BEFORE THE COMMISSIONER

APPOINTED BY ENVIRONMENT SOUTHLAND

In the Matter	of applications for resource consent to operate a landfill (APP20202200, APP-205862-01-V2)
Between	**A B LIME LIMITED**
	Applicant

BRIEF OF EVIDENCE OF WALTER STARKE

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BRIEF OF EVIDENCE OF WALTER STARKE

Introduction

1. My name is Walter Starke. I am a Senior Environmental Engineer at Jacobs New Zealand. I am responsible for landfill engineering, closed landfill assessments and contaminated land studies for Jacobs New Zealand Limited.

2. My academic qualifications are Bachelor of Engineering (Mining) from the University of Auckland (1984-88) and Master of Science in Soil Mechanics from Imperial College, University of London (1991-1992). I am a Chartered Professional Engineer (CPEng) and full member of Engineering New Zealand and an International Professional Engineer (IntPE(NZ)). I have over 30 years' experience in applying environmental engineering principles in landfill design, construction and monitoring, closed landfill assessments and contaminated land studies. I have worked in New Zealand, Australia, Indonesia, England, Germany and South Africa.

3. I have been involved as a landfill engineer in the following projects in New Zealand:

    a) Rosedale landfill (Auckland) - for the design and construction of a new busway and footpath/cycle path through the Rosedale Closed Landfill (Waka Kotahi Northern Corridor Improvement project).

    b) Tirohia landfill (Waikato) - providing a technical review on behalf of Waikato Regional Council (WRC) of the engineering design for the proposed Tirohia Landfill - Phase C resource consent application and preparing a statement of evidence on behalf of WRC.

    c) Hampton Downs landfill (Waikato) - providing WRC technical support in relation to landfill gas and leachate issues related to the Hampton Downs landfill.

    d) Southern landfill (Wellington) - advising Greater Wellington Regional Council on the proposed Southern Landfill Stage 4 expansion.

e) Greenmount, Rosedale, Pikes Point and Devonport closed landfills (Auckland) - providing the former Auckland Regional Council (ARC) on landfill gas and leachate issues and potential for building on these landfills.

f) Greenmount landfill (Auckland) - provide a statement of evidence on behalf of ARC regarding landfill gas migration issues related to the re-zoning of a piece of land located adjacent to the landfill.

g) Willoughby Street and Horotiu closed landfills (Waikato) - on behalf of WRC provide an independent peer review of a landfill gas quantitative risk assessment.

h) Whitford landfill (Auckland) - assisting the former Independent Peer Reviewer with the review of Quality Control and Quality Assurance documentation provided by the consent holder.

i) Craig Quarry landfill (Auckland) - acting as the nominated landfill gas expert on behalf of the former Auckland City Council (ACC) to assess the monitoring and management of landfill gas by the consent holder, for a retirement village built on a closed landfill, including a review of an amendment to the resource consent conditions.

j) Otaihanga closed landfill (Kāpiti Coast) - updating a landfill gas management plan for Kāpiti Coast District Council, performing a landfill gas migration assessment and landfill height variation assessment.

k) Pikes Point Closed landfill (Auckland) - preparing a statement of evidence on behalf of the former ACC with respect to landfill gas building control measures and geotechnical aspects to enable the closed landfill site to be utilised for a commercial industrial development.

l) Several peer review studies on behalf of ACC to assess the applicant's landfill gas assessments for the construction of buildings on closed landfills.

4. I am a co-author of the Technical Guidelines for Disposal to Land, produced by Waste Management Institute New Zealand (WasteMINZ) (Landfill Guidelines, 2018), replacing the New Zealand Landfill Guidelines (2002) and Guide to the Management of Cleanfills (2000).

5. The purpose of this evidence is to describe the technical performance of the AB Lime landfill and discuss relevant performance criteria identified as part of this resource consent application. In this evidence I set out:

   (a) Landfill operations, including:

      (i) Updated waste tonnage data;

      (ii) Proposed Waste Acceptance Criteria;

      (iii) Steepness of waste slopes;

      (iv) The working face;

      (v) Landfill cover; and

      (vi) Crisis/emergency waste acceptance.

   (b) Managing effects at the landfill:

      (i) Relationship between waste tonnage and adverse effects;

      (ii) Leachate;

      (iii) Odour; and

      (iv) Landfill gas, including:

         - Existing landfill gas management;
         - Landfill Gas Management Plan (LGMP);
         - Landfill gas capture;
         - Landfill gas extraction;

- Landfill gas flaring;
- Landfill Gas subsurface migration risks; and
- The Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (NES- AQ), Regulations 25-27 control of greenhouse gas emissions at landfill.

(c) The submissions made on the application that raise or are relevant to landfill engineering; and

(d) The Officer's s 42A Report.

6. I have visited the site and am familiar with landfill operations. I have been involved in landfill engineering aspects of the AB Lime landfill since 2004.

7. Understanding this is a Council Hearing, I acknowledge that I have read and agree to comply with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2014. The qualifications I hold as a landfill engineer are identified above. Other than where I state that I am relying on the advice of another, I confirm that the issues addressed within this statement of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Landfill Operations

8. I have identified in my introduction that I have considerable experience in assessing landfill operations for Class 1 landfills across New Zealand over a long period of time. I note that Class 1 landfills in the NZ Landfill Guidelines have been referred to in the past as Class A landfills, in particular in the Ministry for the Environment document titled *Module 2: Hazardous Waste Guidelines- Landfill Waste Acceptance Criteria and Landfill Classification*, May 2004.

9. From the outset I would like to point out that recent consents for many Class 1 landfills around New Zealand do not stipulate a waste acceptance 'limit'. For example, the Kate Valley landfill in Christchurch, the Hampton Downs and Tirohia landfills in the Waikato, and the Redvale landfill in Auckland are all significant municipal solid waste landfills, just like AB Lime, that do not operate under any waste acceptance limit. To my knowledge it is the older active consents such as the existing AB Lime consent and the Green Island landfill that have a tonnage limit.

10. I would like to emphasise from the outset that I do not believe imposing any sort of cap on the AB Lime landfill serves any purpose but to put an arbitrary limit on operations and does not directly address environmental effects of landfilling.

11. In my opinion, the imposition of a tonnage limit is an outdated measure for consent. It is how the waste is managed that determines the level of potential adverse effects on the environment. The majority of my evidence focuses on why the management of the 'how' is the most relevant to the regional council.

12. Of importance to this proposal is the implementation of a comprehensive Landfill Operations Management Plan (LOMP) provided as **Attachment A**[1], as well as various other management plans to govern particular aspects of the landfill and ensure compliance with consent conditions. The management plans are adequately discussed in Section 1.2 of the AEE.

13. I believe that this proposal will greatly improve landfill operations on site. The current consent was granted in 2003 and runs to 2038. This proposal requires a positive environmental shift in landfill operational management procedures to meet best practice. This proposal, in my opinion, represents a far more advanced regulatory (and best practice) framework for managing the landfill's operations.

[1] This version includes minor updates from the last s 92(1) response, as well as incorporating a minor change as a result of the s 42A report and the deletion of the reference to Aluminium Dross Waste. All changes are clearly highlighted in this version and explained in the roadmap filed with this evidence.

14. The alternative is that the landfill continues to operate under existing consents until 2038, which, in my opinion, is an inferior environmental outcome, even in light of the proposed extension of landfill duration to 2046.

15. I now turn to various aspects of landfill operations and identify how the procedures identified in the proposed conditions of consent and the LOMP that form part of this proposal manage potential adverse effects.

(i) Updated Waste Tonnage Data

16. Appendix O of the AEE (lodged in May of 2020)[2] presented the waste tonnage accepted by the landfill from June 2004 to 2019. This data was used to predict the waste tonnages AB Lime is likely to accept in the future.

17. AB Lime have now collated the waste acceptance data from 2020. The accepted waste tonnage in 2020 was 91,254 tonnes, an increase of 22,455 tonnes from the previous year.

18. An updated assessment of the predicted waste tonnage from 2021 onwards has been completed with the inclusion of the 2020 data set.

19. An upwards trend was identified from 2016 to 2020 and this has formed the basis for the prediction. The analysis predicts that in 2021 the waste acceptance would be 95,946 tonnes. It is predicted that 2022 will be the first year to exceed 100,000 tonnes of waste accepted, with a predicted waste acceptance of 105,908 tonnes. A more detailed explanation of the analysis and a summary of the results is presented in **Attachment B**.

20. Further waste data from January to March 2021 has also been collated. If the waste acceptance is assessed on a year basis from April 2020 to March 2021, rather than a calendar year, the waste accepted during this time is 95,238 tonnes. This approximately reflects the predicted waste amount for 2021, of 95,946 tonnes, from the analysis.

[2] *AB Lime Limited Landfill Resource Consent Application, Appendix O Landfill Capacity and Lifespan Technical Memo,* (29 May 2020).

21. As covered in the evidence of Mr Smith[3], because AB Lime are approaching the 100,000 tonne cap, there may be issues if an emergency waste scenario, such as *Mycoplasma Bovis* were to occur. There is the potential that some or all of the emergency waste will need to be transported to another Class 1 landfill. The closest, large, modern Class 1 landfill is Kate Valley which is 617 km (approximately 8 hours) from the AB Lime landfill.

(ii) Waste Acceptance Criteria

22. AB Lime Limited propose to follow the landfill waste acceptance criteria identified in Appendix D of the WasteMINZ Landfill Guidelines. Appendix D provides waste acceptance criteria for Class 1 landfills. The purpose of the waste acceptance criteria is to enable almost all types of waste to be accepted by virtue of their significant and robust environmental performance requirements.[4]

23. The existing waste acceptance criteria are discussed in Mrs Smith's evidence[5]. The proposed waste acceptance criteria are very similar to the existing waste acceptance criteria. A copy of the proposed and existing waste acceptance criteria is presented in **Attachment D**. The new performance standards for waste acceptance are identified in Schedule 2 of the proposed conditions of consent attached to this proposal.

24. The most important condition for waste acceptance criteria identifies that with the exception of very limited waste streams (that are controlled by criteria stipulated in consent conditions) no hazardous waste shall be accepted for disposal at the landfill. Hazardous waste is clearly defined within this condition. This sets very clear criteria on what cannot be accepted into the landfill[6].

[3] Evidence of Mr Smith at paragraphs [104]-[106]
[4] Landfill Guidelines Table 2.1 – Summary of Landfill Classes
[5] Evidence of Mrs Smith at paragraphs [111]-[112]
[6] Refer to proposed condition 22 in the discharge permit for solid waste onto or into land found in **Attachment A** to Mr McCone's evidence.

25. Further consent conditions related to Waste Acceptance Criteria were recommended by the EHS peer reviewer as part of the s 92(1) process[7].

26. AB Lime has agreed to proposed new conditions regarding Waste Acceptance Criteria Review in the memorandum to Environment Southland provided on 24 November 2020[8]. The proposed conditions are updated as follows:

> *'An annual review of waste acceptance criteria and prohibited items shall be undertaken and the findings reported to Southland Regional Council'*[9]

27. The purpose of this condition is to ensure that the landfill continues to accept waste in line with best practice, particularly as information and standards evolve in relation to acceptable contaminants.

28. The second additional condition proposed and included as the response to the EHS peer review relates to Special Waste acceptance. This condition, in my opinion, addresses any reservations the s 42A report has identified about Special Waste acceptance. The second additional condition stipulates:

> *'Prior to the acceptance of any Special Waste the consent holder shall apply the Special Waste acceptance criteria to determine the methods that need to be employed to manage the receipt and disposal of the Special Waste.*
>
> *If an application is received for a Special Waste product that has not been disposed of at the application site previously the consent holder shall provide the proposed waste acceptance criteria to the Independent Peer Reviewer for acceptance and the Southland*

[7] Technical Review of Further RMA Section 92 Responses for application APP-20202200, APP_205862-01-v2, (17 November 2020).
[8] AB Lime Resource Consent Application, s 92(1) Response 3 (24 November 2020) provided as **Attachment C** to Mr McCone's evidence.
[9] Refer to proposed condition 15 in the discharge permit for solid waste onto or into land found in **Attachment A** to Mr McCone's evidence.

Regional Council for certification prior to accepting any of the waste in accordance with Schedule 1 – General Conditions 13-16[10]

29. I consider that the abovementioned two new conditions are appropriate. They set appropriate guidelines for waste acceptance and help manage expectations for all parties and the wider community on what is and will continue to be acceptable at the AB Lime landfill. The second part of the condition provides an opportunity for independent peer review of the acceptance criteria for a particular waste product to ensure that AB Lime are taking the appropriate steps to manage the receipt of that waste.

30. In the following paragraphs of my evidence I identify the different types of waste streams accepted at the AB Lime landfill.

31. For clarity this application does not result in any changes to the type of waste that can be received. Any 'new waste' cannot be accepted by AB Lime without first meeting the hazardous waste criteria and then meeting the additional waste acceptance criteria screening conditions, which are in line with best practice guidelines. In my opinion, under this proposal the likelihood of a 'new' waste stream entering the AB Lime landfill is less than under the existing consent.

32. As a Class 1 landfill AB Lime is able to accept a wide range of wastes which are generally split into the following categories:

    (a) General Wastes (which includes municipal solid waste); and

    (b) Special Wastes (which include Specified Hazardous Wastes)

General Waste

33. Most of the waste that comes into the landfill is transfer station waste with limited amounts of general and industrial/commercial/institutional waste. **Attachment C** of my evidence provides two figures, one that shows the different transfer station wastes flows into the Southland Regional Landfill (a.k.a. the AB Lime landfill) and another figure that

[10] Refer to proposed condition 14 in the discharge permit for solid waste onto or into land found in **Attachment A** to Mr McCone's evidence.

provides the percentages of the different waste streams going into the landfill.

34. Waste is only delivered to the site in vehicles dedicated specifically for the transport of solid waste, and which have been given prior authorisation to access the site by AB Lime. The landfill is not open to the general public for the disposal of waste, so waste disposal occurs in an organised fashion. Mrs Smith identifies in her evidence that at least every 50 loads a waste inspection is done to ensure acceptable waste is being received[11], which is in line with the proposed condition of consent[12]. This ratio is in accordance with the Landfill Guidelines for Class 1 landfills.

35. In my opinion the general waste practices and procedures identified in Section 7 of the LOMP that form part of this proposal in regard to offloading waste, placement and compaction and daily cover mitigate the potential adverse effects that may arise from this waste stream are appropriate. With effective management at the working face the volume of municipal waste should not correlate to an increase in adverse environmental effects.

36. The following sections identify the waste streams that are more likely to give rise to adverse environmental effects and require a higher level of on-site management and mitigation.

Special Waste

37. Special Waste refers to waste streams that are not 'general waste' and includes industrial and commercial waste streams. Special Waste streams typically have a defined industry source such as biosolids from wastewater treatment plants or contaminated soils from a former horticultural site. AB Lime has a rigorous Special Waste Acceptance Protocol to assess if these special wastes can be accepted at the landfill. Part of the protocol includes laboratory contamination testing to ensure that resource consent limits are complied with.

[11] Evidence of Mrs Smith at paragraph [13].
[12] Refer to proposed condition 22 in the discharge permit for solid waste onto or into land found in **Attachment A** to Mr McCone's evidence.

38. In my experience with other operating landfills, these Waste Acceptance Protocols are standard industry practice.

39. In the context of the AB Lime landfill there are also a small number of hazardous wastes that are provided for within the 'special waste' category

40. Four specific hazardous waste streams are provided for in the current consent and identified in the proposed conditions of consent that are attached to this proposal. The four Hazardous Waste streams are:

    (a) Medical Wastes[13];

    (b) Asbestos Wastes[14];

    (c) Methamphetamine contaminated waste[15]; and

    (d) Aluminium Dross Waste and material contaminated with this waste that meets low concentration levels of aluminium and fluoride.

41. The provision for the acceptance of Aluminium Dross Waste has since been removed from the proposed consent as explained in the evidence of Mr McCone and Mrs Smith[16].

42. Each of these streams are governed by proposed conditions of consent with strict acceptance criteria that must be adhered to for each of these waste streams. The acceptance criteria for these wastes vary, but relate to matters such as leachability limits, concentration limits of hazardous materials, methods of transport, methods for disposal within the site, as well as accurate record keeping and reporting.

43. In regard to meeting these standards for these waste streams I consider that the management of these waste streams provided for in

[13] Ibid at condition 17.
[14] Ibid at condition 14.
[15] Ibid at condition 21.
[16] Evidence of Mr McCone at paragraphs [84]; Evidence of Mrs Smith at paragraph [96].

the LOMP provides improved procedures over those stated in the existing Landfill Management Plan (LMP), since:

(a) The LOMP provides individual subsections for the three abovementioned Hazardous Waste streams as Special Waste streams, with individual appendices to the LOMP on the procedures how to manage these Hazardous Wastes streams at the landfill. This level of detail is not in the existing LMP.

(b) The LOMP dedicates a whole section on the Special Waste Acceptance[17] with subsections on the Special Waste Application Form, it's appraisal, Special Waste Acceptance Criteria and a Special Case Procedure for Special Waste Acceptance used a risk assessment approach. Given the wide range of wastes that may be disposed of this is the most appropriate method for addressing special waste. It provides a robust process for waste specific measures to be put in place when details of the waste type are known. This is a continuation and improvement of the Special Waste Acceptance Criteria and procedures described under the existing LMP and is not a conduit for new waste streams.

(c) The LOMP provides a separate section and more detail on the procedures for the disposal of Special Waste[18] including its location, buffer distance to the liner, additional specificity for asbestos and medical waste and surveying of the location of special waste disposal.

(d) The LOMP provides a separate section on the process for assessing and developing assessment criteria for Emerging Contaminants[19]. Such a process is absent from the existing LMP. As stipulated an annual review of waste acceptance criteria and prohibited items is required as a proposed condition of consent and this section of the LOMP is likely to help inform any

[17] Section 5 of the LOMP provided in **Attachment A**.
[18] Ibid at Section 5.5.
[19] Ibid at Section 4.5.

recommendations on waste streams to be excluded at the AB Lime landfill.

44. In my opinion the acceptance criteria for the approved Hazardous Waste streams (now without Aluminium Dross Waste) and the Special Waste at the landfill that form part of the proposal are comprehensive, appropriate, similar to acceptance criteria adopted by other operating NZ landfills and in line with the New Zealand Landfill Guidelines.

45. I believe the content of the LOMP is appropriate to deal with the process for the approved Hazardous Waste streams and Special Waste acceptance. With the additional review conditions waste acceptance criteria can evolve with changes in best practice and regulations.

46. It is my opinion that this criteria for Special Waste Disposal is appropriate, in line with best practice and will minimise the adverse effects occurring during the disposal phase. Mr Van Kekem identifies in his evidence additional air quality control mitigation measures that form part of the Landfill Air Quality Management Plan (LAQMP)[20].

(iii) Steepness of Internal Waste Slopes

47. There are no specific performance standards regarding internal waste slopes within the current consent.

48. In my opinion some internal landfill waste slopes are currently oversteep, with a grade of approximately 1(V):2(H). These slopes are located on the northern slopes of Areas 11 & 12, the northern slope of Area 14 and the western slope of Area 14. It is estimated that these oversteep slopes have an area of around 23,500 m^2.

49. Oversteep slopes without appropriate temporary capping can increase leachate ingress and reduce the efficiency of landfill gas capture.

50. The New Zealand Landfill Guidelines do not provide guidance on a maximum internal waste slope. Instead international good industry

[20] Evidence of Mr Van Kekem at paragraphs [59]-[78].

practices provide a maximum internal waste slope of 1(V):3(H). This is detailed in Section 9.3 of the LOMP.

51. To bring the landfill's oversteep internal waste slopes in line with best practice this proposal provides a framework for managing waste slopes in order to meet the best practice guideline and maintain a maximum gradient of 1(V):3(H) for future waste slopes. This is presented in Section 9.4 of the LOMP.

52. To further address the potential for effects for oversteep slopes a filling plan for Area 15 has been developed to limit the waste slopes to 1(V):3(H) during waste placement. As shown in **Attachment E**, remedying the oversteep slopes has been proposed through the demonstrated methodology and forms an integral part of this proposal.

53. In my opinion the methodology proposed will produce an environmentally beneficial outcome for the operation of the landfill. A better cap and a gentler gradient of the slopes will decrease the ability for odour and fugitive landfill gas emissions to escape through the landfill surface. It will also reduce air ingress through the cap into the landfill gas extraction wells, which will improve landfill gas extraction. It will reduce leachate generation due to less water infiltrating through the cap and will increase slope stability by reducing the steepness and the potential for water and leachate to build up within the slope (which can cause slope instability).

(iv) The Working Face

54. The Landfill Guidelines do not specify a typical working face for a landfill. Instead they recommend:

    'to *minimise the size of the working face*'[21]

    and note that:

[21] *Waste Management Institute New Zealand WasteMINZ, Technical Guidelines for Disposal to Land* (August 2018) at 116.

'a balance is required in determining the working face area, the number of incoming vehicles, the need to minimise stormwater infiltration, cover requirements and nuisances such as litter'.[22]

55. As of May 2020, the working face was estimated to be around 3,600 m^2. As part of this proposal the size of the working face will not exceed 1000 m^2 as identified in Section 7.4.3 of the LOMP. In my experience a working face of around 1000 m^2 for a landfill is good industry practice.

56. In my opinion reducing the area of the working face will have significant benefits on the potential for adverse effects related to waste deposition at the landfill. A smaller, well-managed working face will:

    (a) Increase landfill gas capture and reduce fugitive landfill gas emissions, and will help with consistency of landfill gas collection, and compliance with the required Regulations 25-27 of the NES-AQ that form part of this proposal;

    (b) Reduce stormwater ingress into the working area, therefore reducing the potential to generate leachate;

    (c) Providing less surface are for fugitive landfill gas emissions to escape; and

    (d) Mr Van Kekem in his evidence identifies the benefits of reducing the working face on providing less surface area for odour from fresh exposed waste[23].

57. I consider that reducing the working face is one of the most important steps AB Lime can take to control landfill operations and manage potential adverse environmental effects. A conditioned objective of the LOMP to maintain a working face that is as small as possible helps secure these measures. Currently, the 1000 m^2 working face is proposed into the LOMP. This specific area is not provided as a condition of consent because, in my opinion, this figure may require

[22] Ibid at 117.
[23] Evidence of Mr Van Kekem at paragraph [107].

adaptation as the needs of the landfill change (i.e. another *Mycoplasma Bovis*). Importantly, any change to the working face (like any change to a management plan) must be signed off by the Independent Peer Reviewer(s) (IPR) and certified by Environment Southland (ES).

(v) Landfill Cover

58. Another key mechanism to control the potential for environmental discharges is to use landfill cover during various stages of the landfill operations. The use of landfill cover is in accordance with the NZ Landfill Guidelines.

59. The proposal, via Section 10 of the LOMP, includes better landfill cover management than that currently required under the existing LMP. Landfill cover is an important mitigation tool because it encapsulates the waste material to reduce stormwater ingress and fugitive gas emissions. The early covers are thinner and more permeable. The faster that less permeable cover layers and ultimately permanent cover can be applied the better. It is proposed that cover arrangements at AB Lime will occur in 4 stages. Starting with Daily Cover which is applied to the working face at the end of each day. Daily cover is also applied immediately to particularly odorous special waste.

60. The next stage of cover is Intermediate Cover. This is intended to be in place for greater than seven days and less than 3 months and will generally be applied to areas that will be reopened as part of the filling plan.

61. If an area of the landfill will not be reopened for a long period of time (>3 months), it is appropriate to apply a relatively thick layer of cover to minimise the risk of rainfall infiltration, surface landfill gas emissions and allow for efficient landfill gas extraction. The relatively thick layer of cover is called Temporary Capping. This thick cover layer may be in place ranging from >3 months to several years.

62. Another area where Temporary Capping may be applied is when the landfill has reached its pre-settlement final height. The permanent or

final cap could be constructed at this stage, however, with ongoing refuse degradation and settlement, it is reasonable to expect regular rework of the final cap to prevent landfill gas surface emissions and rainfall infiltration. From an operational perspective it would be easier to rework to Temporary Capping layer compared to a Permanent Capping layer, with the provision that the Temporary Capping layer will provide appropriate mitigation against the surface gas emission criteria specified in the proposed consent conditions. I discuss the surface gas emission criteria later in paragraphs [118]-[125].

63. To demonstrate the landfill cover improvement I've prepared two tables summarising the cover type, thickness and time period, see Tables 1 and 2 in **Attachment F**.

64. I consider that the landfill cover management in the LOMP is better because:

    a) The daily cover maximum allowable time period has been reduced from 4 weeks to 1 week;

    b) The intermediate cover maximum allowable time was not specified in the existing LMP, and has been limited to 3 months in the LOMP[24]; and

    c) An additional cover layer, called temporary capping, has been introduced (as explained in in paragraph [61]).

65. In my opinion landfill cover betterment will provide a greater level of odour control, reduce the potential for landfill gas emissions and reducing rainfall infiltration and hence leachate generation.

66. There are a variety of ways that the permanent capping can occur. The proposed conditions establish the performance criteria that must be met rather than the exact capping method[25]. This is because different methods; might be appropriate in different locations and may also be affected by availability of materials.

[24] Refer to Section 10.3 of the LOMP in **Attachment A**
[25] Refer to proposed condition 7 in the discharge permit for solid waste onto or into land found in **Attachment A** to Mr McCone's evidence.

67. As part of this proposal a condition is proposed to observe whether the GCL capping design and construction methodology is suitable. AB Lime have begun carrying out investigations, including a trial cap investigation, as to the suitability of this final cap design. They intend to complete the final capping in stages as identified in **Attachment G.**

68. The trial pad will also assess the connection between existing capping design and the proposed capping design, as well as the connection between the proposed capping design. Following completion of the capping trial pad the permanent capping design will be finalised and issued for approval to the Independent Peer Reviewer (IPR) and Environment Southland (ES). Any subsequent change must meet the standards provided for in the conditions of consent and go through the same approval process.

69. In my opinion the process put forward in this proposal will allow for an improved permanent landfill cap. Because the permeability will be inherently be achieved by the use of the GCL the effectiveness of the permanent cap is primarily monitored by it meeting the 0.5% methane surface emissions discharge discussed in paragraphs [118]-[125].

(vi) Crisis/Emergency Waste Acceptance

70. An important part of this proposal is to set out a clear process for accepting crisis and emergency waste. There have been some examples of this during the life of AB Lime to date which is discussed in the evidence of Mr and Mrs Smith[26]. They can result in large volumes of waste materialising in a short period of time which may become problematic as waste volumes received by the landfill increase towards the 100,000 tonne limit.

71. Mr McCone in his evidence outlines the importance of having a framework in place to outline a clear process for such situations[27]. I note that the current LMP does not include procedures for accepting crisis or emergency waste.

[26] Evidence of Mr Smith at paragraphs [39]-[58]; Evidence of Mrs Smith at paragraphs [39]-[45].
[27] Evidence of Mr McCone at paragraph [16].

72. AB Lime have previously accepted emergency waste during the *Mycoplasma Bovis* and *Bonamia Ostreae* biosecurity risk outbreaks related to two of our key primary industries. Mr and Mrs Smith in their evidence identify their experience and lessons learnt from these past events[28]. Mr Van Kekem in his evidence identifies mitigation measures to remedy and mitigate adverse effects on air quality in these future situations[29].

73. A special procedure for the acceptance and management of emergency waste has been developed in Section 6 of the LOMP, which is linked to the proposed conditions of consent that have been introduced as part of this proposal.

74. It is important to note however that the waste accepted as emergency waste is <u>not waste that would otherwise be prohibited under the consent</u>. The emergency waste procedure is developed to help manage the process for disposal of waste that may arrive in the context of an emergency, at rates that might be out of the ordinary or require other special management procedures.

75. Waste is heterogeneous in nature. Predicting the nature of an emergency waste scenario is difficult. In my opinion, the management plan framework proposed provides the best mechanism for managing these scenarios as it provides clarity about the process to be followed for both AB Lime and the other agencies that may be involved.

76. Additional management practices for crisis/emergency waste acceptance are outlined in the LOMP. These include the Environmental Manager managing the entire disposal process and providing the opportunity for an Environment Southland officer to be present. Further management practices for odorous loads are detailed in the LAQMP and are covered in the evidence of Mr Van Kekem[30].

[28] Evidence of Mr Smith at paragraphs [39]-[58]; Evidence of Mrs Smith at paragraphs [39]-[45].
[29] Evidence of Mr Van Kekem at paragraphs [85]-[86].
[30] Ibid at paragraphs [59]-[65].

77. Upon completion of disposal AB Lime is to provide a report of the crisis/emergency waste acceptance to ES including learning from the experience[31].

78. What is put forward in the LOMP as part of this proposal is a robust process for managing landfill operations for crisis or emergency scenarios. It is my understanding that this is a first for Class 1 landfills in New Zealand to adopt this approach for emergency waste management. In my opinion, it is a very positive move as it provides a process to be followed when waste has to be accepted quickly and in situations where there are several stakeholders and moving parts involved. The better these situations are managed the less impact on the communities that AB Lime landfill serve.

Managing Effects at the Landfill

(i) Relationship between Waste Tonnage and Adverse Effects

79. Controlling waste volume is only one dimension to effective waste management. I have already commented that an increase in the waste tonnage rate is not expected to result in an increase in adverse effects. In the following paragraphs, I detail key environmental effects related to landfill operations and the management practices in place or proposed to control potential adverse effects at all levels of operation as part of this application.

(ii) Leachate

80. Leachate is produced from rainfall that lands on the open surface and comes into contact with landfill material as it drains away, as well as any stormwater runoff that comes in contact with landfill material. Wet waste material in the landfill can also create leachate.

81. The generation of leachate is not directly related to the waste tonnage, or the rate at which it is deposited in the landfill. Rather, it is directly related to the amount of water that enters through the working face, exposed liner area, uncapped areas and to a very limited degree the capped areas of the landfill. Adverse effects can arise not from the

[31] Section 6.2 of the LOMP, found in **Attachment A** to this evidence.

leachate itself but from inappropriate management of the landfill which allows leachate to either build up or leak out into groundwater or the surrounding environment.

82. In my opinion the proposed restriction of the working face area to no more than 1000 m², and restrictions on the daily cover area, will have a significant impact on rainfall infiltration and leachate generation. Reducing the volume of leachate created is a key management step to ensure it can be appropriately managed and dealt with.

83. Furthermore, capping of current oversteep faces will minimise the opportunity for rainfall infiltration and therefore minimise leachate generation.

84. In addition, the improved landfill cover processes previously discussed in my evidence[32], will also reduce the potential for rainfall infiltration and leachate production.

85. I expect that once these measures are in place leachate production will be maintained at current volumes despite an increase in the quantities of waste being accepted. A proposed condition of consent identifies that leachate management processes are to be reviewed if this is not the case[33].

86. I note that a new Landfill Leachate Management Plan (LLMP) has been developed as part of this proposal that sets out in detail the procedures required to manage the potential effects related to leachate. The existing LMP does cover aspects of the LLMP, however, in my opinion the LLMP is a much improved document in terms of describing the procedures for the management and monitoring of leachate at the landfill. Examples of this would be procedures for leachate system maintenance and provision of a leachate composition contingency plan that are not present in the existing LMP.

(iii) Odour

[32] Refer to paragraphs [58]-[69].
[33] Refer to proposed condition 10 in the discharge permit for the discharge of leachate in **Attachment A** to Mr McCone's evidence.

87. A number of factors contribute to the potential for odour issues. Odour is not necessarily directly linked to the waste tonnage accepted. Factors such as the type of waste accepted, area of the landfill working face and landfill gas management all contribute to odour.

88. The management practices that are in place to control odour are presented by Mr Van Kekem in his evidence, which I have reviewed. Based on my experience I consider that the proposed changes to landfill operations will result in better odour management, that is consistent with best practise.

(iv) Landfill Gas

89. Landfill gas occurs as a result of microbial decomposition of biodegradable material within a landfill including, food scraps, garden waste, paper, wood and cardboard.

90. Under anaerobic conditions biological activity within the landfill produces a mixture of methane (45%-60%), carbon dioxide (40%-60%), and trace gases including nitrogen, oxygen, ammonia, sulphides, hydrogen, carbon monoxide and non-methane organic compounds (NMOCs). It is the trace gases within landfill gas that give the gas its characteristic odour.

91. A number of factors participate in gas generation in the landfill. Total gas generation is linked to the total tonnage of waste placed and to a lesser degree the rate at which the waste is placed.

92. The potential for landfill gas to generate adverse effects is avoided by landfill gas capture and controlling fugitive emissions. Operational factors such as the area of landfill working face, capping and the steepness of the landfill slopes all have the potential to contribute to uncontrolled landfill gas emissions. The key to managing these uncontrolled landfill gas emissions is through appropriate operational controls (set out in conditions of consent[34]) and management methods which are set out in the LOMP and LGMP. I discuss the existing

[34] Refer to proposed conditions for permit for discharge contaminants into air from combustion processes in **Attachment A** to Mr McCone's evidence.

management methods below and the new methods that will be deployed in the new consent below.

(a) Existing Landfill Gas Management

93. The existing landfill gas management system comprises four main items:

    (a) A lining and capping system to prevent off-site migration of landfill gas;

    (b) A network of in-waste landfill gas collection wells, connected to an aboveground pipework system leading to the landfill gas destruction system;

    (c) A landfill gas destruction system where the collected gas is burned in either the permanent landfill gas flare or used as a supplementary fuel for the coal fired kiln to dry the lime; and

    (d) Monitoring to confirm the effectiveness of the landfill gas management system, including regular monitoring of the collection wells and perimeter wells (perimeter wells are located outside the landfill footprint, and monitored for subsurface migration of gas) and regular landfill surface methane emission monitoring.

94. The existing landfill gas collection and extraction system has been designed in accordance with the principles of the NZ Landfill Guidelines. The landfill gas monitoring at the AB Lime landfill also follows the guidance of these guidelines. In my experience the AB Lime landfill gas management system is similar to other modern NZ landfills.

95. Next, I will describe how the proposed improved landfill operations are expected to better the landfill gas management and reduce the potential for odour emissions.

(b) Landfill Gas Management Plan

96. A new LGMP has been developed as part of this proposal to provide the landfill with procedures on how to manage the potential effects related to landfill gas. The existing LMP does cover aspects of the LGMP, however, the LGMP provided in **Attachment I**[35] is much improved document in terms of describing the procedures for the management and monitoring of landfill gas at the landfill.

97. The LGMP has several objectives to manage the capture, extraction and flaring of landfill gas at all levels of operation. A breakdown of how each of these elements are improved as part of this proposal is identified below:

(c) Landfill gas capture

98. The majority of the potential adverse effects caused by landfill gas is addressed by capturing it. Effective landfill gas capture is interlinked with landfill operations.

99. Improved cover and capping procedures, a reduced working face and remediation of oversteep slopes will make a significant contribution to more effective landfill gas capture by creating less available room for fugitive gas emissions. This is predominantly captured in the requirement for this proposal to meet a tenfold improvement in fugitive methane surface emission discharges (from 5% to 0.5%).

100. Remediation of the oversteep slopes will enable safe landfill surface gas emission monitoring. The increased surface monitoring requirements will ensure areas of the landfill capping where methane concentrations are elevated are identified, and enable remediaion of these areas quickly before they become a compliance issue. I discuss the proposed landfill surface gas emission monitoring in paragraphs [118]-[125].

101. It is my opinion that the landfill operations provided for as part of this proposal will improve landfill gas capture. I also re-iterate that these improvements are not necessarily linked to the tonnage of waste

[35] The LGMP was updated as a response to recommendations of EHS Support raised in the s 92(1) request received on the 17 November 2020.

accepted, instead it is the control of key aspects of the landfill operations that provide the main mechanisms to manage potential landfill gas effects.

(d) Landfill gas extraction

102. Another key aspect of landfill gas that has the potential for adverse effects is related to efficient landfill gas extraction. Better extraction results in less potential for uncontrolled landfill gas emissions through the landfill cap/cover.

103. The NZ Landfill Guidelines note that the landfill gas extraction well spacing may range from approximately 50 m to 100 m. Therefore, a 50 m well spacing was used during the earlier phases of the AB Lime landfill. The current design for Area 15 is based on a 35 m grid. The reduction is grid spacing was based on the additional wells installed in the period 2017-2019, discussed below. I consider that reducing the gas well spacing from 50 m to 35 m will result in greater landfill gas capture and less potential for fugitive landfill gas emissions through the landfill cap resulting in a more effective landfill gas capture system.

104. I also note that in the period 2017 to 2019 fifteen gas additional landfill gas extraction wells were retrospectively installed to improve landfill gas collection efficiency to assist in managing the effects from cull cows and oyster disposal. This was successful as the volume of landfill gas collected increased from around 30 m^3/hr to 120 m^3/hr (though I note that the increase in waste accepted in the period 2017 to 2019 would also be attributable to the increased in gas flow rate to the permanent flare).

(e) Landfill gas flare

105. In 2009 a principal landfill gas flare was installed. This continues to operate at the site. The design and monitoring of the principal flare occurs in accordance with the NES-AQ despite the NES-AQ not being required to be complied with under the current consents. Section 4.2.3.1 of the LGMP identifies thorough maintenance procedures and inspections for the principal flare.

106. Secondary to the principal flare, a back-up flare will be installed in accordance with the NES-AQ. As stated in Mr McCone's evidence a condition precedent has been provided as part of this proposal that identifies this back-up flare must be installed prior to giving effect to the new consents[36].

107. Thirdly, as identified in Mr Smith's evidence, landfill gas is already being used to power the lime kilns that are otherwise powered by coal[37]. Given that, there will effectively be a three-tiered system for the flaring and utilisation of landfill gas. This provides an extra layer of redundancy to ensure that landfill gas is appropriately managed and must be in place prior to giving effect to this consent.

(f) Landfill Gas Subsurface Migration Risks

108. Once landfill gas is generated, it moves through the refuse and soil by both convection and diffusion. Convection is the movement of gas from an area of higher pressure to an area of lower pressure. Diffusion is the movement of gas from an area of higher concentration to an area of lower concentration. For landfills convection is typically the dominant method of gas migration. Migration of gas can create hazards both on and off-site.

109. The main potential hazard associated with off-site migration of landfill gas is the possibility of gas entering structures and being ignited, or possibly asphyxiation due to gas entering a confined space (e.g. a manhole) through cracks in foundations or utility services.

110. The site geology at the AB Lime site is mainly limestone. In-situ permeability testing carried out as part of the original resource consent application for the landfill in the early 2000s shows that the limestone has a permeability ranging from 1.2×10^{-8} to 2.9×10^{-6} m/s with an average of 3.3×10^{-7} m/s.

[36] Evidence of Mr McCone at paragraph [158].
[37] Evidence of Mr Smith at paragraph [21].

111. This is considered to be a relatively low permeability for the natural ground surrounding the landfill. In my opinion there is limited potential for significant lateral landfill gas migration from the site.

112. In addition to the relatively low permeability of the ground surrounding the landfill, other mitigation measures to minimise the risk of landfill gas migration are that the landfill has an engineered base and sidewall liner system and a landfill capping system that has been designed in accordance with good industry practice. Effectively this means that the landfill gas cannot escape and cause subsurface migration (as opposed to unlined landfill where there is a risk of subsurface landfill gas migration).

113. Subsurface gas migration from the site has been, and will continue to be monitored, with a series of landfill gas monitoring probes installed around the southern perimeter of the landfill. These are located between the landfill and onsite buildings. By monitoring at these locations, the safety of buildings and the risk of off-site migration can be appropriately managed. Monitoring of these probes has shown no methane.

114. In my opinion the geological setting, liner and sidewall design and effective monitoring all combine to provide a very low risk of off-site migration that is appropriately managed by this proposal.

(g) NES-AQ- Regulations 25-27 (Control of Greenhouse Gas Emissions at the Landfill)

115. As stated in Mr McCone's evidence the existing resource consents pre-date the NES-AQ (2004) and as such the provisions do not apply to the current consents. It is clear the control of greenhouse gas emissions regulations stipulated in the NES-AQ do apply to this proposal[38].

116. To provide greater certainty to submitters and the regulatory authorities AB Lime has committed to complying with these regulations prior to exercising the new consents associated with this proposal.

[38] Evidence of Mr McCone at paragraphs [121]-[122].

117. The key regulation in the NES-AQ that has to be met as part of this proposal is Regulation 26(2)(a):

> *26 Control of Gas*
>
> *(1) No person may allow the discharge of gas to air from a landfill.*
>
> *(2) Subclause (1) does not apply if the landfill has a system for the collection of gas from the landfill –*
>
> > *(a) that is designed and operated to ensure that any discharge of gas from the surface of the landfill does not exceed 5000 parts of methane per million parts of air.*

118. The current consent allows the discharge of gas from the surface of the landfill that does not exceed 50,000 parts of methane per million parts of air. In other words, the existing methane emission limit of 50,000 ppm is tenfold higher than the 5000 ppm limit under NES-AQ.

119. AB Lime is well aware that this is a significant change in landfill operations. It will require frequent monitoring and proactive rehabilitation of any emerging 'hot spots' in the landfill cap.

120. Under Section 6.5.1 of the LGMP the surface emission monitoring will be carried out on a 50 m grid for the permanently capped areas of the landfill and a 25 m grid for the temporary/intermediate capped areas in accordance with best practice.

121. If methane is detected during surface emission monitoring the data will be reviewed by the Environmental Technician and the Environmental Manager who will discuss the monitoring results, identify any trends, potential problems and remediation options as required.

122. Importantly, Section 6.5.2.1 of the LGMP sets trigger levels well within the NES-AQ standards for the implementation of mitigation measures. Internal trigger levels are set at 500 ppm methane for permanently capped areas, 1000 ppm for temporary capped areas and 1000 ppm for discrete features such as wellheads. These lower trigger levels ensure that steps are taken well before compliance with the NES-AQ requirements is exceeded.

123. AB Lime understand the importance of meeting this standard and are taking steps to improve their surface walkover monitoring. The latest surface monitoring emissions data is from 30-31 March 2021 and identified two areas > 5000 ppm as identified in **Attachment H**.

124. Regulation 26(2)(a) of the NES-AQ sets a standard but does not provide a methodology for meeting this standard. Other landfills required to meet this regulation carry out regular monitoring and ensure appropriate remediation measures are undertaken as soon as practicable. In practice, the meeting of this standard is not uniform, and ongoing compliance requires constant monitoring and vigilance.

125. In my opinion the surface walkover data obtained to date indicates that the compliance with these standards is readily achievable.

126. The second element of the NES-AQ, which must be complied with is Regulation 27. This identifies the system required for the principal flare and back up flare if energy conversion of landfill gas is not in place.

127. The principal flare meets these requirements, particularly now that there is more efficient landfill gas capture and flow.

128. A report to demonstrate compliance with this standard is required to be produced by a suitably qualified professional demonstrating that the operation of the landfill complies with the control of greenhouse gas emissions at landfills provisions of the NES-AQ prior to the tonnage cap being lifted.

129. Mr Smith has identified in his evidence that the purchase of a back-up flare will require significant capital investment, as such, AB Lime are awaiting the outcome of this process. However, based on my knowledge of the site operations to date, once the back-up flare is installed it is my opinion AB Lime will be able to demonstrate compliance with the NES-AQ. Achieving compliance with the NES-AQ is a significant positive outcome of this consent process.

Addressing Submissions Related to this Evidence

130. The submissions provided by Mr Hamilton, Mr and Ms McKerchar, Mr and Ms Sinclair, and Mr Johnston and Ms Cavanagh are relevant to landfill operations matters.

131. The submissions by Mr Hamilton, Mr and Ms McKerchar, Mr and Ms Sinclair all raise concerns about leachate discharges or leakage from the landfill.

132. The whole landfill footprint is underlain by a double liner system overlain by a thick gravel layer with perforated pipework system. The landfill has been designed to collect this leachate for safe off-site disposal via tanker trucks to the Clifton wastewater treatment plant. The risk to groundwater from leachate is addressed by Mr Baker in his evidence.

133. Concerns about landfill gas emissions were also raised in submissions by Mr and Ms McKerchar and Mr and Ms Sinclair.

134. I have addressed landfill gas management in paragraphs [96]-[97] in my evidence. Management practices such as improved capping, a reduced working face and remediation of oversteep waste slopes will, in my opinion, reduce the potential for fugitive gas emissions. Off-site odour is addressed in Mr Van Kekem's evidence.

135. Mr Johnston and Mrs Cavanagh raised issues with the gas flare in their submission. As stated in paragraph [126] of this evidence, should this proposal be accepted, a back-up flare will be installed in order to comply with the NES-AQ standards. Further, a consent condition has been added to this proposal that means AB Lime must meet these NES-AQ standards and install a back-up flare prior to any new consent coming into effect. The installation of a back-up flare will demonstrate compliance with the NES-AQ and provide certainty around gas flaring.

Officer's s42A Report

136. In the following paragraphs I will address key issues raised by the s 42A report. Specifically, I will address the following points:

    (a) Waste acceptance standards; and

(b) The role of landfill legacy effects in assessing the existing environment; and

Waste Acceptance Standards

137. The s 42A report makes the following statements:

"The key elements of the application are that, if granted the new consents would incorporate within the consent framework a regime of management plans, allowing elements of the landfill operation (including new waste streams) to be managed in a way that can adapt and change"

And;

'the assessment is limited to the effects arising from the quantity of waste to be received, not the type of waste to be received'[39]

And;

'there is no assessment of the various types of waste which may potentially be received, especially from emergencies and remedial waste management, and any particular effects on (for example) leachate generation volumes, leachate chemistry or other characteristics…'[40]

138. The s 42A report has misunderstood the application and has overlooked the proposed conditions of consent. Hazardous waste streams that do not meet the stringent criteria[41] cannot be accepted into the landfill.

139. The premise of the emergency response framework is to put in place better processes to respond to situations when emergencies occur. It is not a right to breach consent conditions with different types of waste.

[39] *Section 42A Officer's Report: Hearing of resource consent application by AB Lime,* Report of Michael Durand at 3.3.1.
[40] *Section 42A Officer's Report: Hearing of resource consent application by AB Lime,* Report of Michael Durand at 3.3.1.
[41] Refer to condition 22 of discharge permit for solid waste onto or into land in Attachment A of Mr McCone's evidence.

140. The waste acceptance criteria for this proposal is at a minimum consistent with current operations. In my opinion, the waste acceptance criteria are much improved with this proposal and provides better management and environmental outcomes compared to current operations. The additional improvements are identified through additional conditions of consent providing extra performance criteria, as well as several additional sections in the LOMP to manage waste acceptance are provided in paragraph [43] of this evidence.

141. There are no new waste streams that form part of this proposal. This is why the s42A report has potentially misunderstood the application and this is also why he does not find an assessment of effects for any '*various types of waste that may potentially be received'.*

142. No particular sites or types of waste are assessed in the proposal because any such waste must meet the performance criteria identified. For example, if any remediated sites contain hazardous waste it cannot be accepted. Therefore, there are no unknown effects related to these waste streams. They either meet the waste acceptance criteria or they do not.

The roll of legacy effects in assessing the existing environment

143. In the following paragraphs I set out in detail the legacy effects that are associated with the landfill if it were to close in 2038. The purpose of this exercise is to demonstrate what the environment would be like without current consents governing currently lawful discharges.

144. In terms of the type and duration of environmental effects the NZ Landfill Guidelines[42] state that:

    (a) Landfill aftercare is required to ensure ongoing management of final cover and leachate, stormwater and landfill gas control systems; and

    (b) Monitoring of groundwater, surface water and landfill gas needs to be continued during the aftercare period of the landfill, until the

[42] *Waste Management Institute New Zealand WasteMINZ, Technical Guidelines for Disposal to Land* (August 2018).

strength of discharges has reduced to a level at which they are unlikely to have an adverse effect on the environment. This aftercare period is likely to last 30-50 years for a Class 1 landfill.

145. The Landfill Guidelines also identifies the following site operations as necessary during the post-closure period:

(a) Leachate collection and disposal;

(b) Landfill gas control;

(c) Monitoring of site integrity;

(d) Repairs to the final cover system;

(e) Maintenance and control of vegetation;

(f) Stormwater and sediment control; and

(g) Monitoring of groundwater, surface water and landfill gas.

146. It is clear from the above that there is a need for appropriate management of site operations post-closure. Whilst the Landfill Guidelines provide guidance, a suite of resource consents will be required for a substantial period of time to manage post-closure

147. The legacy effects associated with landfills post-closure include the effects of leachate, landfill gas capture, capping and stormwater.

Leachate legacy effects

148. The key legacy effects that are associated with leachate include the effects on groundwater, surface water and air quality.

149. Post-closure of the landfill, leachate generation would be expected to decrease but not cease. Post-closure would see permanent capping installed over the entire landfill. This would decrease the amount of rainfall and surface water entering the landfill and thus reduce the ability to generate leachate.

150. It is expected that leachate generation will continue for a minimum of 30 years after the closure of the landfill. Therefore, the ongoing

collection of leachate, maintenance of the leachate system, and monitoring will be required.

151. There are three potential legacy effects associated with leachate. Firstly, mismanagement of leachate can cause potential adverse effects on groundwater. Secondly, leachate that is not managed properly can also have adverse effects on surface water. Surface water that comes into contact with waste material is currently treated as leachate. Finally, leachate collection and processing has been identified as a potential odour source, thus having effects on air quality.

152. The risk of leachate contamination is considered to be low, however, the risk still remains.

Landfill gas legacy effects

153. The key legacy effects that are associated with landfill gas are the effects of air quality.

154. If the landfill were to close landfill gas will continue to be produced as the waste slowly decomposes. The landfill gas would still need to be captured, destroyed/burnt, and monitored for many years, probably decades, after landfill closure.

155. Landfill gas that is not captured and managed effectively will produce fugitive landfill gas emissions that have the potential to cause legacy effects on the environment. Finally, landfill gas is a known source of odour and has the potential to cause adverse effects in regard to odour that is offensive and objectionable as long as landfill gas is being produced.

Capping legacy effects

156. The key legacy effects that are associated with capping are the effects of air quality, groundwater and surface water.

157. Final capping would need to be installed on any open areas if the landfill were to close. For a minimum of 30 years post-closure (but probably considerably longer) the cap would need to be monitored and

maintained to assess and repair signs of cracking, erosion, and subsidence.

158. There are three potential legacy effects associated with capping. Firstly, without effective management of the capping, the occurrence of cracking, erosions and subsidence may result in fugitive landfill gas emissions and odour issues. Secondly there is also the potential for an increase in the production of leachate due to water ingress. This may impact groundwater quality. Thirdly, there is the potential for an increase in effects on surface water. If there is ineffective management of landfill capping, such an untimely repair of cap erosion and/or settlement leading to waste becoming exposed, there is the potential for surface water run-off to carry contaminants to the stormwater system and thus contaminate the surface water.

Stormwater legacy effects

159. The key legacy effects that are associated with stormwater are the effects on surface water.

160. Stormwater generated in the quarry is collected in an open channel before it is discharged to a stormwater pipe which drains under the landfill into the stormwater pond.

161. If the landfill were to close, the pipe would have to be decommissioned with the stormwater in the quarry needing alternative management. A significant stormwater diversion would need to be constructed around the outside of the landfill to divert the stormwater into the pond.

162. Stormwater from the permanent landfill cap will also need to be diverted into the stormwater pond to allow sediment to settle until the site is sufficiently rehabilitated to allow stormwater run-off directly into natural drains.

163. Post-closure, the ongoing collection of stormwater, maintenance of the stormwater collection, treatment and storage systems, and monitoring will be required. Sedimentation and contamination of stormwater will

remain as potential legacy adverse effects on the Winton Stream as the ultimate receiving environment.

Conclusion

164. In this evidence I have stated that it is not the rate of filling rather it is the management of this waste that determines the level of potential adverse environmental effects. AB Lime are currently nearing the 100,000 tonne waste acceptance limit. During 2020, AB Lime accepted 91,254 tonnes and within the last year (April 2020 to March 2021) they have accepted 95,238 tonnes.

165. AB Lime are not proposing to accept any new waste streams, rather they are providing a more prescriptive approach to managing the acceptance of general and special waste.

166. No hazardous waste streams, other than those stated in the proposed consent conditions, will be accepted.

167. Along with a number of management plans the LOMP and LGMP are put forward as part of this proposal to provide management frameworks to better manage operations on site. Management practices such as reducing oversteep slopes, decreasing the working face, and increasing landfill cover are key elements of this proposal that I have identified. They have considerable environmental benefits such as reducing leachate generation, increasing the efficiency of landfill gas capture, and will help in controlling odour, as discussed in paragraphs [47]-[69] of my evidence.

168. The LOMP also provides processes to be followed during an emergency waste event, an improvement from the existing LMP, which I believe is a first for Class 1 landfills in New Zealand and in my opinion sets a positive example for others to follow.

169. This proposal also necessitates AB Lime to comply with the NES-AQ, a positive step change from the current consent. The allowable methane concentration from the discharge of gas to air is a tenfold reduction compared to the current consent. The significance of this change cannot be underestimated. In my evidence I have set out how this can

be achieved. The monitoring data to date indicates that compliance with the 0.5% discharge standard is readily achievable.

170. In conclusion, I believe that this proposal provides enhanced management of waste acceptance criteria and a number of improved aspects to landfill operations. In my opinion, this proposal provides superior landfill operations than under the existing consents and the environmental benefits from these changes are significant.

171. This is particularly relevant given my assessment that the imposition of a tonnage limit is arbitrary for matters under consideration before the Southland Regional Council.

172. In my opinion, the AB Lime landfill will be an environmentally improved operation under this proposal.

Date: 28th April 2021

Walter Starke