Before the Selwyn District Council

under: the Resource Management Act 1991

in the matter of: Proposed Private Plan Change 69 to the Operative District Plan: Lincoln South

and: **Rolleston Industrial Developments Limited**
Applicant

Statement of Evidence of Cathy Nieuwenhuijsen (Odour)

Dated: 4 November 2021

Reference: JM Appleyard (jo.appleyard@chapmantripp.com)
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STATEMENT OF EVIDENCE OF CATHY NIEUWENHUIJSEN

INTRODUCTION

1 My full name is Catherine (Cathy) Elizabeth Nieuwenhuijsen.

2 I am a Senior Air Quality consultant at Golder Associates New Zealand Limited, now owned by WSP. I have a degree in Chemical and Process Engineering and I am a Certified Air Quality Professional. I have nearly 20 years' experience in wide range of Air Quality Assessments.

3 With regards to odour assessments, I have:

3.1 been a project manager and a technical lead in preparing assessments for various chicken farms, including Brinks Poultry (Canterbury and Waikato) and Cobb Vantross poultry farm (Waikato).

3.2 been an internal technical reviewer for a number of other assessments, including Lamond Poultry (a free-range layer farm) in Christchurch, and working for potentially affected neighbours in undertaking a review of two meat chicken farms in Canterbury.

3.3 been the technical lead and Project Manager of assessments on Rendering sites, including Hawkes Bay Proteins and Tuakau Proteins.

3.4 worked as Environment Canterbury's expert for the review of a composting operation, including attending Environment Court Mediation.

3.5 assisted with assessment of odour and contaminants from Ravensdown's three fertiliser factories and several Alliance meat processing operations, including rendering/fellmongering and wastewater treatment plants.

3.6 significant atmospheric dispersion modelling experience and have been technical lead on numerous air quality assessments involving complex dispersion models. These include assessment of energy plants, milk powder driers, pyrolysis plants, generators, and refinery emissions.

4 With regard to odour assessments in the context of this plan change, I was the project manager and technical lead for the assessment of the odour effects (Golder 2021)[1] that was prepared in

[1] Golder (2021) Letter C Nieuwenhuijsen to J Lewes. Golder Ref 20438027-004-L-Rev0.

response to a request for further information (RFI) relating to the Lincoln South Plan change area.

5 I am familiar with the plan change application by Rolleston Industrial Developments Limited (*the Applicant*) to rezone approximately 190 hectares of land on Springs Road, Lincoln to enable approximately 2,000 residential sites and a small commercial zone.

CODE OF CONDUCT

6 Although this is not an Environment Court hearing, I note that in preparing my evidence I have reviewed the Code of Conduct for Expert Witnesses contained in Part 7 of the Environment Court Practice Note 2014. I have complied with it in preparing my evidence. I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where relying on the opinion or evidence of other witnesses. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

7 The scope of my evidence is an assessment of odour effects on the PC69 land, specifically the need or otherwise for housing to be setback from the former Lincoln sewage treatment plant (the STP). I have only considered the current anticipated use of the plant and not potential future uses.

8 I have prepared the attached letter report (**Appendix A**) incorrectly dated 16 February 2020 (but issued on 16th February 2021) (Golder 2021). This letter was prepared in response to a RFI for PC69. This letter covers the use of the STP for storage in storm (peak wet weather) events.

9 In preparing my evidence, I have reviewed and considered the following:

9.1 Novo Group report– Request for Change to the Selwyn District Plan prepared for: Rolleston Industrial Developments Limited. April 2021;

9.2 Aqualink report – Application to use land for a community wastewater management pond – Assessment of Environmental Effects. Report dated 18 Apr 2019;

9.3 Council's Section 42a Report prepared by Mr Nick Boyes; and

9.4 The odour peer review prepared by Mr Chris Bender.

10 My evidence will provide a summary of the letter report, followed by updates to my assessment and response to the conclusions in **Mr Bender's** and **Mr England's** evidence regarding odour effects and the potential for reverse sensitivity.

SUMMARY OF LETTER REPORT FOR PC69

11 In summary, my letter report provides a review of the potential odour effects from the Lincoln Sewage treatment plant (STP) operations on the proposed Lincoln South Plan Change area and whether the existing 150 m setback for housing (currently required by Rule C4.9.32) is still required to prevent reverse sensitivity odour effects.

12 Key points include the following:

12.1 The Lincoln STP consisted of sequential batch reactor (SBR) tanks and an oxidation pond to treat the wastewater prior to discharge. However, the activity was only permitted under CRC210644 until 31 March 2013. The Lincoln STP is no longer used for sewage treatment. Instead, the tanks and pond associated with the Lincoln STP are used to buffer flows to the Pines Wastewater treatment plant (WWTP) during storm events (peak wet weather) and the tanks and pond are made available for emergency wastewater storage events.

12.2 The flow buffering involves temporary storage of dilute wastewater in the tanks with overflow into the pond if required.

12.3 For high rainfall events, based on the evaluation of flows by WSP (2020), for the 1-in-5-year annual reoccurrence interval (ARI) over a 12-hour period, a conservative estimate of 700 m^3 of dilute wastewater is generated beyond the capacity of the pump station. This has previously been determined by WSP as the critical storm duration and hence is expected to result in the highest requirement for temporary storage. In this event, tanks will be filled first. The tanks have capacity of up to 600 m^3 with the remaining 100 m^3 discharged into the pond.

12.4 For the PC69 area, due to the use of tanks for short-term wastewater storage in high-rainfall events, the freshness of the wastewater, and the distance (190 m) to the residential area, it was concluded that the storage of wastewater in the tanks was likely to result in less than minor odour effects

12.5 With regard to the pond use, the natural capacity of the pond to provide the oxygen required by the dilute wastewater is

expected to result in a less than minor potential for offsite odour effects.

12.6 I note that aerators are now installed in the pond; these appear to have been installed recently, as the first aerial photograph they are visible in is dated December 2020. I do not have the specifications of the aerators, but these are likely to increase the oxygen available at the inlet of the pond and reduce the sludge build-up in this area. The aerators are unlikely to increase the odour potential of the pond compared to my original assessment, and indeed are likely to reduce the odour potential.

13 Therefore, the current use of the Lincoln STP was concluded to be unlikely to result in offsite odour at the PC69 area and no restrictions on land use in the Lincoln South subdivision are considered necessary to mitigate against reverse sensitivity to odour during high rainfall events.

14 Mr Bender agrees with the above assessment and has not raised any concerns relating to the normal operation of the ponds in wet weather events.

RESPONSE TO SECTION 42A REPORT

15 With regard to the emergency use provisions raised by Mr Bender and Mr England, I have reviewed the resilience planning document[2] referred to by Mr Bender. The land use application (CRC193742 – currently on hold) also describes the use of the STP.

16 In the resilience planning document, simulations of operational scenarios including failure of critical wastewater pipelines, pump stations and treatment plant are modelled to determine the resilience of the network capacity. A criteria of 8 hours storage has been applied to allow time for repair/diversion to be undertaken. The Lincoln STP pond and tanks are included as part of the network storage capacity.

17 As Mr Bender describes, the tanks and ponds can be used for emergency situations, including failures in either the rising mains wastewater pipes or in the pump stations between Lincoln and the Pines WWTP. The resilience planning document evaluates the situations listed by Mr Bender and Mr England (excluding peak wet weather flows evaluate earlier in this evidence).

18 Simulations of various failure scenarios were undertaken to determine whether the network has sufficient capacity to hold the

[2] WSP/OPUS/Stantec. Eastern Selwyn Sewerage Scheme Resilience Planning Prepared for Selwyn District Council 16 September 2019.

wastewater for 8 hours. There was no evaluation of the likelihood of the scenarios in this report.

19 To assist with determining the potential for odour effects I have consulted with my colleague, Adam Wheeldon, a WSP technical principal and pipe condition specialist who also has experience in wastewater networks, and he estimated that for a recently installed, well-designed, and maintained system, failures of the kind evaluated in the resilience report, are likely to be an approximately 1 in 20 year event if not less frequently. When considering odour effects, I would consider this to be a very low likelihood.

20 As far as I am aware there have been no major failures of the network to date.

21 To determine the level of odour effect likely in the emergency evaluated in the resilience report, I have considered the wastewater discharged into the pond in an event. In the worse scenario for discharge into the pond (Scenario 2– Selwyn Road Rising Main Failure), the pond would receive wastewater 3 hours after the event (due to network and Lincoln SBR tanks capacity).

22 In the period up to the 8 hour timeframe considered, the pond is stated to receive 21% of the available residual capacity. I estimate this to be 4,200 m^3 based on the 20,000 m^3 residual pond capacity reported. On the basis that this is undiluted wastewater with an BOD_5 of 200 to 300 g/m^3, this is a BOD loading of 870 to 1,260kg BOD_5.

23 Following the repair of the system, wastewater would be pumped out of the pond and tanks, either to Pines WWTP or potentially to the Christchurch network.

24 The amount of wastewater discharged into the pond, the period of time that wastewater was stored in the pond, and pond conditions prior to the wastewater being discharged into the pond as well as ambient factors will contribute to the pond's response to the wastewater.

25 While the pond is not regularly receiving any wastewater and therefore any emergency loading would be a shock load, to quantify the wastewater load it is useful to consider what BOD load this size pond would be treating if it were operating as facultative pond.

26 Using an indicative design specification (EPA 2011)[3], loading for an unaerated facultative pond is typically between 22 and 56 kg

[3] Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers, and Managers (epa.gov) https://www.epa.gov/sites/default/files/2014-09/documents/lagoon-pond-treatment-2011.pdf

BOD_5/1,000m^2/day. For the 33,000 m2 pond area, this is a daily load of between 730 and 1850 kg BOD_5. Therefore, the emergency load is consistent with a single day of load expected.

27 The inflow would occur without the pond having a bacteria population that would consume that load, however I do not expect there to be a significant lag in the pond's biological system to adapt to the increase in BOD demand. Therefore, I estimate that there may be odour observed offsite perhaps up to a period of a few days for the pond top layer to clarify and for natural oxygen transfer at the surface of the pond to resume.

28 Overall, I consider the use of the pond for emergency storage may potentially result in observable odour beyond the boundary. However, due to the likely infrequency of this event and the expected relatively short term nature of the odour, I consider that the risk of odour is acceptable and maintaining the 150 m setback is not required to mitigate against infrequent short term events such as these.

CONCLUSIONS

29 I have considered the odour potential from the Lincoln STP and whether maintaining a 150m setback is justified for the current operation of this site. I have considered the use of the ponds for storage during storm (peak wet weather) events and as contingency storage for wastewater network resilience.

30 For storm events, I consider that the pond has sufficient capacity to provide the oxygen demand required such that there is likely to be less than minor potential for offsite odour effects. When the ponds are used for emergency storage, there is the potential for odour to be observed offsite, but due to the low frequency and short-term nature of this, I do not consider that a 150m buffer is required to mitigate odour effects.

Dated: 4 November 2021

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Cathy Nieuwenhuijsen

APPENDIX A

GOLDER

16 February 2020

Project No. 20438027-004-L-Rev0

Jocelyn Lewes
Selwyn District Council
2 Norman Kirk Drive,
Rolleston 7614,
Selwyn

REVIEW OF ODOUR EFFECTS RELATING TO LINCOLN SEWAGE TREATMENT PLANT SETBACK - LINCOLN SOUTH PLAN CHANGE

Dear Jocelyn,

Rolleston Industrial Developments Ltd (RIDL) have lodged a private plan change request with Selwyn District Council (SDC) (Plan change request 69). This plan change is to change the Selwyn District Plan (Plan) by rezoning approximately 186 hectares of Rural Outer Plains Zone to Living X, Living Z and Business 1 Zones, in Lincoln. Following the application, SDC have issued a request for further information (RFI). Item 40 of the RFI identifies the current restriction on housing when within 150 m of the boundary of the area designated for the Lincoln Sewage Treatment Plant (rule C4.9.32 of the Plan). The request is as follows:

> *40. The Lincoln Sewage Treatment Plan, referred to in the request* [plan change request] *as the Allendale Pump Station, is located on the north-eastern boundary of the plan change area. This area is designated (SDC-153) and Rule C4.9.32 requires that any dwelling shall be setback not less than 150 m from the boundary of the designed area. The plan change request has not sought to vary this rule, therefore please demonstrate how this will be achieved and address any other reserve sensitivity effects that may arise from the location of residential activity in close proximity to the designated area. This is particularly relevant as the request proposes that the ponds will be required to buffer wastewater flows from the plan change area during periods of wet weather.*

This letter[1] provides a review on the potential odour effects of the Lincoln Sewage treatment plant operations on the proposed Lincoln South Plan Change area and whether the existing 150 m setback is still required to prevent reverse sensitivity odour effects.

Background

The Lincoln Sewage Treatment Plant included sequential batch reactor (SBR) tanks and oxidation pond treatment system prior to discharge into the L II River. The discharge of treated wastewater was only permitted under CRC210644 until 31 March 2013. There is no longer discharge of wastewater, or treatment

[1] This letter is subject to the limitations provided in Attachment 1.

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of wastewater at this site and since 2013 all wastewater is pumped to the Pines WWTP in Rolleston for treatment. Currently the tanks and pond are available for emergency wastewater storage events.

It is noted that the 150 m setback rule for housing (referred to in the RFI) was set when there was sewage treatment undertaken at the site.

Wastewater Storage at Allendale Pump Station

Using conservative assumptions, WSP (2020)[2] estimated that with the addition of the Lincoln South Plan Change area (2,000 households), that a 1 in 5-year annual reoccurrence interval (ARI) 12-hour storm event, would result in 700m^3 of wastewater overflow from the Eastern Selwyn Sewerage Scheme. This volume of wastewater would need to be stored near to the Allendale pump station. It is understood that this would be stored firstly in the three former SBR tanks (up to 600 m^3) and then any additional (up to 100 m^3) within the adjacent pond.

As the storage would be required following high rainfall events (due to water infiltration into the wastewater system), WSP[3] have estimated that the 700 m^3 of excess wastewater would be approximately 2 to 3.5 times more dilute than the normal municipal wastewater, and wastewater entering the pond being at the upper end of this level of dilution.

Once normal system flows have resumed, WSP[3] have also estimated that it would take 1 hour to empty the three former SBR storage tanks and they consider it is unlikely that the pond would be emptied.

Odour Potential

A key driver of odour is the maintenance of the wastewater in a non-septic state – that is avoiding anaerobic conditions. For the tanks, the duration that wastewater is to be stored in them is expected to be relatively low, i.e., it is expected to be a number of hours[3]. Therefore, the wastewater in the tanks is unlikely to become septic prior to being pumped to the Pines WWTP.

For the pond storage, we have undertaken a desktop review of the oxygen demand of the inflow wastewater compared to the ability of the pond to provide this demand with its existing residual dissolved oxygen inventory.

New Zealand municipal wastewater typically has a biochemical oxygen demand (BOD_5) of approximately 200 to 300 g/m^3 (MfE 2003[4]). Therefore, the dilute wastewater that could be discharged into the pond in a wet weather event is estimated to have a biological oxygen demand in the order of 8.5 kg[5].

The pond has an area of 3.32 ha (WSP[3]) and is understood to currently have a water level of around 1.2 m deep. Based on a review of historical aerial photographs available through Google Earth, we can see no strong evidence that the pond suffers from seasonal algal blooms, i.e., there is no obvious sign of such events, or other pond discolouration. Some aerial photographs indicate significant surface aerations (white caps) during wind events. Therefore, it is likely that at least the top 0.5 m of the pond, would be close to being fully saturated (or close to it) with oxygen. At sea level and a temperature of 25 °C, the saturated dissolved

[2] Memorandum WSP Charlotte Mills to Bruce Van Duyn 31 October 2020.

[3] Pers Comms Charlotte Mills (WSP), Bruce van Duyn Carter Group).

[4] Section 2.3 of Sustainable wastewater management: A handbook for smaller communities MfE (2003). Accessed at https://www.mfe.govt.nz/publications/waste/sustainable-wastewater-management-handbook-smaller-communities-part-1-0 last accessed 9/2/2020.

[5] 8.5 kg = ((300 g/m^3 * 100 m^3) / (1000 g/kg)) / 3.5 (assumed dilution factor).

oxygen content is 8 g/m^3 (footnote[6]). This means there is approximately 130 kg[7] of available dissolved oxygen inventory within the pond when dilute sewage enters. At lower temperatures, the percentage dissolved oxygen in saturated conditions will be higher, therefore, this is considered to be a conservative assumption.

Using the above assumptions, if the BOD_5 demand of the inflow was met within the top 0.5 m of the pond, this would result in an approximate reduction in the dissolved oxygen content of 6.3 % (i.e., 8.5 kg / 133 kg). This would reduce the dissolved oxygen to 7.5 g/m^3 (footnote [8]). It is noted that the pond may not be fully mixed, and a small area of lower dissolved oxygen may occur in the pond, however, it is expected that pond mixing, and natural aeration is expected to readily restore the dissolved oxygen to typical levels within hours. Therefore, the dissolved oxygen content is unlikely to reduce as much as indicated by the above simplistic calculation.

Odour Effects

Regarding odour effects on the proposed Lincoln South subdivision, given the distance between the tanks and the boundary with the subdivision (approximately 190 m), the low frequency which the tanks will be used and the expected short duration of storages, there are expected to be less than minor odour effects from the use of the tanks as short-term wastewater storage in high rainfall events.

Regarding the use of the pond, the natural capacity of the pond to provide the oxygen required by the dilute wastewater is expected to result in a less than minor potential for offsite odour effects. The use of the pond for receiving excess wastewater flows would be infrequent (one event in five years), and these events have a very low potential to cause odour that could be recognised at the proposed sub-division.

It is also noted that it is unclear if using the pond for buffering excessive wastewater flow during 1 in 5 year ARI storm event would be adopted by SDC or whether additional tank storage would be installed. While the option of additional tank storage has not been fully evaluated, due to the distance to the plan change area, and relatively short-term storage of wastewater (as is the case for the current tanks), it is expected that several additional tanks located close to the current tanks, would be unlikely to result in offsite odour effects at the Lincoln South Plan change area.

Therefore, when considering odour effects, it is considered that a 150 m buffer, as current Rule C4.9.32 suggests is not required. While this was appropriate for the previous use of the Lincoln WWTP system, given the current consented use of the Lincoln WWTP, based on the tanks/pond being used only for storage during peak rainfall events, there is expected to be less than minor odour effects beyond the boundary and no restrictions on land use in the Lincoln South subdivision is considered necessary to mitigate against reverse sensitivity odour.

Closing

We trust the above information will assist RIDL in understanding the odour impacts on the proposed Lincoln South Plan Change area due to the Lincoln WWTP operation in a wet weather scenario. If you have any queries regarding this letter, please contact the undersigned by email at cnieuwenhuijsen@golder.co.nz or by phone at (021) 782 440.

[6] https://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/. Last Accessed 15/2/2021.

[7] 133 kg = (((3.32 ha x 10,000 m^2/ha) * 0.5m) * 8 g/m3) / 1000 g/kg.

[8] 7.5g/m^3 = (133 kg - 8.5 kg) / (3.32 * 10,000 * 0.5).

Yours sincerely,

Golder Associates (NZ) Limited

Cathy Nieuwenhuijsen
Senior Air Quality Consultant

CN/RC/mt

Attachment: Report Limitations.

https://golderassociates-my.sharepoint.com/personal/mtsoy_golder_com/documents/documents/2021/cathy/20438027-004-l-rev0-review of odour effects lincoln wwtp.docx

ATTACHMENT 1

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