of the practices and procedures ... (text continues)	Accepted.	
22	(No original condition)	The consent holder shall prepare and maintain a Landfill Operations Management Plan (LOMP) ... (text continues)	Insufficient information currently. Awaiting responses to S.92 questions 2.16, 2.17, 2.18, 2.19, 2.20, 2.21, 2.22, 2.28, 2.29, 2.30 and 2.34.	
23	(No original condition)	The consent holder shall prepare and maintain a Landfill Gas Management Plan (LGMP) ... (text continues)	Insufficient information at the moment. Awaiting responses to S92 questions 2.37, 2.38, 2.44, 2.46, 2.49. Currently no back up flare is installed, therefore system does not comply with the NES Air Quality.	
24	(No original condition)	The consent holder shall prepare and maintain a Landfill Concept, Landscaping, Rehabilitation and Aftercare Management Plan (LCLRAP) ... (text continues)	Insufficient information currently. Awaiting responses to S.92 questions 2.76 and 2.77.	
25	(No original condition)	The consent holder shall prepare and maintain a Landfill Leachate Management Plan (LLMP) ... (text continues)	Insufficient information currently. Awaiting responses to S.92 questions 2.60, 2.65, 2.66, and 2.67.	
26	Out of scope			
27	(No original condition)	The consent holder shall prepare and maintain a Site Stormwater Management Plan (SSMP) ... (text continues)	Insufficient information currently. Awaiting responses to S.92 question 2.71.	
28	Out of scope			
29	The EMP and sub-management plans (where applicable) shall include monitoring with respect to surface water, groundwater, leachate, landfill gas and nuisance. ... (text continues)	The EMP and sub-management plans (where applicable) shall include monitoring with respect to surface water, groundwater, leachate, landfill gas and nuisance. ... (text continues)	Proposed new condition accepted.	
30	A geological map of the base grade of the landfill shall be prepared and upgraded from time to time as the base grade is exposed. The geological mapping shall include detailed logging of the location, extent, and nature of fractures, fracture zones, Karst features and other defects.	No change.	Accepted. No requirement to alter condition for proposed increase in waste acceptance	
31	As-built drawings shall be forwarded to the Southland Regional Council following completion of works and structures, ... (text continues)	No change.	Accepted	
32	All investigations, design, supervision of construction, monitoring, operation and after-care shall be undertaken by suitably qualified personnel .. (text continues)	No change.	Accepted.	
(Original conditions 8-11)	Refer document.	Applicant has proposed removing these conditions on basis that requirements within are addressed by new landfill management conditions above.	Insufficient information is available to assess whether these conditions should be deleted in their entirety.	
33	The consent holder shall submit a concept rehabilitation and aftercare plan ... (text continues)	Applicant has deleted the majority of consent text and has added the following: "The consent holder shall submit a revised Landfill Concept, Landscaping, Rehabilitation and Aftercare Management Plan (LCLRAP) to the Southland Regional Council at least twenty-four months prior to planned landfill operations ceasing on this site. The revised plan shall be prepared after consultation with the owners of adjacent properties and the Southland District Council.	Partially accepted. It is noted elements of the LCLRAP are being examined as part of the S92 process and awaiting responses to 2.76 and 2.77.	
34	The consent holder shall retain an appropriately experienced person to supervise ... (text continues)	No change.	Accepted.	
35	Out of scope			
36	All water quality sample analyses required shall be undertaken as detailed in the "Standard Methods for the Examination of Water and Waste Water, 1998" 20th Edition by A.P.H.A and A.W.W.A and by W.E.F or by some other method approved in advance in writing by the Southland Regional Council.	No change.	Accepted.	
37	Out of scope			

Condition Number	Consent Condition	Proposed Change	Reviewer Comment (Initial)	Reviewer Comment - Final
38	Out of scope			
39	Out of scope			
40	Out of scope			
41	Out of scope			

Environment Southland
Private Bag 90116
Invercargill 9840
New Zealand

1 October 2020

Attention: Bruce Halligan

Dear Bruce

AB Lime Landfill Review of Response to Request for Further Information

Environment Southland (ES) has commissioned Beca Limited (Beca) to review the response to a request for further information¹ (Section 92 Request) provided by NZAir Limited (NZAir) regarding the discharges to air associated with a planned expansion of the AB Lime Landfill. Beca has also reviewed the “*Addendum to Air Dispersion Modelling Assessment*” prepared by NZAir dated 14 July 2020.

For brevity, this response only discusses the responses to the questions in the Section 92 Request where Beca considers there are still outstanding questions to be answered, or where Beca disagrees with the response. For all other questions, the responses can be considered to be complete and Beca accepts the information provided.

Question 1.4

Question 1.4 relates to the automated weather station alerts that will be included in the Air Quality Management Plan (AQMP) for wind speed and directions. Beca supports the inclusion of both low wind speed (for minimising odour effects) and high wind speed triggers (for minimising dust effects). NZAir recommends that the upper wind speed trigger for limiting the effects of dust be set at 7 m/s. The Ministry for the Environment “*Good Practice Guide for Assessing and Managing Dust*” (GPG Dust) notes that at wind speeds in excess of 5 m/s fine particles can be lifted from unconsolidated surfaces and recommends that trigger levels are set to provide an alarm when winds above 5 m/s are exceeded and dust creating activities to cease when wind speeds exceed 10 m/s.

Beca therefore recommends that the AQMP includes an additional wind speed trigger level of 5 m/s, which is used to initiate a review of the effectiveness of dust control methods on site. If the review identifies that dust is not impacting beyond the boundary and no potentially dusty activities are planned to commence, no further action will need to be taken. If, on the other hand, dust sources are identified on the site that have the potential to impact beyond the site if wind conditions deteriorate, then additional dust control methods should be initiated and potentially dust creating activities are delayed until wind conditions improve.

Question 1.5 (c)

Part (c) of Question 1.5 requested an explanation of the source of the emission factors used to calculate the emissions from the lime kiln. This information is required in order to assess the differences in emissions that

¹ Environment Southland Letter: S92(1) Request for Further Information – AB Lime Limited – APP 20202200, APP 205862-01-V2, 23 July 2020.

will result from changing the fuel from coal to a mixture of coal and landfill gas (LFG) and the effects that may have on ambient air quality.

For the emissions of nitrogen oxides (NO_x) and carbon monoxide (CO), NZAir has stated in the Section 92 response that they used emission factors for the combustion of lignite, in Chapter 1.7 of the US EPA AP42 Compilation of Emission factors (AP42) database, to estimate the emissions from the kilns, rather than the emission factors for lime kilns in Chapter 11.17 of AP42, as there were no emission factors included in Chapter 11.17 for kilns with wet scrubbers. To review the emission factors used by NZAir, Beca has referred to the following documents:

- US EPA AP 42 Chapter 11.17 (AP42)²
- National Pollutant Inventory Emission Estimation Technique Manual for Lime and Dolomite Manufacturing Version 1.1, (NPI)³
- Best Available Techniques (BAT) Reference Document for the Production of Cement, Lime and Magnesium Oxide Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control), 2013⁴ (EU BAT)

Nitrogen Oxides (NO_x)

The National Pollutant Inventory (NPI) document provides emission factors for lime kilns sourced from AP42 and quotes an emission factor for NO_x emissions from lime kilns burning coal, with venturi scrubbers, of 0.11 kg/tonne of lime produced. This is equivalent to an emission factor of approximately 0.055 kg/tonne of limestone processed (1 tonne of limestone produces between 0.45 and 0.7 tonne of lime)⁵. At a peak throughput of limestone through the kilns of 120 tonnes per hour, the NO_x emission rate from the kilns is calculated to be 6.6 kg/hr. This can be compared to the emission rate used by NZAir as an input to the dispersion model of 8.82 kg/hr. Beca is therefore satisfied that the emission factor used by NZAir for NO_x of 8.82 kg/hr from the kilns should not underestimate the kiln emissions of NO_x.

The NPI document also provides an emission factor of 1.4 kg/tonne of NO_x for kilns burning a combination of coal and gas with venturi scrubbers. However, the NPI document did not provide any information on the relative quantities of coal and gas that were in the fuel. It is possible that burning LFG in the kilns will increase the emissions of NO_x from the kilns, but it is not possible to determine the scale of any increases.

However, Beca considers that it is unlikely that burning LFG in the kiln, instead of in the flare, will result in any differences to the overall site emissions of NO_x that are likely to have a significant impact beyond the

² US EPA AP 42 Compilation of Emission Factors Chapter 11.17

³ Australian Government Department of the Environment and Heritage “*National Pollutant Inventory “Emission Estimation Technique Manual for Lime and Dolomite Manufacturing Version 1.1”*”, September 2003

⁴European Commission JRC Reference Reports “*Best Available Techniques (BAT) Reference Document for the Production of Cement, Lime and Magnesium Oxide Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control)*”, 2013

⁵ Ibid at 4

boundary of the site, due to the scale of the operation and the distance of the kilns and flares from the boundaries of the site. No further explanation is therefore required.

Carbon monoxide (CO)

For CO, the NPI and AP42 emission factors for lime kilns burning coal is given as 0.74 kg/tonne of lime produced, which is equivalent to an emission factor of approximately 0.37 kg/tonne of limestone processed. At the limestone throughput rate of 120 tonnes per hour provided by NZAir, the CO emission rate is calculated to be 44.4 kg/hour, which is considerably higher than the emission rate of 0.35 kg/hour used by NZAir.

The EU BAT document also notes that typical concentrations of CO in the exhaust gases of lime kilns are between 100 and 400 mg/Nm³ @ 11% O₂. The measured flowrate of exhaust gases from one kiln at AB Lime, when using coal as fuel, was approximately 30,800 Nm³/hr @ 11% O₂, and approximately 53,400 Nm³/hr @ 11% O₂ when a mixture of coal and LFG was used⁶. Using the EU BAT typical concentrations of CO, the emission rate of CO from one kiln can be calculated to be between 3.0 and 12.3 kg/hr when coal was used, and 5.3 to 21.4 kg/hr when a combination of coal and LFG was used. For two kilns, this equates to CO emissions of between 6.2 and 24.6 kg/hr when coal was used, and 10.7 and 42.7 kg/hr when coal and LFG was used. The EU BAT document did not provide any information on the differences that various emission controls or fuels made to the emissions.

It is therefore apparent that there is considerable variation and uncertainty in the published emission factors for CO from lime kilns, when they are burning coal, but they are all higher than the emission rate used by NZAir. It is recommended that NZAir considers the potential impacts of the higher CO emission factors included in the EU BAT and NPI documents and includes discussion of this in their assessment.

The NPI document also provides an emission factor of 0.41 kg/tonne of CO in the exhaust gases of lime kilns burning a mixture of coal and gas, which is less than the NPI CO emission factor for using only coal. This indicates that burning LFG in the kiln is unlikely to increase the emissions of CO from the kilns, or the overall discharge of CO from the site.

Particulate Matter (PM)

NZAir has estimated the emissions of total PM and PM₁₀ from the lime kilns using AP42 emission factors for the combustion of lignite. In a lime kiln, total PM is generated both from the combustion of the fuel as well as dust produced from the flow of air through the limestone in the kiln and mechanical attrition of the limestone. Therefore, the use of emission factors for just combustion may underestimate total PM emissions.

The AP42 emission factor for coal fired kilns with venturi scrubbers is 0.86 kg/tonne of lime produced which is equivalent to an emission factor of approximately 0.43 kg/tonne of limestone processed. At the limestone throughput rate of 120 tonnes per hour, the total PM emission rate is calculated to be 51.6 kg/hour. NZAir estimated the total PM emission rate to be between 0.46 – 2.3 kg/hr based on information provided in the EU BAT document.

⁶ The average oxygen content of the emitted kiln flue gas was reported to be 14.8% when coal was used as fuel as 16.6% when coal and LFG was used as fuel.

The EU BAT document notes that the majority of total PM emissions from lime kilns are between 20 and 100 mg/Nm³ but does not provide any information on the differences in emissions when different fuels are used.

For coal and gas-fired kilns with venturi scrubbers, the AP42 emission factor is 0.44 kg/tonne of lime produced, which indicates that replacing a portion of the coal used as fuel with LFG should reduce total PM emissions from the kilns and from the site. So despite the large disparity between the emission factors provided in AP42 and the EU BAT document changing the fuel from coal to a mixture of coal and gas should reduce the emissions of PM from the kilns and should not result in any increase in offsite concentrations of PM and PM₁₀. No further information is therefore required from NZAir on this matter.

Summary

Beca recommends that the AQMP includes an additional wind speed trigger level of 5 m/s, which is used to initiate a review of the effectiveness of dust control methods on site.

It is also recommended that NZAir considers the potential impacts of the higher CO emission factors included in the EU BAT and NPI documents and includes discussion of this in their assessment.

Yours sincerely



Prue Harwood
Senior Associate - Environmental

on behalf of

Beca Limited

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