BEFORE THE TASMAN DISTRICT COUNCIL

Under	the Resource Management Act 1991
In the matter of	an application by **THE NELSON REGIONAL SEWERAGE BUSINESS UNIT** for the resource consents to continue applying biosolids to land on Moturoa/Rabbit Island.

STATEMENT OF EVIDENCE OF NICHOLAS DAVID BERRY FOR THE NELSON REGIONAL SEWERAGE BUSINESS UNIT

11 MAY 2022

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STATEMENT OF EVIDENCE OF NICHOLAS DAVID BERRY

Introduction

1 My full name is Nicholas David Berry. I hold the degrees of Master of Engineering and Management (MEng & Man) in Mechanical Engineering, Manufacture and Management from the University of Birmingham (UK); Master of Science (MSc) in Water Pollution Control Technology and Engineering Doctorate (EngD), both from Cranfield University (UK). I am a Technical Director - Wastewater Engineering at Beca Limited.

2 In completing my doctorate, I was based on a wastewater treatment plant, commissioning and operating a full-scale trial plant. Following completion of my doctorate studies in 1999, I joined Thames Water Utilities Ltd as a Process Engineer and spent four years working on wastewater design and planning projects. I spent the following four years working as a Senior Process Engineer for Copa MBR Technology, carrying out process design, site supervision, process commissioning and training for installation of plants using the membrane bioreactor (**MBR**) process. Since 2007 I have worked for Beca Ltd on a wide range of water and wastewater projects. I have spent a total of 25 years working in the wastewater engineering field.

3 In my time with Beca, I have worked on a wide range of projects which include leading the options assessment for the Army Bay WWTP consent application (Watercare); leading the engineering input and options assessment for consenting of the Warkworth and Snells-Algies WWTPs (Watercare); carrying out a peer review of the wastewater treatment plant design submitted in the Rotoiti/Rotomā consent application (Bay of Plenty Regional Council); led the development of a 30 year master plan for wastewater treatment in Tauranga (Tauranga City Council); and Lead Process Engineer for the Pukekohe WWTP upgrade. For this project, I carried out a review of process alternatives for biosolids treatment within the context of producing Grade A biosolids suitable for beneficial reuse.

4 While this is a Council-level hearing, I acknowledge that I have read and am familiar with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014, and that I agree to comply with it. I confirm that this evidence is within my area of expertise, except where I state that this evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions I express in this evidence.

Background

5 I authored the Biosolids Process Alternatives Assessment1 appended to the NRSBU resource consent application and Assessment of Environmental Effects (AEE) submitted to Tasman District Council (TDC) in August 2020.

6 In preparing my Appendix D technical assessment I was responsible for:

6.1 Assessing relevant operational data from the Bell Island wastewater treatment plant (WWTP) to confirm compliance with the stabilisation and contaminant grade requirements set out in the NZ Biosolids Guidelines (2003) (NZ Biosolids Guidelines), including comment on compliance against the draft Biosolids Guidelines (2017);

6.2 Predicting the estimated future biosolids production levels at the WWTP over the life of a new consent (35 years);

6.3 Investigating a list of treatment alternatives to confirm the preferred option for processing the wastewater sludge generated at the Bell Island WWTP;

6.4 Providing advice on national and international approaches to dealing with emerging organic contaminants in wastewater processes; and

6.5 Providing advice and input to the volunteered consent conditions - particularly condition 9 (six-yearly monitoring technology review report) and conditions 15 – 19 (Biosolids volume and quality).

7 In preparing my evidence, I have reviewed the resource consent application and AEE, the evidence of Mr Chris Purchas and Mr Nathan Clarke and the cultural impact assessment[2] prepared following lodgement of the resource consent application.

Scope of Evidence

8 In my evidence I will outline the following:

8.1 An overview of the existing treatment processes at the Bell Island WWTP.

8.2 A summary of the current biosolids production and estimated future biosolids production.

[1] Moturoa / Rabbit Island Consent Application – Biosolids Process Alternatives Assessment (Beca), 30 July 2020, Appendix D to the Moturoa / Rabbit Island Biosolids Reconsenting Assessment of Effects on the Environment (Tonkin +Taylor), August 2020.

[2] Moturoa / Rabbit Island Biosolids Application Resource Consent Cultural Impact Assessment (Aranga Environmental Consultancy), February 2021

8.3 Biosolids classification in New Zealand and demonstration of compliance for the existing process at Bell Island.

8.4 End uses of biosolids and required level of treatment required.

8.5 Screening of a long list of treatment options to select a short list of processes aligned with potential end uses

8.6 Evaluation of the short listed alternative solutions.

8.7 Updates since submission of AEE

8.8 Summary of findings

8.9 Comments on Officer's Report, and

8.10 Comments on submissions where relevant to my evidence.

Existing Treatment Processes at Bell Island WWTP

9 The existing treatment processes at Bell Island WWTP are summarised as follows:

9.1 The WWTP at Bell Island has two liquid streams, one comprising primary settling, activated sludge and secondary settling and the second comprising facultative and maturation ponds.

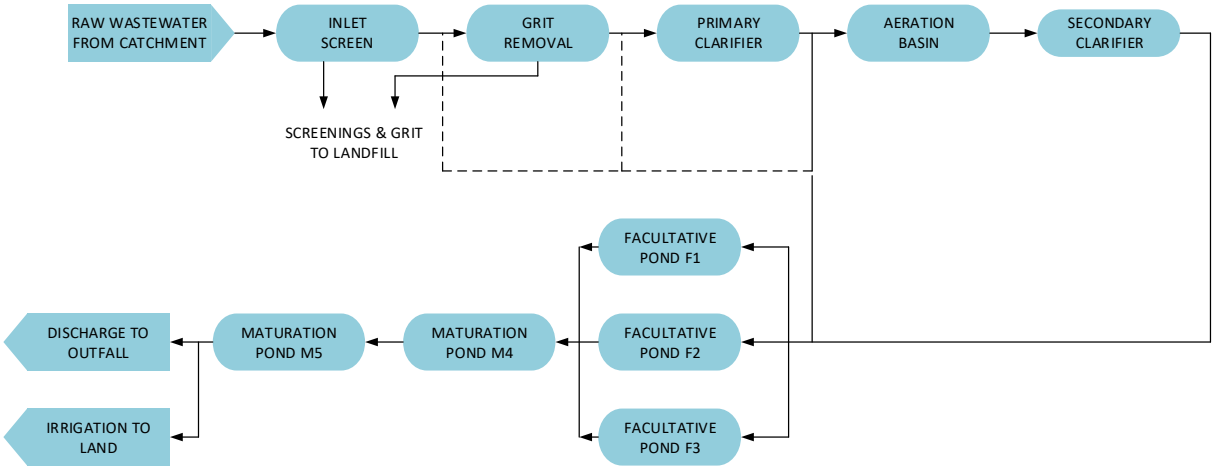

Figure 1: Liquid stream process train at Bell Island WWTP

9.2 Primary sludge and waste activated sludge are thickened to approximately 5% dry solids (DS) and treated in an autothermal thermophilic aerobic digestion (ATAD) process, to produce biosolids suitable for application to land.

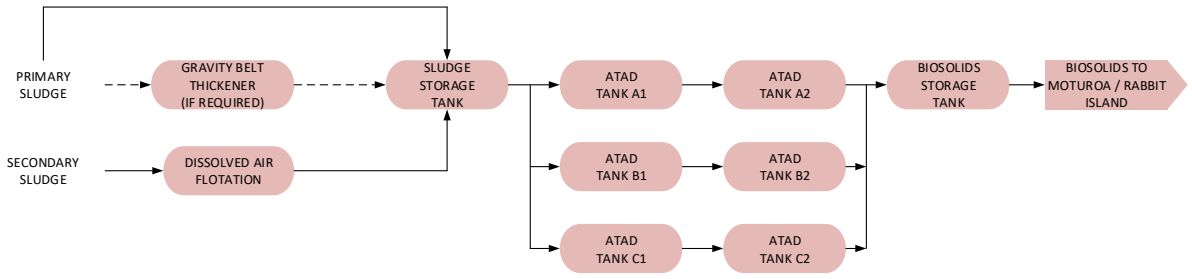

Figure 2: Solids stream process train at Bell Island WWTP

10 By following the ATAD 'three train' approach (each with two tanks in series) no biosolids can be transferred to the Biosolids Application Facility (BAF) without having had at least 24 hours retention, in the second tank of the ATAD train, and similarly no biosolids can enter the second tank of each train without having had at least 24 hours retention in the first tank of that train. This process ensures that the biosolids produced at the Bell Island WWTP meet the pathogen reduction requirements set out in the consent conditions and the NZ Biosolids Guidelines.

11 When maintenance of the ATAD is required, it is understood that NRSBU requires the ATAD to process the discharge from any maintained train to ensure there is no possibility of reduced

residence time or reduced exposure of all the biosolids to the full temperature requirements. See also Figures 4 and 5 below which present the elevated temperatures and retention times of both tanks in each ATAD train.

Current and estimated future biosolids production

12 The current and future biosolids generation from the Bell Island WWTP is summarised as follows:

12.1 Current biosolids production (in the year to 30 June 2020) is approximately 2,613 kg DS/d or 89 m^3/d at 3% DS as an annual daily average.

12.2 Due to population increases expected through the duration of the consent, it is expected that the biosolids production will increase. It is estimated that, based on current operation the biosolids production could increase to approximately 3,020 kg DS/d, or 100 m^3/d at 3%DS over the duration of the consent.

12.3 The actual future production could vary due to changes in trade waste discharges received at the plant and operational management to control the biosolids loads and associated nutrient loads. NRSBU's management of the trade waste load to the Bell Island WWTP is addressed in the evidence of Mr Nathan Clarke.

13 Biosolids loads are not directly related to the influent loads as the Bell Island WWTP has the operational flexibility e.g. by varying the split between the activated sludge plant and the ponds, to manage the biosolids loads. The variation in influent cBOD5 and TSS loads and resulting biosolids loads are shown in Table 4 below.

14 The nutrient content of biosolids is more important than the volume produced, particularly nitrogen load, as it is this that limits the quantity of biosolids that can be applied. The Bell Island WWTP can be managed to favour more or less nutrients in the biosolids in order to maintain prescribed nitrogen loads within consent limits.

Biosolids classification relative to Bell Island WWTP

15 I have summarised the Biosolids Guidelines upon which the current consent is based and the New Zealand Biosolids Guidelines as they apply to the biosolids produced at Bell Island WWTP:

15.1 The existing consent conditions prescribe pathogen reduction requirements and are based on the US EPA Guidelines, Part 503 guidelines. Key aspects are the temperature-time relationship required to demonstrate pathogen reduction and the options for meeting the vector attraction reduction (VAR) requirements for a "Class A sludge". Both of these aspects have been adopted in the NZ Biosolids Guidelines (2003).

15.2 The current New Zealand Biosolids Guidelines were published in 2003 by the Ministry for the Environment and the New Zealand Water and Wastes Association[3] (now Water New Zealand). In due course the current guidelines will be superseded by the proposed NZ Biosolids Guidelines (Draft 2017)[4], which have been out for consultation and are due to be finalised in 2022. My technical report used the 2003 guidelines as these were current at the time. Where relevant I have commented as to how the biosolids would be graded under the 2017 guidelines.

15.3 The NZ Biosolids Guidelines (2003) biosolids grading system is made up of two parts. The first part, which is denoted by a capital 'A' or 'B' represents the stabilisation grade. The second part, denoted by a lower case 'a' or 'b' represents the chemical contamination grade.

15.4 The existing ATAD process achieves the pathogen and VAR requirements of Grade A biosolids as per the NZ Biosolids Guidelines (2003) and the NZ Biosolids Guidelines (Draft 2017); and produces Class A biosolids as defined by the US EPA and required under the existing consent conditions.

15.5 The heavy metal concentrations in the biosolids, specifically cadmium, copper and zinc, exceed the concentration limits for a contaminant Grade a but are within those for a Grade b product as per the NZ Biosolids Guidelines (2003). The biosolids would meet the Grade A1 requirements for metals as outlined in the proposed NZ Biosolids Guidelines (Draft 2017).

15.6 It is not uncommon for the metals concentrations in biosolids in New Zealand to exceed the Grade a criteria. Wang *et al.* (2008)[5] presented data for wastewater treatment plants at Bell Island, Christchurch, Foxton Beach, Green Island, Mangere, Moa Point and Rotorua and in all cases the Grade a limits for cadmium, copper and zinc were exceeded.

15.7 The metals in the wastewater come from a wide range of sources including food products, detergents, bodycare products, cosmetics, corrosion and leaking from plumbing, paints, etc. Trade waste controls are typically used to limit discharges from commercial and industrial uses, however, there will be some residual discharge and there are no controls on domestic wastewater.

[3] NZWWA, (2003). Guidelines for the safe application of biosolids to land in New Zealand.
[4] Water NZ, (2017). Guidelines for Beneficial Use of Organic Materials on Productive Land, Draft for Public Comment.
[5] Wang, H., Brown, S.L., Magesan, G.N., Slade, A.H., Quintern, M, Clinton, P.W. and Payn, T.W., (2008). Technological options for the management of biosolids. *Environ Sci Pollut Res*, **15**, 308-317.

15.8 The existing biosolids produced at Bell Island WWTP are Grade Ab as per the NZ Biosolids Guidelines (2003).

Potential end uses for biosolids and required level of treatment required

16 The level of treatment required to produce biosolids will be influenced by the ultimate end use of the product. Through discussion with Mr Purchas, who has assessed the alternative end uses of the biosolids, four end uses were identified for consideration. The biosolids requirements adopted for each of these is identified in the Table 1 below.

Table 1: Biosolids requirements for alternative end uses of biosolids

End Use	Biosolids Requirements
Application to land as a slurry	Grade A stabilised and compliant with the Grade b contaminant limits in the NZ Biosolids Guidelines (2003)
	A liquid or slurry that can be pumped and distributed in a tanker
Application to land as a dewatered cake	Grade A stabilised and compliant with the Grade b contaminant limits in the NZ Biosolids Guidelines (2003)
	Dry solids content > 20% DS
Application to land as a dried product	Grade A stabilised and compliant with the Grade b contaminant limits in the NZ Biosolids Guidelines (2003)
	Stabilised and dry solids content > 90% DS
Disposal to landfill	Grade B stabilised – not strictly required but some degree of stabilisation will reduce the volume for disposal and reduce the nuisance odour potential during transportation
	Dry solids content > 20%

Screening of options long list

17 The screening process for the long list process options is summarised as follows:

17.1 A long list of 21 process alternatives[6] was identified and evaluated against the following criteria

- Technically feasible i.e., processes that are proven and commercially available in the marketplace.
- Technically viable i.e., technically feasible technologies that have been successfully applied in the treatment of municipal wastewater biosolids at a scale commensurate with the Bell Island WWTP operation.

[6] Ibid note 1 at [16]

- Consistent with NRSBU project objectives.

17.2 Process technologies which met the three criteria outlined above, were then considered on the basis of how they could contribute to achieving the biosolids requirements for the end uses identified.

17.3 Following evaluation of the long list of technology options, six options were identified as being able to achieve the biosolids requirements appropriate for each of the four end uses. These solution options are summarised in Table 2 and include the existing ATAD process and 5 alternative process solutions.

Table 2: Solution options evaluated

End Use	Option #	Proposed Processes
Application to land as a slurry	Option 1	ATAD
	Option 2	Thermal pre-treatment + anaerobic digestion
	Option 3	Thermal pre-treatment + anaerobic digestion + post-aerobic digestion
Application to land as a dewatered cake	Option 4	Thermal pre-treatment + anaerobic digestion + dewatering
Application to land as a dried product	Option 5	Anaerobic digestion + dewatering + drying
Disposal to landfill	Option 6	Anaerobic digestion + dewatering

Evaluation of short listed alternative solutions

18 A high level, comparative evaluation of the six shortlisted options was carried out using criteria identified and agreed with the NRSBU project team. The options were compared using a “traffic light” approach. The outcome of this is comparative exercise is summarised in Table 3 below. The colour coding adopted relates to the relative level of effect for each option as follows:

	Low effects	Most beneficial
	Medium effects	to
	High effect	Least beneficial

Table 3: Summary of evaluation of six short listed options

Option	Grade A Biosolids	100% Reuse of Biosolids	Technical Risk / Viability	Local Environmental	GHG Impacts	Operating Cost	Capital Cost
1	✓	✓					
2	✓	✓					
3	✓	✓					
4	✓	✓					
5	✓	✓					
6	✗	✗					

18.1 None of the alternative processes considered would produce a Grade Aa biosolid as they do not materially affect the metals concentrations.

18.2 There are alternative processes that could also produce a Grade Ab biosolid, however, for continued application to land as a slurry, they offer no significant net benefits over the existing ATAD solution and would incur a significant investment cost to implement.

18.3 For continued application of biosolids as a slurry on Moturoa / Rabbit Island, the ATAD process is the preferred option. The ATAD is a proven, relatively simple process that produces Grade Ab biosolids. Given the retention times currently used, there should be capacity to treat increased loads within the existing footprint. For producing a liquid product, the ATAD is very effective.

18.4 A move to an alternative biosolids reuse pathway could be the trigger for a change in process to open up opportunities for further resource recovery, e.g., energy recovery from biogas.

Updates since submission of the AEE

19 I have reviewed some aspects of my 2020 technical report as it is nearly two years since this was first prepared. For the aspects which were reviewed, I make the following comments:

19.1 In my technical report, an estimate was made as to the likely future biosolids production at the Bell Island WWTP. Based on operation at the time the biosolids were estimated to increase to approximately 3,020 kg DS/d, or 100 m^3/d at 3%DS over the duration of the consent.

19.2 Table 4 below is an updated version of Table 3 from my report, with additional data shown in the bottom two rows. It can be seen that the biosolids load has increased over the last two years, however this increase is less than 2%.

Table 4 – Summary of influent $cBOD_5$ and TSS loads and biosolids loads generated at Bell Island WWTP

Year	Influent cBOD5 (kg/d)	Influent TSS (kg/d)	Biosolids (kg/d)
July 2012 to June 2013	6,238	7,990	1,602
July 2013 to June 2014	6,304	8,491	1,925
July 2014 to June 2015	5,875	5,638	2,341
July 2015 to June 2016	7,349	6,681	2,065
July 2016 to June 2017	7,904	6,493	2,227
July 2017 to June 2018	7,198	6,495	2,445
July 2018 to June 2019	6,525	6,687	2,288
July 2019 to June 2020	6,090	7,499	2,613
July 2020 to June 2021	6,965	7,566	2,654
July 2021 to April 2022	7,294	8,666	2,657

19.3 One of the key factors in determining continued use of the existing ATAD process being preferred was the long term operation at temperatures and retention times appropriate for producing a Grade A biosolid. Site operational data collected subsequent to the submission of the AEE has been reviewed to confirm that this is still the case. The graphs included in my 2020 technical report as Figures 4 and 5 have been updated with more recent data and are presented as Figure 3 and Figure 4 below. The ATAD plant at Bell Island WWTP continues to be operated at the required temperatures to achieve Grade A biosolids.

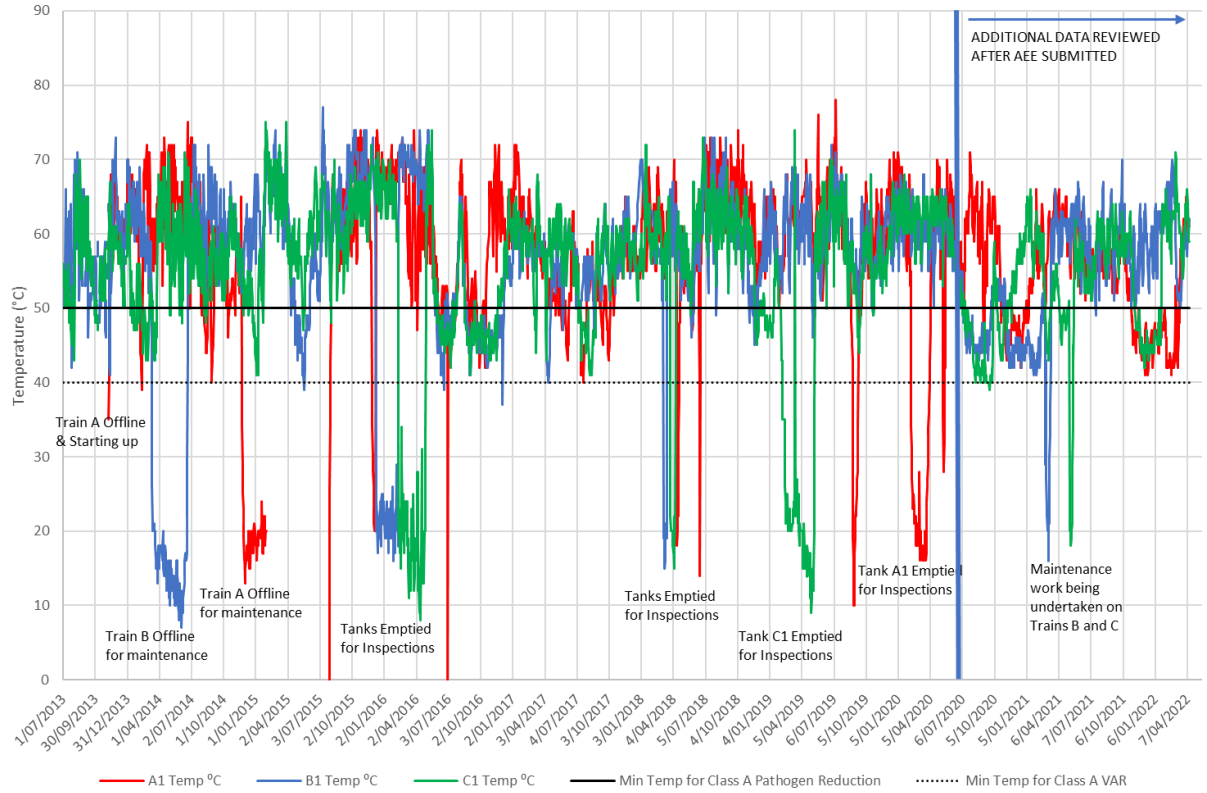

Figure 3: Operating temperatures for Tank 1 in each ATAD train (new data from July 2020 to April 2022)

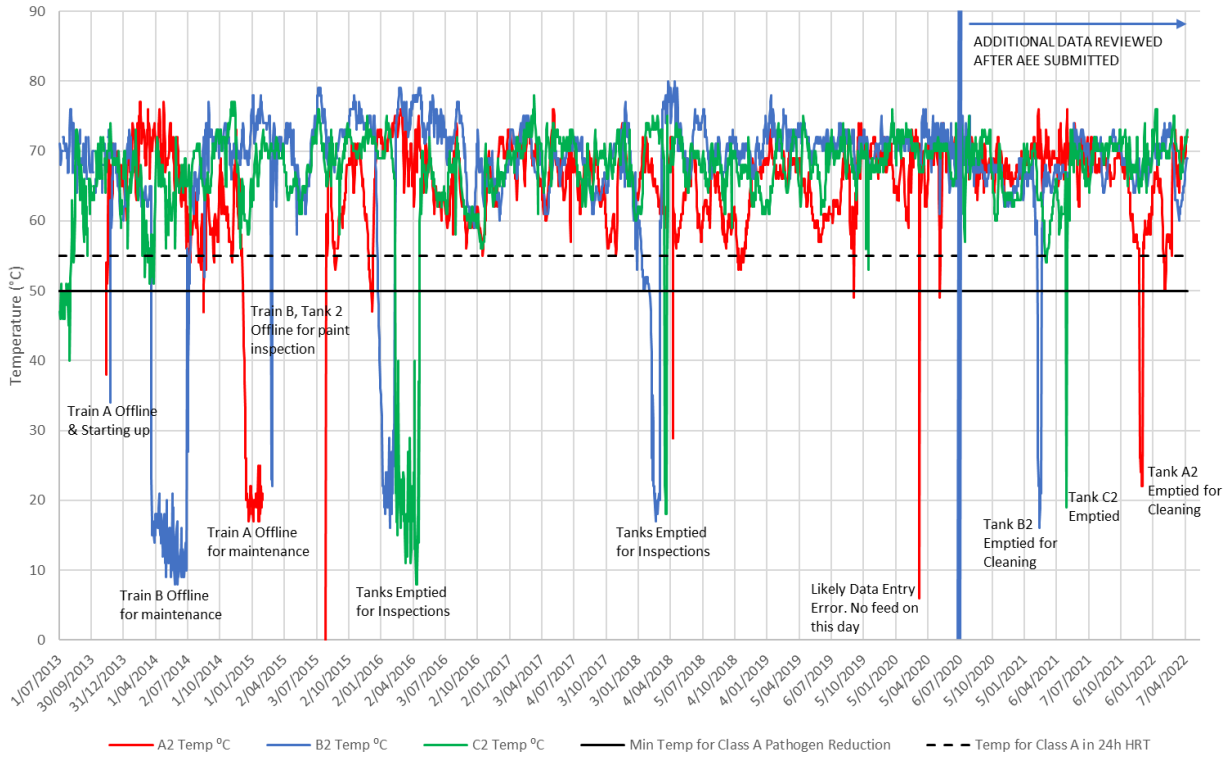

Figure 4: Operating temperatures for Tank 2 in each ATAD train (new data from July 2020 to April 2022)

19.4 The cost estimates[7] prepared for my 2020 technical report have not been updated. Over the past two years, the COVID 19 pandemic has had a significant impact on global supply chain which has led to increased delivery timeframes and costs of materials. These factors, in addition to typical escalation of costs over time will mean that all of the capital costs estimated previously would be higher now. This will further increase magnitude of the investment required should a decision be made to replace the ATAD process with an alternative, and hence the gap between Option 1 all other options considered.

Summary of findings

20 Following a review of the NZ Biosolids Guidelines, the current performance of the solids stream at Bell Island WWTP and the alternative process options available, my findings are summarised as follows:

20.1 Current biosolids production (July 2021 – April 2022) is approximately 2,657 kg DS/d or 89 m^3/d at 3% DS as an annual daily average. This is estimated to increase to approximately 3,020 kg DS/d, or 100 m^3/d at 3%DS over the duration of the consent (35 years).

20.2 The existing biosolids produced at Bell Island WWTP are Grade Ab as per the NZ Biosolids Guidelines.

20.3 A number of alternative processes were considered within the context of different end uses for the biosolids.

20.4 None of the alternative processes considered would produce a Grade Aa biosolid as they do not materially affect the metals concentrations.

20.5 There are alternative processes that could also produce a Grade Ab biosolid, however, for continued application to land as a slurry, they offer no significant net benefits over the existing ATAD solution and would incur a significant investment cost to implement.

20.6 For continued application of biosolids as a slurry on Moturoa / Rabbit Island, the existing ATAD process is the preferred option.

[7] Ibid note 1 at Appendix B

Comments on Submissions where relevant to my evidence

21 The Waimea Inlet Forum Working Group (WIF) consider that the volunteered conditions do not deal with:

any increasing volume or change in composition of the biosolids caused, by, for instance, urban growth and changing trade waste composition

22 I consider that condition 9(a) of the volunteered condition suite[8] already addresses the WIF submission above. The 6 yearly Monitoring Technology Review Report (MTRR) is to be prepared by a suitably qualified person and requires inclusion of:

Forecast of biosolids quality and quantity throughout the remainder of the consent term as a result of potential future changes to wastewater inputs and/or the wastewater treatment process at the Bell Island wastewater treatment plant

23 The only difference is the use of 'biosolids quality' in place of 'composition'. Furthermore, conditions 20, 21 and 22 act to limit biosolids application. In addition, the increase in biosolids production over the two years since the application was submitted are in line with the predictions set out in my 2020 technical report. As outlined above, the NRSBU has the ability to manage the biosolids production to some degree through the relative flow split to the ponds and the activated sludge process. If the six yearly MTRR identifies that the biosolids volumes or composition are changing outside of what is currently expected appropriate mitigation measures can be identified and implemented at that time.

24 The WIF submission also seeks that the consent conditions include trigger points to determine when application of biosolids should be altered and seeks compliance of the proposed activity against the NZ Biosolids Guidelines.

25 The volunteered consent conditions include robust monitoring requirements to confirm that the biosolids process is operated in accordance with the NZ Biosolids Guidelines, and in line with industry best practice. The proposed biosolids volume and quality conditions require compliance against the standards set out in the Biosolids Guidelines for E.coli and volatile soils reduction and heavy metal concentrations. In addition, the soil monitoring conditions proposed require "each composite sample shall not exceed the heavy metal maximum soil concentration limits recommended in the Biosolids Guidelines". The six yearly MTRR also requires "an assessment against the Biosolids Guidelines, including any subsequent update". I consider that the conditions proffered are based on compliance with the Biosolids Guidelines and adopt appropriate trigger levels as outlined in the Biosolids Guidelines.

[8] Moturoa / Rabbit Island Biosolids Reconsenting Assessment of Effects on the Environment (Tonkin +Taylor), August 2020, at Appendix Q

Comments on Officer's Report

26 I have reviewed the Council Officer's report[9] and respond as follows:

26.1 At paragraphs 7.3 and 7.4, the Council Officer states that the 2003 Biosolids Guidelines are the current and that he has used the 2017 Biosolids Guidelines to guide him through the application. This is consistent with my approach in preparing my technical report in which the 2003 Biosolids Guidelines were adopted as current and an indication of compliance against the draft 2017 Guidelines has been provided.

26.2 At paragraphs 7.27 – 7.28 the Council Officer notes that Condition 19 has been volunteered to monitor "key organic compounds" with a few contaminants used as indicators. The organic compounds identified are those currently in the draft guidelines (2017) in addition to PCBs which are in the current guidelines (2003). The other organic contaminants in the current guidelines (2003) have not been included as their use is banned and they should not be present. The contaminants proposed to be monitored would be reviewed under Condition 9(d) which should identify any changes to the organic contaminants of concern in the current Biosolids Guidelines. As noted in my 2020 technical report, I believe that the NRSBU approach to EOCs is in line with other WWTPs in NZ.

26.3 At paragraphs 7.85 and 7.86, the Council Officer discusses the Cultural Impact Assessment[10] with respect to future development and growth. Particularly, that iwi have concerns that Council's planned projections for increased residential and industrial development have not taken into account the potential increase in loads on current infrastructure facilities and the staging of maintenance and upgrade requirements that may be required to meet demand. My response to these concerns is detailed in the paragraphs above.

26.4 The Council Officer's report includes proposed revision to the condition suite volunteered by the NRSBU. Relevant to my area of expertise are two conditions 17A and 18A that introduce reporting and action requirement in the event that there are consecutive non-compliant samples for monitoring biosolids quality.

26.5 Condition 17A requires the consent holder to notify Council if the biosolids are non-compliant for pathogen reduction and inform them of the proposed remedial action to be undertaken. I believe this is reasonable as it requires the consent holder to undertake more intensive monitoring to confirm compliance and to take action if the biosolids are non-compliant. I believe the number of non-compliant samples that triggers reporting should be more than three (3) and that if there are less than or equal to three (3) non-

[9] Tasman District Council – Commissioners (Resource Consent) Hearing Agenda – 27 May 2022
[10] Ibid note 1

complying samples in the three month period weekly samples can resume. This would be consistent with the Biosolids Guidelines.

26.6 Condition 18A requires the consent holder to notify Council if the biosolids are non-compliant for metals and inform them of the proposed remedial action to be undertaken. I believe this is reasonable as it requires the consent holder to undertake more intensive monitoring to confirm compliance and to take action if the biosolids are non-compliant. Six consecutive weekly samples as the trigger for reporting to council gives sufficient timeframe to rule out any outliers and to demonstrate that there is a potential ongoing issue.

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Nicholas Berry

11 May 2022