BEFORE THE TASMAN DISTRICT COUNCIL

Under	the Resource Management Act 1991
In the matter of	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 DR PAUL ALBERT GILLESPIE FOR THE NELSON REGIONAL SEWERAGE BUSINESS UNIT

11 MAY 2022

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STATEMENT OF EVIDENCE OF PAUL ALBERT GILLESPIE

Introduction

1 My full name is Paul Albert Gillespie

2 I am an aquatic microbial ecologist with 50 years' experience in estuarine, marine and freshwater research and consulting.

3 I have a B.Sc. in Bacteriology South Dakota State University, USA 1965, a M.Sc. in Bacteriology from South Dakota State University, USA 1967, and a Ph.D in Microbiology/Oceanography from Oregon State University, USA 1970.

4 My employment history is as follows:

May 2022	Emeritus Fellow, Cawthron Institute
1983 - 2022	Senior research scientist/consultant, Cawthron Institute
1977 - 1983	Research scientist/consultant, Cawthron Institute
1974 – 1977	Post-Doctoral Fellow, Woods Hole Oceanographic Institute, USA
1971 - 1973.	Post-Doctoral Fellow, Cawthron Institute
1970 - 1971	Post-Doctoral Fellow, Oregon State University, USA.

5 I have been engaged by the NRSBU to provide evidence on the environmental implications of land applications of biosolids to Moturoa / Rabbit Island. I was involved with the original application in 1996, subsequent monitoring and reports, and the report supporting this renewal application.

6 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.

Scope of Evidence

7 In my evidence I will outline the following:

7.1 Cawthron's involvement in the NRSBU biosolids project;

7.2 An executive summary of my evidence;

7.3 An overview of the state of the receiving environment, including:

7.3.1 Water quality in the Waimea inlet; and

7.3.2 The intertidal areas around Moturoa/Rabbit Island.

7.4 Background to the Assessment of Effects relating to the coastal environment, particularly:

7.4.1 What are the potential adverse effects?

7.4.2 Our approach to assessment and monitoring of effects.

7.4.3 The key outputs from historical monitoring.

7.5 Nutrient Loads and Concentrations in Waimea Inlet and Inner Tasman Bay;

7.6 Assessment of Ecological Effects within the Waimea inlet:

7.6.1 Values of affected species and habitats

7.6.2 Effects of organic material and nutrients derived from biosolids

7.6.3 Effects of toxic contaminants derived from biosolids

7.6.4 Effects on shellfish quality

7.6.5 Assessment Summary

7.7 Comments on Officer's Report; and:

7.8 Comments on submissions where relevant to my evidence.

Cawthron's involvement in the NRSBU biosolids project

8 A biosolids land disposal programme was initiated by the Nelson Regional Sewerage Authority (NRSA), now the Nelson Regional Sewerage Business Unit (NRSBU), in February 1996. As part of the consent conditions for disposal, Cawthron was engaged by the NRSA to design an estuarine monitoring programme to identify any significant environmental effects on the adjacent intertidal habitats of Moturoa / Rabbit Island. The programme included the following surveys, all done by Cawthron:

- a pre-application baseline survey of 12 intertidal monitoring transects carried out in February 1996
- follow-up visual inspections of all transects carried out at approximately six-monthly intervals after commencement of biosolids applications (February 1996–August 2001)
- a detailed monitoring survey carried out in April 2003
- a visual inspection carried out in May 2006

- a second detailed monitoring survey carried out in February 2008 including, for the first time, sediment fauna
- a third detailed monitoring survey carried out in February 2014
- a fourth detailed monitoring survey carried out in November 2019.

9 Cawthron was also engaged by NRSBU to prepare an assessment of ecological effects of biosolids disposal on intertidal habitats of Moturoa / Rabbit Island in 2020[1].

Executive summary of assessment of effects

10 This evidence is supported by the previous monitoring (both baseline and since the biosolids activity commenced), as outlined above. This evidence summarises the report prepared by Cawthron that accompanied the application for resource consent, titled *Assessment of the Effects on the Coastal Environment of Biosolids Application to Land on Moturoa/Rabbit Island dated August 2020*. The assessment of effects on intertidal habitats is based on the large body of monitoring data collected during the five surveys between 1996 and 2019.

11 There have been no changes to the conclusions reached in that report, and this evidence reiterates the key points. In summary:

11.1 Effects on the coastal environment of the application of biosolids to pine forests of Moturoa / Rabbit Island are mediated by groundwater transfer and dilution of nutrients (including nitrogen and phosphorus species) and toxic contaminants (such as trace metals) that may leach into the intertidal zone.

11.2 When nutrients reach the intertidal area, they may cause excessive growth of micro- and macroalgae, and toxic contaminants may have adverse effects on organisms living in the sediment. However, monitoring shows that the risk of adverse effects from cumulative nutrient and contaminant enrichment of intertidal sediments and the wider Waimea Inlet due to continued application of biosolids is likely to be less than minor.

11.3 Although concentrations of arsenic and nickel in cockles from monitoring survey locations are higher than guidelines for human consumption, this is true of locations adjacent to and away from biosolids application areas. This indicates that the source of contamination is natural (i.e., soils in the catchment) rather than derived from biosolids.

[1] Morrisey D, Campos C, Gillespie P 2020. Assessment of the effects on the coastal environment of biosolids application to land on Moturoa / Rabbit Island. Prepared for Nelson Regional Sewerage Business Unit. Cawthron Report No. 3500. 58 p. plus appendices.

11.4 Based on the previous monitoring, other evidence supporting this application, and the proposed consent conditions put forward by NRSBU, it is my view that the effect on the coastal environment from the activity will be less than minor.

Description of the receiving environment

Water quality in the Waimea inlet

12 Approximately 95% of the area of Waimea Inlet is intertidal. Due to its broad, shallow configuration, and a spring tidal range of 3.7 m (Hume et al. 2016[2]), the tidal compartment is largely drained with each ebbing tide, resulting in a relatively rapid flushing rate (Robertson et al. 2002[3]). The estimated residence time (total volume / spring tidal component plus average runoff) of the waters in the Inlet is 0.6 days (Heath 1976[4]). This regular flushing with relatively clean (i.e., low concentrations of organic, inorganic and microbiological contaminants) water from Tasman Bay plays a major role in maintaining water quality in the Inlet.

13 The main freshwater inflow to the Inlet is from the Waimea River and its tributaries (mean annual flow is 27.5 m^3/s). The freshwater discharge from the Waimea River separates into two channels just south of Moturoa / Rabbit Island, with most of the flow travelling along the eastern side of the Island towards the eastern entrance to the Inlet. Several smaller streams also contribute to the total freshwater inflow.

14 The Waimea Inlet catchment area is 933 km^2 (Hume et al. 2016[5]), with much of the central lower catchment being relatively flat or undulating, particularly the Waimea Plain and adjacent river valleys. However, the catchment extends south to the Gordon Range and east to encompass the steep, eastern slopes of the Richmond and Bryant ranges and Dun Mountain. The Dun Mountain 'mineral belt' region contains ultramafic rock formations particularly high in metals such as chromium, copper and nickel and are a source of these metals to Waimea Inlet and Tasman Bay.

15 Monitoring of water quality in eastern Waimea Inlet as part of consent monitoring for the Bell Island Wastewater Treatment Plant (WWTP) discharge (e.g., Morrisey et al. 2021[6]) indicates that concentrations of faecal indicator bacteria (FIB) are generally low (for example, less than

[2] Hume TM, Snelder T, Weatherhead M, Liefting R 2007. A controlling factor approach to estuary classification. Ocean & Coastal Management 50: 905-929.
[3] Robertson BM, Gillespie PA, Asher RA, Frisk S, Keeley NB, Hopkins GA, Thompson SJ, Tuckey BJ 2002. Estuarine environmental assessment and monitoring: a national protocol. Part A. Development, Part B. 159 p. Part C. 40 p. plus field sheets.
[4] Heath RA 1976. Broad classification of New Zealand inlets with emphasis on residence times. New Zealand Journal of Maine and Freshwater Research 10(3): 429-44.
[5] Hume et al. (2016) op. cit.
[6] Morrisey D, Campos C, Johnston O, Edhouse S 2021. Impact of the Nelson (Bell Island) regional sewerage discharge on the coastal environment: receiving water survey – August 2021. Prepared for Nelson Regional Sewerage Business Unit. Cawthron Report No. 3698. 29 p. plus appendices.

Nelson City and Tasman District Councils' bathing water standard for enterococci[7]). In contrast to the main body of the Inlet, relatively high concentrations of FIB occur around stream and river mouths, particularly the Waimea River, largely from agricultural sources within the catchment.

16 The water quality monitoring for the WWTP also shows that concentrations of nutrients (nitrogen and phosphorus) in the Inlet are relatively low indicating an 'unenriched' state below levels at which problems of nuisance algae tend to appear (Stevens & Robertson 2010[8]). Concentrations of ammonia (which can act as both a nutrient and, at high concentrations, a toxicant) in waters of the eastern Inlet are well below guidelines for the protection of aquatic life[9].

17 Monitoring has not recorded any phytoplankton blooms (in the form of excessively elevated concentrations of chlorophyll-*a*) within the Inlet or inner Tasman Bay.

Intertidal areas of Waimea Inlet, including Moturoa / Rabbit Island

18 State-of-the-environment monitoring of sites in Waimea Inlet[10] indicate that the estuary is in a generally healthy ecological state compared with many other New Zealand estuaries, and retains many areas of significant ecological value, but that it has been impacted by extensive habitat loss / modification and sedimentation.

19 In 2020, 20 ha of the Inlet was assessed as exhibiting 'high enrichment conditions', characterised as being degraded by nutrient enrichment, high macroalgal growth and accumulation of fine mud. The areas found to be most affected are locations of high natural deposition, where concentrated catchment inputs of sediments and nutrients provided suitable conditions for the growth of opportunistic algae. None of the enriched areas are around the shoreline of Moturoa / Rabbit Island, which we would expect to see if the enrichment was linked to the biosolids application. Although the condition of these individual areas was classified as 'poor', they represent less than 1% of the total area of the Inlet and the enrichment status of the Inlet was assessed as 'good'.

20 Saltmarsh herbfields and rushlands occur along much of the upper intertidal area on the Inlet side of Rabbit Island. The area of saltmarsh in the Inlet in 2020 shows a 21% (74 ha) reduction relative to the area in 1946 (estimates are based on aerial photographs, of which 1946 is the

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[7] The highest recorded concentration of enterococci in the 2021 survey was 42 MPN/100 ml (excluding samples taken at the outfall or at the mouth of the Waimea River). Nelson City Council's bathing water guideline for individual samples from Tahunanui Back Beach is 140 MPN/100 ml, as is the MfE/MoH 'surveillance' (green mode) guideline, which has been adopted by Tasman District Council.

[8] Stevens LM, Robertson BM 2010. Waimea Inlet 2010: Vulnerability assessment and monitoring recommendations. Report prepared by Wriggle Coastal Management for Tasman District Council. 58 p.

[9] ANZG 2018. Australian and New Zealand guidelines for fresh and marine water quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.

[10] Waimea Inlet Estuary Monitoring Programme. Prepared for Tasman District and Nelson City Councils. Salt Ecology Report 052. November 2021. Available at: https://storymaps.arcgis.com/stories/588d9cc93f8f485b8878b832195dce70 (accessed 12 April 2022.

earliest available). The main causes of this reduction are erosion, infilling of coastal areas, and changes to drainage patterns through installation of culverts and causeways.

Assessment of Effects

What are the potential adverse effects?

21 Effects of the application of biosolids on pine forests on Moturoa / Rabbit Island on the coastal environment will potentially be mediated by leaching of particulate and soluble components of the biosolids into the ground water. These components may then enter the coastal zone by surface runoff and groundwater flow and seepage (as shown in *Image 1* below). The principal components of concern are nutrients (including nitrogen and phosphorus species) that may cause excessive growth of micro- and macroalgae, and toxic contaminants such as trace metals, that may adversely affect organisms living in the sediment. Pathogens are effectively eliminated from the biosolids via pre-treatment to the extent that they are considered to pose no risk to human health or to adversely affect other organisms.

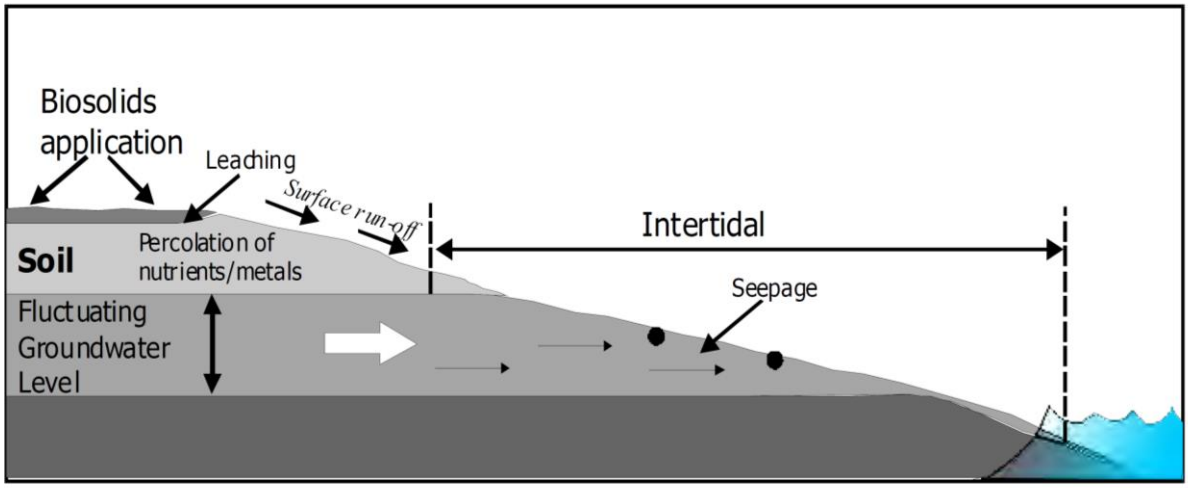

Image 1: Environmental influences on the fate and transport of contaminants following land application of biosolids.

22 Once transported to the coastal environment via groundwater seepage, most contaminants are likely to remain associated with the sediment rather than the water column. Most trace metals and many organic contaminants tend to bind preferentially to sediment particles rather than enter solution, particularly in fine-grained, organic-rich sediments. Toxic contaminants, such as trace metals and ammonia, may be acutely toxic at the point where they enter the coastal environment if their concentrations are high enough, or they may accumulate over time until they reach acutely or chronically toxic concentrations.

23 Nutrients may accumulate in sediments but will also be taken up and used by bacteria, microalgae and macroalgae growing in or on the sediment, enhancing their growth. This enhanced growth can give rise to visible bacterial mats and blooms of micro- and macroalgae. Such blooms can smother intertidal and shallow-subtidal habitats, depriving the organisms

beneath (such as infauna and seagrass) of oxygen. Reduced availability of oxygen is exacerbated when blooms die and decay and frequently give rise to anoxic conditions[11].

24 If contaminant loads exceed the capacity of sediments to bind and assimilate them, they may enter the water column either in solution or in suspension attached to sediment particles. Because of the high rate of tidal exchange around Moturoa / Rabbit Island, contaminants entering the water column are unlikely to accumulate. Instead, they will be diluted and dispersed throughout Waimea Inlet and out into Tasman Bay, adding to the much larger nutrient and contaminant loads from rivers, land runoff and anthropogenic sources.

Approach to assessment and monitoring of effects.

25 Any adverse ecological effects of metals, nutrients or other contaminants derived from biosolids will be most obvious at the point where groundwater enters the receiving environment. Beyond this, dilution and dispersion will make their contribution very difficult to detect. Our assessment of effects therefore focusses on the seabed in the intertidal area of Moturoa / Rabbit Island.

26 We assess and monitor the effects of application of biosolids to land through a series of visual assessments and detailed surveys of intertidal habitats. The nature of intertidal sediments and the plants and animals living in them are monitored at 12 locations along the foreshores of both islands. A baseline assessment was undertaken in 1996 and reference locations (i.e., control sites) were identified, prior to the start of the biosolids application programme. Repeat surveys were carried out in 2003, 2008, 2014 and 2019. The most recent survey, November 2019, is described by Morrisey et al. 2021[12].

27 Survey locations are on the Waimea Inlet sides of Moturoa / Rabbit and Rough islands, which is downstream of the direction of groundwater flow (see *Image 2* below). Locations include some near biosolids application areas and some reference locations adjacent to areas where no application takes place. The same locations have been used since 1996, and the amount of biosolids applied to the forestry blocks adjacent to each has changed over time with the management cycle of the blocks. The locations of the monitoring sites are shown in the map below, together with the location and amount of biosolids applied in the period November 2018 to October 2019, preceding the most recent intertidal survey.

[11] The total absence of oxygen in sediments and overlying water, usually accompanied by the presence of toxic hydrogen sulphide and black iron sulphides.
[12] Morrisey et al. (2021) op. cit.

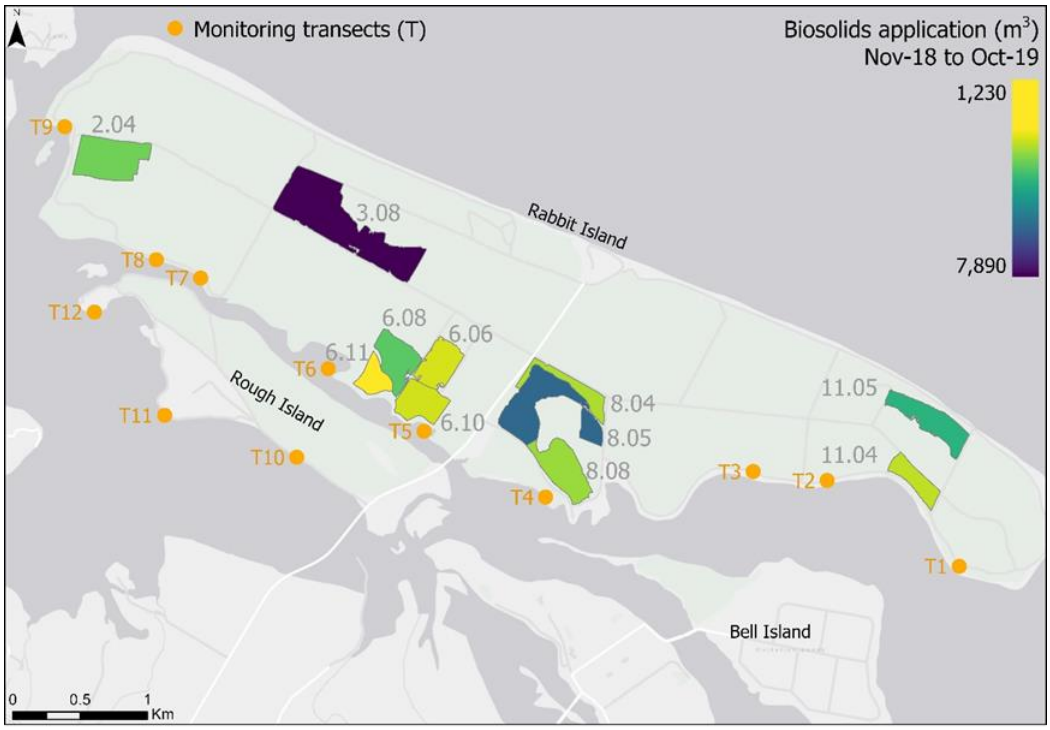

Image 2: Locations of sampling transects on Moturoa / Rabbit and Rough islands, and the volume of biosolids applied during the period November 2018 to October 2019. Transects 1, 10, 11 and 12 are 'reference' transects.

28 At each location, we collect samples at two places in the intertidal area where groundwater seepage is most apparent. The type of sediment (mud, sand, etc.) and abundances of animals (and their burrows) and plants on the sediment surface are recorded. Samples are collected for laboratory analyses of the species and abundance of animals living within the sediment. We also measure the sediment grain-size distribution and concentrations of organic matter, several species of nitrogen and trace metals. Samples of shellfish (cockles) are collected to measure concentrations of trace metals and faecal indicator bacteria. The latter are discussed in the evidence of Dr Neale Hudson and are not considered in my statement of evidence.

Key outputs from historical monitoring

29 Intertidal monitoring to date has shown no adverse symptoms of organic enrichment (e.g., excessive algal growth, sediment anoxia and presence of hydrogen sulphide) at most sites. I say "most" sites because although algae are often more abundant at some sites than others, and the sediment is less well oxygenated at some sites (evidenced by grey or black deeper layers of the sediment profile), these conditions occur both at survey locations near application areas and at reference locations and do not suggest an effect of biosolids application.

30 Spatial and temporal differences in organic matter and total nitrogen content in sediments among sites reflect differences in sediment texture, and there were no patterns that would suggest an effect of biosolids application. Rather, the increases in mud and organic matter at

some transects are likely to reflect the generally increasing muddiness of Waimea Inlet over time, identified from state-of-the-environment monitoring.

Nutrient Loads and Concentrations in Waimea Inlet and Inner Tasman Bay

31 To complement our assessment of effects, we updated a previous nitrogen budget for Waimea Inlet to quantify the relative contribution of nitrogen from biosolids application in relation to other sources affecting the Inlet. Our review incorporated estimates of nitrogen concentrations and loads developed by the groundwater component of the application (reported separately). We also reviewed water-quality data for Waimea Inlet collected in other monitoring surveys by Cawthron on behalf of NRSBU.

32 The estimated potential concentration of 3 g/m^3 of nitrate-N in groundwater from Moturoa / Rabbit Island at the point of discharge into the coastal environment suggests a biosolids contribution of approximately 22 t/y to the Waimea Inlet. This represents 4.8% of the reported mean annual cumulative nitrogen load to Waimea Inlet from its catchment (461 t/y). The estimated contribution from biosolids to the nitrogen load to Tasman Bay from its catchment (1803 t/y) is 1.2%.

33 The loading and percentage contributions in paragraph 32 are different to those presented in the assessment of ecological effects[13]. This is because, in his evidence, Mr Bennett has revised his original estimate loading (14 t/y[14]) to incorporate biosolids application rates averaged over the last ten years rather than the life of the present consent, which I understand is a more conservative approach. Our assessment of how the additional nitrogen input from biosolids application might affect enrichment in Waimea Inlet and Tasman Bay reflects the fact that the total input to Tasman Bay from its catchment constitutes only about 40% of the amount of nitrogen lost from water and sediments as a result of denitrification (the microbial conversion of nitrate to nitrogen gas). In view of this denitrification capacity, the revised nitrogen loading does not alter our conclusion that nitrogen from biosolids would not have a measurable effect on enrichment.

34 Waimea Inlet plays a significant role in the integration of terrestrial and coastal marine ecosystems (Robertson et al. 2002[15]). High value is placed on the Inlet's terrestrial-wetland-coastal aquatic continuum as habitat for wildlife (e.g., waterfowl), fish and invertebrates, and its complex, heterogeneous physical and biological structure. This is the context within which we assess ecological effects of biosolids application.

[13] Morrisey et al. (2020). op. cit.
[14] Tonkin & Taylor Ltd 2020. Moturoa / Rabbit Island biosolids application facility groundwater assessment. Prepared for Nelson Regional Sewerage Business Unit. Tonkin & Taylor Job No. 1012787.0203. 16 p. plus appendices.
[15] Robertson et al. (2002) op. cit.

Assessment of Ecological Effects within the Waimea inlet

Values of affected species and habitats

35 Waimea Inlet is listed in Schedule 25D of the Tasman Resource Management Plan (TRMP) as an area (Area 22) with nationally significant ecosystem values. These values include the Inlet's status as the largest barrier-enclosed estuary in the South Island. The Inlet is one of only two sites where the endangered peppercress plant (*Lepidium banksii*) has been recorded and the endangered grey saltbush (*Atriplex cinerea*) is also present[16]. The Inlet is 'considered of outstanding importance to waders', and is used by kōtuku / white heron[17], royal spoonbill, Australasian bittern and banded rail.

36 The Inlet's variety of coastal habitats provide biodiversity value in terms of the numbers and range of types of organisms. The Inlet also provides ecosystem services. These services include retaining and processing sediments and other contaminants from the catchment, nutrient cycling, and primary and secondary production, some of which is exported to Tasman Bay. It also serves as a feeding or nursery area for several species of fish and birds.

37 It is unlikely that contaminants or nutrients derived from biosolids will directly affect any of these values. For example, the risk of toxicity through direct exposure is very low. However, some values could potentially be affected by a reduction in environmental quality, such as nutrient enrichment or an accumulation of toxic contaminants that encourages smothering algal mats or reduces abundances of intertidal invertebrates on which fish and birds feed.

Effects of organic material and nutrients derived from biosolids

38 The discharge of some organic matter and nitrogenous compounds (through groundwater and surface runoff) to Waimea Inlet from biosolids application is moderately likely. However, the rate and load are likely to be small, both in absolute terms and relative to other inputs to the Inlet, and the magnitude of effect is therefore expected to be low / minor.

39 Consistent with these expectations, there is no evidence of accumulation of organic matter and nitrogen adjacent to application areas, relative to the general increase in muddiness and associated organic matter over time throughout Waimea Inlet. The spatial scale of potential effects is medium (hundreds of metres) in the case of effects on the intertidal area adjacent to application areas, but large (kilometres) in terms of effects on Waimea Inlet.

40 Any enrichment of intertidal areas that might occur will not persist beyond the duration of the application programme. When the application of biosolids to a particular area of Moturoa / Rabbit

[16] Both species are classified at Threatened: Nationally Critical under the New Zealand Threat Classification System (NZTCS). See: https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs22entire.pdf.
[17] Kōtuku and bittern are classified as Threatened: Nationally Critical under the NZTCS, spoonbills as At Risk: Naturally Uncommon, and banded rail as At Risk: Declining. See: https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs36entire.pdf.

Island ceases, any organic material derived from biosolids, or resulting from nutrients derived from biosolids, will be degraded by microbial activity in the sediments and water column. Therefore we do not expect to see irreversible effects from enrichment, should it occur.

41 Consequently, the risk of adverse effects from cumulative nutrient enrichment of intertidal sediments and the wider Waimea Inlet due to future application of biosolids (in amounts no higher than those applied to date) is likely to be less than minor.

Effects of toxic contaminants derived from biosolids

42 Monitoring data suggest that the application of biosolids to land on Moturoa / Rabbit Island has not resulted in the accumulation of arsenic or any of the monitored trace metals in intertidal sediments as a result of the seepage of contaminated groundwater. Consistent with this, infaunal monitoring has found no evidence of any detrimental effect from the biosolids programme on infaunal communities at the study transects. Consequently, the risk of adverse effects from toxic contaminants on the biota of intertidal sediments and the wider Waimea Inlet due to future application of biosolids (in amounts no higher than those applied to date) is likely to be less than minor.

Effects on shellfish quality

43 Concentrations of arsenic in shellfish (cockles) exceeded the Food Standards Australia New Zealand guideline for human consumption[18] at all survey sites. Concentrations of nickel in shellfish exceeded the Median International Standards (MIS)[19] at eight sites. However, the data does not suggest that these elevated concentrations were related to biosolids applications because similarly elevated levels occurred at both application and reference sites.

44 The cockle samples consisted of composites of whole shellfish tissues, including intestinal tracts. Consequently, ingested inorganic particulate materials may have been the main source of elevated arsenic and nickel concentrations. Arsenic and nickel concentrations in shellfish throughout Waimea Inlet are affected to varying degrees by the mineralogy of the catchment.

45 Concentrations of cadmium, chromium, copper, lead, mercury and zinc were below the corresponding MIS guidelines for safe human consumption.

Assessment Summary

46 Although it is unlikely that contaminants or nutrients derived from biosolids will directly affect any of the natural values of Waimea Inlet, they could potentially cause a reduction in environmental quality. However, monitoring shows that the risk of adverse effects from cumulative nutrient and contaminant enrichment of intertidal sediments due to continued

[18] https://www.foodstandards.gov.au/code/Documents/Sched%2019%20Contaminant%20MLs%20v157.pdf.
[19] Russman D 2000. State Mussel Watch Program: 1995–97 data report. State Resource Control Board California Environmental Protection Agency. Appendix V: Median International Standards: international standards for trace metals in fish and molluscs.

application of biosolids is likely to be less than minor. Concentrations of arsenic and nickel in cockles from monitoring survey locations are higher than guidelines for human consumption but this is true of locations adjacent to and away from biosolids application areas. This indicates that the source of contamination is natural (i.e., soils in the catchment) rather than derived from biosolids.

Comments on Officer's Report:

47 I understand that the Council Officer has agreed with the report prepared as part of the Assessment of Environmental Effects. There are no issues arising from this report that I feel need further clarification.

Comments on submissions where relevant to my evidence.

48 The submission by Te Ātiawa Manawhenua Ki Te Tau Ihu Trust considers that the discharge of effluent to the coastal environment is abhorrent and allows for continued degradation of the mauri of the coastal environment; the health of which has a negative impact on the mana of the iwi.

49 I recognise and share this concern over possible progressive degradation of natural values in Waimea Inlet. We have identified these values in terms of water quality, ecological health of intertidal habitats and the organisms living in them. By identifying and monitoring intertidal values that may potentially be affected by biosolids application, we have demonstrated that effects to date have been less than minor and are likely to remain so in future.

50 We understand that the proposed conditions:

50.1 Include ongoing coastal monitoring as has been occurring under the operative consents;

50.2 Include a technology review condition to ensure that monitoring is keeping pace with advancements in the field; and

50.3 Allow for reviews of consent conditions where necessary.

51 We also note that in terms of the quality of water and intertidal habitats in the Inlet, effects of activities in the catchment are likely to outweigh those of application of biosolids. This applies to the concentrations of nutrients and faecal contaminants in the water and the degree of organic enrichment of intertidal sediments, and any consequent effects on intertidal organisms.

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Paul Gillespie
11 May 2022