

In the matter of the Resource Management Act 1991

And

In the matter of an application for Resource Consents by Oceania Dairy Limited to construct and operate a pipeline to discharge treated wastewater into the ocean.

**STATEMENT OF EVIDENCE OF ANNABELLE JULIA COATES FOR
OCEANIA DAIRY LIMITED**

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INTRODUCTION

- 1 My full name is Annabelle Julia Coates. I am employed by Babbage Consultants Limited (Babbage) as an ecologist. I have been employed by Babbage since July 2018.
- 2 I hold a Bachelor of Science in Biology, endorsed in Environmental Science, and a Master of Science in Environmental Science from the University of Canterbury. I am a member of the Environment Institute of Australia and New Zealand, a professional body for environmental practitioners.
- 3 My role at Babbage includes ecological surveys and monitoring, assessments of ecological value and assessments of effects of proposed works. I have written many assessments of effects for projects in freshwater, estuarine, marine and terrestrial environments. I have completed ecological surveys and undertaken monitoring required by resource consents throughout New Zealand.

CODE OF CONDUCT

- 4 While this is a Council 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 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

- 5 I have been asked by Oceania Dairy Limited (ODL) to prepare ecological evidence in relation to its application for resource consent.
- 6 ODL has applied for resource consents to build a pipeline from their dairy processing plant at Cooneys Road, Glenavy, to the coast; to build an outfall off the end of Archibald Road; and discharge up to 10,000m³ of treated dairy processing plant wastewater to the coastal marine area (CMA).
- 7 My evidence is divided into two parts. Part 1 consists of a summary of my report, and the other ecological reports prepared by my colleagues. It includes:
 - 7.1 An overview of the ecological values of the site;

- 7.2 A summary of potential effects of the construction of the proposed pipeline and outfall, and of the discharge of treated dairy processing plant wastewater to the marine environment;
- 8 Part 2 outlines issues in regards to ecology raised by the Cultural Impact Assessment, submitters, and in the s42A report, and my response to those matters. Part 2 also includes comment on the proposed draft resource consent conditions put forward by the applicant (and responded to by the s42A report) in relation to ecology.
- 9 My evidence includes assessments of effects prepared by my colleagues addressing specific components of ecology including:
- 9.1 Avifauna, on behalf of Graham Don and Treffery Barnett from Babbage/Bioresearches;
- 9.2 Herpetofauna, on behalf of Dylan van Winkel from Babbage/Bioresearches; and
- 9.3 Marine mammals, on behalf of SLR Consulting NZ Limited.
- 10 Although I did not prepare the assessment of effects in relation to avifauna, herpetofauna and marine mammals, I am qualified to speak to these subjects at hearing because of my wider experience in the field of ecology and knowledge of ecological principles and practices, and my knowledge of the site and issues. My comments on these matters are informed by the reports prepared by my colleagues, my site visit to the proposed outfall location, and my own expertise.

EXECUTIVE SUMMARY

- 11 Construction of a pipeline from ODL's dairy processing plant to the coast and an outfall in the CMA is within terrestrial, intertidal and marine habitat. Surveys of ecological values in the area affected by the proposal were completed and included:
- 11.1 Marine benthic biota sampling and analysis, sediment analysis, intertidal analysis, review of existing marine fish data sourced from the Ministry for Primary Industries (MPI), and review of existing freshwater fish data from NIWA's Freshwater Fish Database, all of which I completed.

- 11.2 Surveys of bird presence in in the coastal area around the proposed outfall, completed by Graham Don and Treffery Barnett from Babbage/Bioresearches.
 - 11.3 Surveys of lizard presence and potential lizard habitat along the pipeline alignment, completed by Dylan van Winkel from Babbage/Bioresearches.
 - 11.4 Review of existing information about marine mammal presence along the coastline around the proposed outfall sourced from the Department of Conservation's (DOC) Marine Mammal Sightings, and Marine Mammal Strandings Databases, completed by SLR Consulting.
- 12 Ecological values were given to each ecological component using criteria adapted from guidelines published by the Environment Institute of Australia and New Zealand (EIANZ)¹. These guidelines were also used to describe the magnitude of each potential effect.
- 13 Key ecological features and values of the area include:
- 13.1 The marine habitat is of high value and is relatively free from human influence. The high value is mostly derived from the presence of threatened species. The habitat is subject to significant natural variation and disturbance due to the exposed nature of the coast and inputs from the Waitaki River (located 7.5 kilometres south of the proposed outfall).
 - 13.2 The sea bed consists of limited areas of mobile sand and fine clay/silt amongst riverine gravels and cobbles. Analysis of sediment showed it contained low levels of contaminants (copper, phosphorus, zinc, nitrogen, ammonia, organic carbon) indicating the area was typical of a moderately disturbed, high energy coastal area.
 - 13.3 Samples of seabed macroinvertebrate communities showed they contained tolerant, opportunistic taxa in low densities.

¹ EIANZ, 2018, 'Ecological Impact Assessment (EcIA) – EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems,' 2nd edition, Environment Institute of Australia and New Zealand, Melbourne.

- 13.4 Spot water quality samples showed slightly elevated levels of chlorophyll a and nitrogen. Turbidity, suspended solids, salinity and temperature are dependent weather and sea conditions.
- 13.5 The Canterbury Bight supports a variety of fish species. Barracouta (*Thyrsites atun*), spiny dogfish (*Squalus acanthias*), smooth leatherjacket (*Meuschenia scaber*), red cod (*Pseudophycis bachus*), gurnard (*Chelidonichthys kumu*), tarakihi (*Nemadactylus macropterus*), rough skate (*Dipturus nasutus*), rig (*Mustelus lenticulatus*), and flat fish (including sole and flounder), are expected to be present in the vicinity of the proposed outfall. The area surrounding the proposed outfall does not present a significant commercial fishing resource.
- 13.6 No freshwater habitats will be affected by the proposal. The closest natural waterway is Whitney's Creek, 4.5km south of the plant.
- 13.7 One lizard species, McCann's Skink (*Oligosoma maccanni*) was observed along the pipeline alignment – on the coastal cliffs at the end of Archibald Road. McCann's skink are listed as Not Threatened². The alignment contains areas of potential lizard habitat including areas of rank grass, piles of concrete and piles of logs.
- 13.8 Surveys of birds utilising the area showed most species just fly through the site. Buller's shearwater (*Puffinus bulleri*), listed as Threatened – Naturally Uncommon³, white fronted tern (*Sterna striata striata*), listed as At Risk – Declining³, spotted shag (*Stictocarbo punctatus punctatus*), listed as Not Threatened³, and Australasian gannet (*Morus serrator*), listed as Not Threatened³, were observed feeding on or over the water.
- 13.9 Two species of marine mammal are likely to be regularly present around the outfall including Hector's dolphin (*Cephalorhynchus hectori*) and New Zealand

² Hitchmough, R., Barr, B., Lettink, M., Monks, J., Reardon, J., Tocher, M., van Winkel, D., & Rolfe, J., 2016, 'Conservation status of New Zealand reptiles, 2015', New Zealand Threat Classification Series 2. Department of Conservation, Wellington.

³ Robertson, H. A., Baird, K., Dowding J. E., Elliott, G. P., Hitchmough, R. A., Miskelly, C. M., McArthur, N., O'Donnell, C. F. J., Sagar, P. M., Scofield, P., and Taylor, G. A., 2017, 'Conservation Status of New Zealand birds, 2016', New Zealand Threat Classification Series 19, Department of Conservation, Wellington.

fur seal (*Arctocephalus forsteri*). Hector's dolphin are listed as Threatened – Nationally Vulnerable⁴ and fur seals are listed as Not Threatened⁴.

- 14 The level of effect, determined by incorporating the value of the habitat for specific components of ecology and the magnitude of the effect on these values, will be low to very low for all components with the exception of marine mammals, where the very high value of the habitat for marine mammals means there is a potential for moderate effects.
- 15 I support the inclusion of draft consent conditions requiring a Construction Management Plan be prepared, including measures to protect lizards such as rescue and relocation if necessary. I support the inclusion of conditions requiring ongoing monitoring of the benthic marine environment and marine water quality.
- 16 I reply to submitters regarding the effects on the marine environment, lack of certainty around effects of the discharge, the proposed Type 2 Marine Protected Area, effects on the skink population and effects on recreational fishing resources.
- 17 Overall, providing the discharge meets the proposed water quality standards, the outfall is constructed as designed, and the construction period includes a management plan to address lizard species within the construction zone, the effect of the construction of the pipeline and outfall, and discharge of treated dairy processing plant wastewater will have very low to low effects on ecological values.

EVIDENCE

PART 1: SUMMARY OF REPORTS

Existing Ecological Values

- 18 The following provides a summary of the results of the various surveys and investigations undertaken to determine ecological values of the project area. For the purposes of this evidence, project area refers to the terrestrial zone along the alignment of the pipeline, and the CMA where the outfall will be located along with an area of approximately 1000m radius of CMA around the outfall diffusers.

⁴ Baker, C. S., Boren, L., Childerhouse, S., Constantine, R., van Helden, A., Lundquist, D., Rayment, W. & Rolfe, J. R., 'Conservation status of New Zealand marine mammals, 2019', 2019, New Zealand Threat Classification Series 29, Department of Conservation, Wellington.

- 19 The terrestrial project area lies within highly modified coastal land in South Canterbury. Surrounding land is dominated by enhanced pasture, managed intensively as dairy grazing. The marine part of the project area is within the southern portion of the Canterbury Bight. It is highly dynamic and subject to strong winds, swells and currents, as well as influenced by the Waitaki River, approximately 7.5km south of the outfall. Tall eroding coastal cliffs separate the farmland from the marine area.

Herpetofauna

- 20 The terrestrial area presents various potential areas of lizard habitat including numerous piles of logs and branches, likely from the shelter hedgerows along Archibald Road, stockpiled concrete slabs, low growing scrubland, rank grass, and cobble screes. Lizards sun-bask in open sunspots, where sunlight reaches the ground.
- 21 Seven species of lizard have been recorded within 50km of the project area however not all are likely to be present. McCann's skink were found on the coastal cliff at the end of Archibald Road. McCann's skink are listed as Not Threatened. It is possible other species are present and were not observed.

Freshwater

- 22 There are no freshwater habitats within the project area. The only surface water exists in irrigation canals that only contain water during the irrigation season, and therefore do not present habitat capable of supporting a sustained aquatic ecosystem. The closest natural waterway is Whitney's Creek, south of the plant with the Waitaki River further south.
- 23 At the mouth of Whitney's Creek and the Waitaki River is the potential for inanga spawning habitat, however this was not assessed in person as it was considered too far from the discharge to be affected by it. Other migratory species such as eels are present in the Waitaki River and Whitney's Creek, however neither waterway will be affected by the project, therefore no migratory patterns will be affected. Once migrating eels reach the coast, or glass eels (newly hatched baby eels) reach the vicinity, dilution of the discharge plume will mean the only area where they may be displaced is within the mixing zone. This effect is negligible considering the very small size of the mixing zone in relation to the wider Canterbury Bight habitat.

Avifauna

- 24 The Canterbury Bight provides habitat for a large variety of coastal and sea birds. Two day-long surveys of the area (conducted 5 March and 25 October 2019) around the proposed outfall recorded a total of 17 different coastal and sea birds using the area. Song birds that were observed were not recorded. Of these 17 species one is Threatened – Nationally Critical (black billed gull, *Chroicocephalus bulleri*), three are Threatened – Nationally Vulnerable (Caspian tern, *Hydroprogne caspia*; Hutton's shearwater, *Puffinus huttoni*; white fronted tern, *Sterna striata*), three are At Risk – Declining (red billed gull, *Chroicocephalus novaehollandiae scopulinus*; South Island pied oystercatcher, *Haematopus longirostris*; sooty shearwater, *Ardenna grisea*) and one is At Risk – Naturally Uncommon (Buller's shearwater, *Puffinus bulleri*). The remaining species are either Not Threatened, or Migrant or Introduced species.
- 25 The majority of the birds were only observed flying through the area. Across the surveys 594 bird observations were made. Of these, 67% of the observations were of birds traversing the area and not utilising any of its habitat, 27% were of birds resting on the water or intertidal area, and just 6% were of birds actively engaging in feeding behaviour. Species where feeding behaviour was observed included Australasian gannet, spotted shag, white fronted tern, Buller's shearwater, and black backed gull. Of these feeding birds, the only species with a listed conservation status was the single Buller's Shearwater (At Risk – Naturally Uncommon).
- 26 There were no signs of penguin presence. It is unlikely penguins will utilise the coastal area for nesting as the cliffs are made of material too loose for digging burrows and too small to provide crevices suitable for nests. Penguins may use the offshore area for feeding however the area is relatively far from the known breeding colonies at Timaru and Oamaru.

Intertidal Zone

- 27 The intertidal area consists of steep greywacke cobbles, sand and coarse gravel. Driftwood is deposited above high tide level. The beach experiences significant wave action.
- 28 Intertidal species in New Zealand either live within soft sediment such as sand and mud, or on hard surfaces such as rocky outcrops. No such habitat was present in the vicinity of the project area and therefore the intertidal area is considered to be of limited ecological value.

Marine Zone

- 29 The benthic biota, macroinvertebrates that live in the seabed sediment, was sampled at 14 sites around the proposed outfall (Figure 1), including two control sites four kilometres north and south of the outfall. The control sites can be used in future monitoring for comparison with samples closer to the outfall. Sediment cores were also collected at these sites. Samples were collected by a team of professional divers, working from a boat, while I remained on the boat sorting, cleaning and preserving the samples as necessary.
- 30 The divers found conditions on the seabed to be turbulent, often having to expend significant effort to remain upright, despite both sampling days being relatively calm (approx. 1m swell, no wind, no whitecaps). Visibility at the bottom was low (approximately 0.5 metres), with sediment from the seabed constantly being turned over by the swell and current action. Areas of soft sediment suitable for collection for invertebrate samples and sediment analysis were variable. Within each site, depths of sediment ranged from a few centimetres to in excess of 30cm. Below the fine sediment was riverine sourced gravels and cobbles.

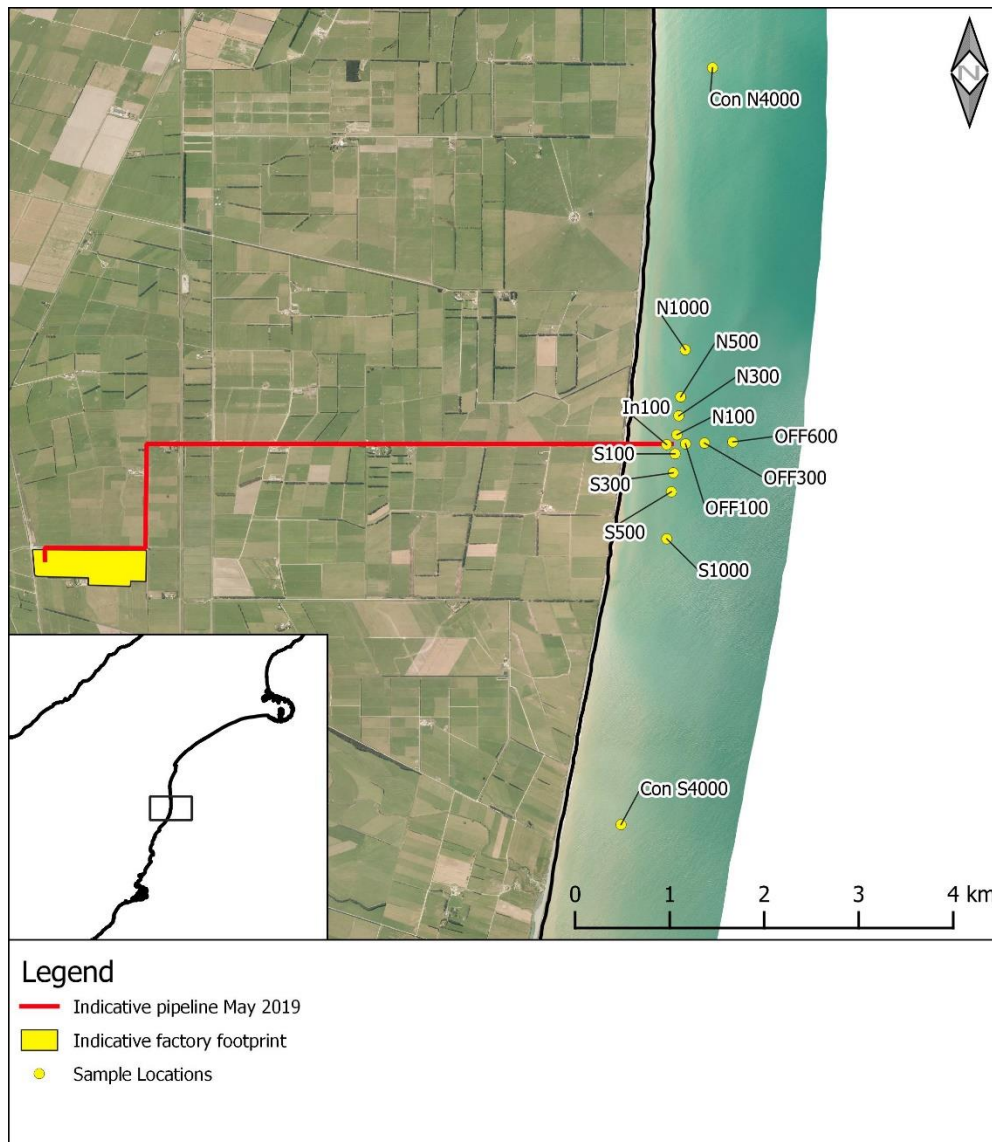


Figure 1: Benthic macroinvertebrate and sediment sample locations

- 31 The benthic community contained low numbers of opportunistic taxa capable of rapidly recolonising areas subject to disturbance and sediment turnover. The community had a low to medium level of diversity indicated by Shannon-Wiener diversity scores from 1.3 to 2.2. The community was very even, indicated by Pielou's evenness scores from 0.76 to 0.97 meaning there were similar numbers of each taxa in the samples, and samples were not dominated by one or more taxa (Figure 2).
- 32 Generally, the offshore sites contained a more numerous and diverse community as shown in Figure 2. This could be for a number of reasons including greater water depths buffering the impact of rough seas creating a more stable benthic environment.

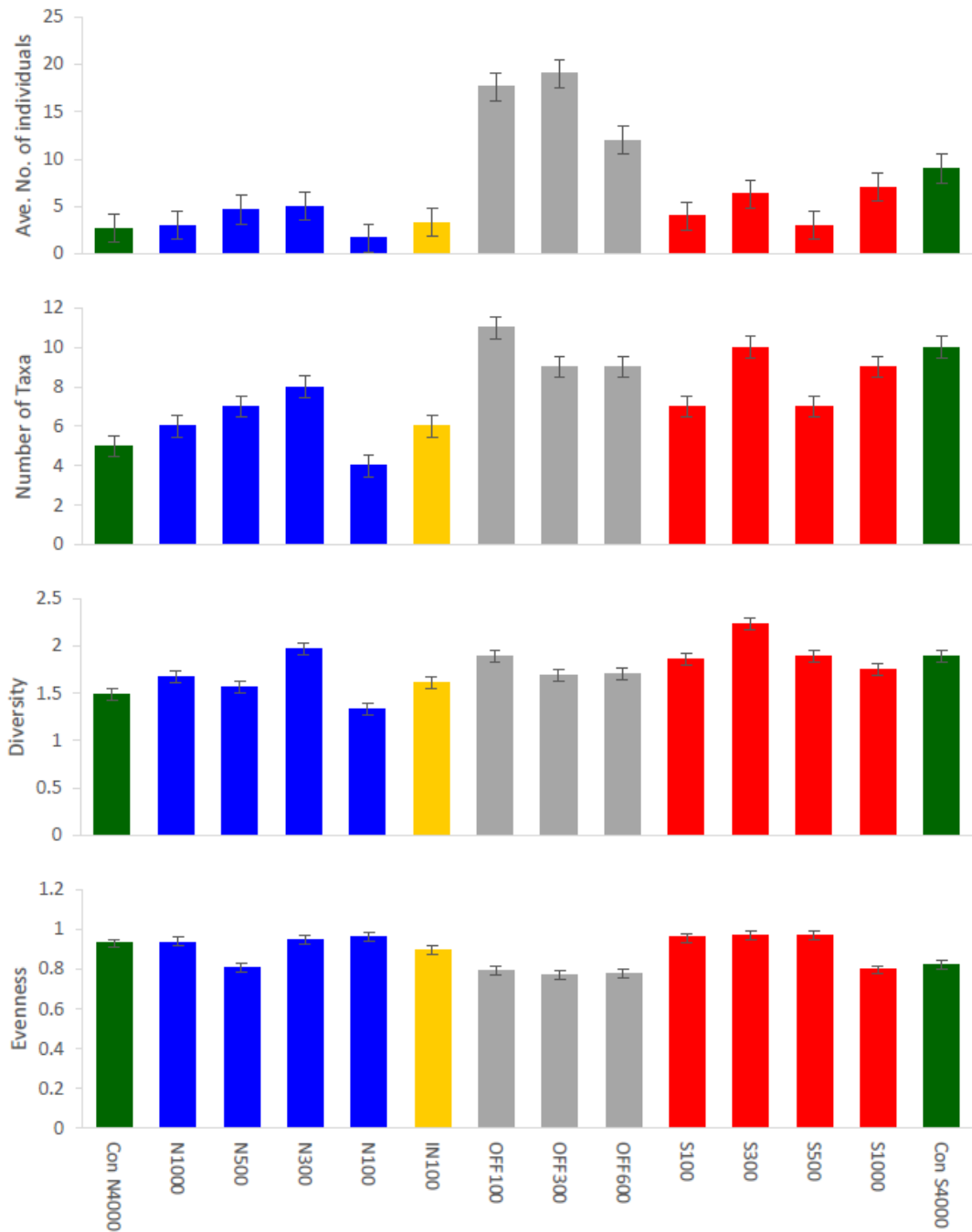


Figure 2: Benthic community structure across all sample sites. The top graph is generated from the average number of individuals in each sample (N=3). The bottom three graphs are generated from the combined three samples from each site to make one composite sample. Error bars represent ± 1 SE.

- 33 The sediment samples contained low concentrations of contaminants with total nitrogen and ammonia both being below laboratory detection limits in all samples. Copper and zinc were well below ANZECC (2000)⁵ high and low interim sediment quality guidelines in all samples. Phosphorus levels were elevated but are considered to be typical of moderately disturbed coastal systems with similar concentrations recorded further north at the proposed location of Fonterra's Studholme outfall, and at the operational Fonterra Clandeboye outfall. Sediment cores did not show any evidence of anoxic conditions. This was likely the result of regular turnover of sediment meaning anoxic conditions do not form and are thus not experienced.

Fish

- 34 Fish data was sourced from MPI's research trawl database as well as from actual catch data provided after an Official Information Act request. The majority of these commercially targeted species are caught in waters with depths of greater than 50m, while water depths around the outfall and diffuser are approximately eight metres.
- 35 Virtually no commercial fishing activity occurs in the vicinity of the outfall due to existing restrictions, limiting fishing.
- 36 Species considered likely to be present in the vicinity of the outfall, due to the ability to live in shallower habitats include:
- 36.1 Barracouta (*Thyrsites atun*)
 - 36.2 Red cod (*Pseudophycis bachus*)
 - 36.3 Elephant fish (*Callorhinchus milii*)
 - 36.4 Spiny dogfish (*Squalus acanthias*)
 - 36.5 Gurnard (*Chelidonichthys kumu*)
 - 36.6 Tarakihi (*Nemadactylus macropterus*)
 - 36.7 Rough skate (*Dipturus nasutus*)

⁵ ANZECC, 2000, 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality', Australian and New Zealand Environment Conservation Council.

36.8 Rig (*Mustelus lenticulatus*)

36.9 Flatfish

Marine Mammals

37 Marine mammal presence was assessed based on an 'Area of Interest' (AOI) of 50km north and south of the proposed outfall, extending to 25nm offshore.

38 Based on records of sightings and strandings from DOC databases, Hector's dolphin and New Zealand fur seals are likely to be frequently present in the AOI. I also observed Hector's dolphin around the mouth of the Waitaki River from the boat on the way from Oamaru to collect the benthic samples.

39 Five other species could be present on occasion around the outfall. These include southern right whale (*Eubalaena australis*), listed as At Risk – Declining⁶; orca (*Orcinus orca*), listed as Threatened – Nationally Critical⁶; common dolphin (*Delphinus delphis*); dusky dolphin (*Lagenorhynchus obscurus*), both listed as Not Threatened⁶ and leopard seals (*Hydrurga leptonyx*), listed as At Risk – Naturally Uncommon⁶. However, their large home ranges mean that any potential presence around the outfall is predicted to be highly infrequent and transitory in nature.

Summary

40 A summary of the values of the ecological habitat and major components of the environment are given in Table 1. Ecological values have been determined using EIANZ guidelines⁷.

Table 1: Summary of ecological values within the project area and surrounding areas.

Component	Value	Comments
Marine Habitat	High	Contains typical habitat for the wider area supporting a range of different types of guilds and species, for different parts of lifecycles.
Benthic Fauna	Low	Benthic community depauperate and dominated by common, opportunistic species adapted to the high energy and highly

⁶ Baker, C. S., Boren, L., Childerhouse, S., Constantine, R., van Helden, A., Lundquist, F., Rayment, W., and Rolfe, J. R., 2019, 'Conservation status of New Zealand marine mammals, 2019', New Zealand Threat Classification Series 29, Department of Conservation, Wellington.

⁷ EIANZ, 2018, 'Ecological Impact Assessment (EiA) – EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems,' 2nd edition, Environment Institute of Australia and New Zealand, Melbourne.

		dynamic Canterbury Bight environment. Benthic community does provide food resources for the fish community.
Benthic Habitat	Low	Benthic habitat dominated by highly mobile substrates typical of the Canterbury Bight area as well as wider east coast of South Island.
Fish	Low	Species that frequent the area are locally common, present within the Canterbury Bight area, and in most cases, at least Pegasus Bay as well. Some species widely distributed around New Zealand and other global waters.
Intertidal Habitat	Low	Very limited habitat available for intertidal species as substrate was too coarse but mobile.
Freshwater Habitats	High	Freshwater habitats contain At Risk – Declining inanga including possible spawning locations.
Herpetofauna	Moderate	No At Risk or Threatened species found during search of area but habitat available including the eroding gravel/cobble sea cliffs.
Avifauna	Very High	At Risk and Threatened species recorded as either using the Project Area or traversing through. Use of the area included resting and feeding.
Marine Mammals	Very High	Nationally Threatened species present in the area. Usage of the area is transitory in nature.

Assessment of Effects

- 41 The effects of the project include both construction and operational effects. Construction effects will be temporary and limited to the period of time when construction is occurring. Operational effects will be longer term and can be expected for the life of the outfall.

Construction effects in the terrestrial environment

- 42 Trenching and drilling for the pipeline will temporarily remove potential skink habitat along the grassed berms on Archibald Road and in the gully in the coastal cliffs leading to the beach. Habitat will be reinstated once construction has ceased. Vehicle access provisions on the coastal cliff at the end of Archibald Road will alter habitat where McCann's skink are known to be present.
- 43 The applicant will prepare a lizard management plan prior to works commencing. The plan will be prepared by an appropriately qualified and experienced herpetologist and will specify measures around vegetation clearance, salvage and relocation of

indigenous lizards, restoration and enhancement of lizard habitat and post release monitoring if required. A DOC Wildlife Act Authority will also be required. I consider that the management plan will be appropriate to prevent harm to the known population of skinks, and any other lizards potentially in the area. The management plan will identify areas of potential habitat and outline the required steps when working within that area. I understand that the construction of the pipeline is to take place in 10 metre sections. I consider this will make it straightforward to include a qualified herpetologist on site when construction is occurring within potential habitat areas.

- 44 I do not consider there will be any long term or permanent effects of the project on lizards.

Construction effects on the marine environment

Suspended sediment

- 45 Suspended sediment can have various effects on the marine environment. It can reduce light penetration, smother seabed habitat and food resources and act as an irritant to fish and marine mammals.
- 46 Construction in the marine environment has the potential to release plumes of sediment depending on the method of construction ultimately chosen. Construction activities will be temporary and the zone of effect, where sediment is higher than the surrounding water, will be limited to a few hundred meters in either direction with the remainder of the habitat unaffected and open for fish and marine mammals to utilise.
- 47 The coastal environment around the project area is already naturally subject to high levels of suspended sediment as a result of resuspension of seabed sediments during inclement weather, coastal erosion and when the Waitaki River is in flood. As such, species present in the area are capable of tolerating periods of elevated sediment levels.
- 48 I consider the zone of effect to be very small in relation to the balance of the habitat that remains unaffected by the activity. Fish and marine mammals are highly mobile and will easily move to an immediately adjacent area unaffected by sediment if they are uncomfortable in the construction zone.

Disturbance to birds, fish and marine mammals

- 49 Activity in the works area may disturb birds, fish and marine mammals, rendering the area unsuitable for them during this time.
- 50 I consider the impact on birds and fish to be negligible as they are highly mobile, and easily able to move to adjacent areas free from construction activities.
- 51 There is a risk of boat strike of marine mammals when the outfall is being constructed and/or positioned in the CMA. However, I consider the risk of this occurring to be low due to the following:
- 51.1 Larger vessels (<80m) are more frequently involved in collisions than smaller vessels. Barges used to install outfalls are significantly smaller than 80m;
 - 51.2 Most lethal marine mammal collisions involve vehicles travelling at speeds greater than 12 knots, while the barge used to install the outfall will be moving very slowly, or be stationary for much of the process;
 - 51.3 Large whales are the most common victims of collisions (e.g. right whales, humpback whales, fin whales, minke whales and sperm whales), none of which are expected to be present in the shallow waters where the outfall will be located; and
 - 51.4 Dolphins and seals are highly agile and able to move away from perceived danger easily and quickly. Dolphins regularly play in boat wakes and bow waves while avoiding collisions with the vessel.
- 52 Noise associated with construction activities has the potential to interfere with marine mammals. Many marine mammals produce sounds for communication, foraging, navigation, reproduction, parental care, and avoidance of predators. These noises could be masked by noise generated from construction. I consider the risk of construction noise interfering with marine mammals to be low for the following reasons:
- 52.1 Operational noise from construction will be comparable to routine dredging that occurs in many coastal waters of New Zealand;
 - 52.2 No pile driving will occur and no explosives will be used during construction;

- 52.3 The construction period will be short (in the order of days or weeks) and therefore any masking of behaviours will be short term; and
- 52.4 The operational noise from the barge is likely to be much less intense than other small fishing and recreational vehicles that may be in the area.

Loss of benthic biota

53 Installing the outfall on the seabed will result in loss of an area currently utilised by benthic biota. These taxa form one of the lower levels of the food chain and provide a food resource for higher level predators. I consider the effect on benthic biota to be negligible for the following reasons:

- 53.1 The benthic community is relatively low in abundance;
- 53.2 The community is dominated by species able to quickly recolonise following disturbance; and
- 53.3 The area of habitat lost, and therefore the amount of food resource for predators lost, is negligible compared to the unaffected habitat along the South Canterbury coast and the wider Canterbury Bight area.

Effects of outfall operation

Water quality

- 54 The effects of the discharge on water quality have been fully addressed in the evidence of Dr Nathaniel Wilson. Based on the conclusions in his evidence, I will discuss water quality in terms of the effect on ecological values.
- 55 Based on Dr Wilson's evidence, I understand that water quality will be negligibly affected by the wastewater discharge, and therefore have a negligible effect on marine life due to the following:
 - 55.1 The discharge will contain no stormwater or human or animal sewage;
 - 55.2 Modelling has predicted discharged wastewater will be diluted to a factor of 300 times within 50m of the outfall diffusers under 'worst case' sea and weather conditions (i.e. where very calm conditions persist for six hours or more). Conditions such as these only occur approximately 2% of the time;

- 55.3 Under 'normal' conditions (i.e. conditions that occur for 80% of the time, with energetic wind and wave action), the discharge disperses quickly and a dilution factor of approximately 500 times is expected to occur within 50m of the discharge;
- 55.4 The project area is already subject to natural water quality variability, particularly with regards to turbidity and salinity as a result of the proximity to the Waitaki River;
- 55.5 After discharge and dilution within the mixing zone, it is expected concentrations of contaminants in the discharge will be very, very low, and indistinguishable from the water quality of the wider area;
- 55.6 There may be some avoidance behaviour of fish immediately around the diffuser due to the discharge of freshwater into a saline environment, however fish will remove themselves as necessary and relocate to an adjacent area with more suitable salinity levels. The avoided area will be very small, in the range of centimetres to metres. Unaffected, unchanged fish resources will still be available for marine mammals outside of the mixing zone; and
- 55.7 Elevated turbidity can affect marine mammal's ability to forage for food, however no species is entirely reliant on the area immediately around the diffusers for foraging habitat. Hector's dolphin were observed feeding in the highly turbid Waitaki River plume when I undertook the marine sampling. New Zealand fur seals generally feed further offshore than where the outfall will be located and are accustomed to foraging in low light levels.
- 56 Bioaccumulation is the process of accumulation of a substance in an organism over time, while biomagnification is the concentration of toxins in the tissues of tolerant organisms at successively higher levels of the food chain. There is little information available for the products, including cleaning products that may be present in the wastewater stream, used within the dairy processing plant regarding the risk of bioaccumulation and biomagnification occurring, and therefore I consider that there remains a minor risk of bioaccumulation and/or biomagnification of contaminants in marine species. Significant further investigations would be necessary, in a controlled environment such as a large scale laboratory, to determine this for sure. I consider the risk of bioaccumulation and biomagnification to be low due to the low concentrations of these chemicals being discharge and the highly dynamic coastal environment rapidly dispersing the discharge away from the diffusers. On that basis,

I consider that the significant further investigations outlined above are unnecessarily costly and time-consuming, when considered against the potential effect.

Effects on the benthic community

- 57 Benthic communities can alter depending on habitat conditions. They can reflect substrate size and depth, organic matter availability, water depth, wave and weather conditions and water quality.
- 58 I consider the effect of the discharge on the benthic community to be low for the following reasons:
- 58.1 There may be some changes in community structure, however the environment is highly dynamic and the benthic community is regularly disturbed and has to re-establish itself. Taxa present in the area are opportunistic and able to recolonise quickly. The species that recolonise after one disturbance may be suited to conditions at that particular time, and will likely be different to the species that recolonise next time.
- 58.2 Long term monitoring at various discharge sites around New Zealand^{8, 9, 10, 11, 12} have shown minor changes in community composition that could not be attributed to the discharges, rather they were the result of natural phenomena. I have no reason to expect a different outcome for ODL's discharge providing it is constructed and operated as proposed.
- 59 There is potential that installing a hard surface, such as the outfall and diffusers may attract new species such as encrusting species (mussels, barnacles etc.) to the area

⁸ Fonterra Clandeboye (Cawthron Institute, 2013, 'Monitoring survey of benthic ecology, sediments and water quality at the Fonterra Clandeboye Ocean Outfall: 2013', report no. 2454, prepared for Fonterra Cooperative Group Ltd.

⁹ Beca, 2009, 'Assessment of Environment Effects for Timaru Wastewater Ocean Outfall – Volume One: Report', prepared for Timaru District Council.

¹⁰ Ryder Consulting, 2014, 2015, 2016, 'Tahuna Wastewater Treatment Plant Outfall – Discharge Consent 2002.623: Offshore sediment survey', prepared for Dunedin City Council.

¹¹ Cawthron Institute, 2002, 'Assessment of ecological effects on the seabed and surrounding the Gisborne wastewater outfall: June 2002', prepared for Gisborne District Council.

¹² Taranaki District Council, 2018, 'Fonterra Whareroa Monitoring Programme Annual Report 2016-2017', Technical Report 2016-66.

as they will have a hard, stable substrate to attach to. However, I consider this only a possibility and therefore not a significant potential positive effect.

Effects on birds

60 Birds are highly mobile species that regularly move across significant distances for feeding and breeding. A number of Threatened and At Risk species are present in the vicinity of the project area however their use of the habitat is very low. I consider birds will be subject to a very low level of effect from the discharge. This is due to their low level of use of the habitat, ability to move away from unsuitable areas and the vast majority of the Canterbury Bight and North Otago coast remaining unaffected by the project.

Effects on marine mammals

61 Other than potential minor displacement of marine mammals from the mixing zone as already discussed, I do not consider there will be any other effects on marine mammals from the discharge due to their highly mobile nature and the vast majority of their habitat remaining unaffected.

Effects on commercial and recreational fishing

62 The project area, and the surrounding coastal zone does not present a significant resource for commercial fishers and essentially no commercial fishing occurs in this area of the Canterbury Bight. The area is already subject to restrictions and exclusions including a trawl prohibition, except for low headline trawl nets, up to two nautical miles offshore; Danish seine prohibition up to three nautical miles offshore; and set net prohibition up to four nautical miles offshore. For these reasons, I do not consider the discharge will have any effect on commercial fishing.

63 The effects of the project on recreation will be addressed by Rob Greenaway, however I will discuss recreational fishing in relation to the fish species targeted.

64 I consider there may be some displacement of recreational fishing species but only from the area immediately over the diffusers, as I have already discussed. A recreational fisher would have to be fishing directly above the diffusers to be affected, an activity that would require the use of a boat, or motorised kontiki or similar. Anyone in a boat or other activity has mobility to move outside the zone of influence where there is significant unaffected habitat of the same nature for recreational fish species.

Effects on freshwater

- 65 I do not consider the discharge will have any effect on freshwater environments or inanga spawning habitats. The closest inanga spawning habitats are located at the mouth of the Waitaki River, approximately 7.5km south and at the Waiho Box approximately 11km north. Both of these areas are well away from the mixing zone and the discharge plume will be undetectable at these locations.

Cumulative effects

- 66 There are six other consented discharges to the CMA or to surface water that discharges to the coast within 70km in either direction of the proposed discharge. In addition, there are various non-point source discharges, and watercourses of various sizes that potentially introduce contaminants to the marine environment. The consented discharges are:
- 66.1 Alliance Pukeuri, Oamaru – discharge treated wastewater from meat processing facility discharged via water race to surface water very close to the coast
 - 66.2 Waitaki District Council, Oamaru – discharge treated municipal wastewater to surface water then to sea
 - 66.3 Silver Fern Farms, Pareora – discharge up to 12,000m³ per day treated meatworks processing effluent
 - 66.4 Timaru District Council – discharge up to 40,000m³ per day of treated municipal wastewater
 - 66.5 Fonterra, Clandeboye – discharge up to 34,300m³ per day of treated dairy factory wastewater
 - 66.6 Fonterra, Studholme – discharge treated dairy factory wastewater (yet to be constructed)
- 67 The area is subject to very little to no pressure from commercial fishing, and disturbance by commercial and recreational vessels is very low, meaning effects on the wider area are largely limited to effects from land derived pollutants.

- 68 There is no evidence these discharges are having adverse effects on the water quality or aquatic ecology of the wider environment. Monitoring of discharges has found either no effect, or very minor localised changes. Wider scale changes in benthic community have been attributed to wider scale environmental patterns and natural disturbances.
- 69 There have been periodic exceedances of guidelines/trigger values in Environment Canterbury's long term coastal monitoring that occurs throughout the Canterbury region. Overall, the environmental state of the wider Canterbury Bight area appears to be in good condition.
- 70 I do not consider it likely that ODL's discharge will result in cumulative effects on the environment (environment here being the ecological environment) when combined with the effects of other discharges in the area. The coastal environment is highly dynamic and the discharge will be well mixed within 50m of the diffusers under all weather conditions. Outside of the mixing zone, the discharge will be barely detectable, and will be completely undetectable at the location of the nearest adjacent discharges.

Summary of Effects

- 71 Table 2 provides summaries the effects I believe will occur as a result of the project. Effects are measured in magnitude which ranges from Negligible to Very High. Magnitude of effect is adapted from criteria set out by EIANZ¹³.

Table 2: Summary of ecological effects

Effect	Magnitude of Effect	Comments
Construction effects on terrestrial environments	Moderate	Lizard habitat will be unavailable or altered during construction, however this will be a temporary effect and will be unaffected once construction ceases.
Construction effects on marine environments – Suspended sediment	Low	Works generating sediment will be temporary and in an environment already subject to period naturally elevated sediment loads.

¹³ EIANZ, 2018, 'Écological Impact Assessment (EclA) – EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, 2nd edn', Environment Institute of Australia and New Zealand, Melbourne.

Construction effects on marine environments – Disturbance to fish, birds and marine mammals	Negligible	Fish, birds and marine mammals are highly mobile and able to move away from disturbed areas. Adjacent non affected habitat is plentiful and of the same nature as the project area. Fish, birds and marine mammals are not reliant on the project area.
Construction effects on marine environments – Loss of benthic biota	Negligible	Community has low diversity of common species. Losses of individuals during construction will be minor in relation to the wider Canterbury Bight community. Species will recolonise rapidly once disturbance ceases.
Outfall operation effects – Water quality	Low	The wastewater will experience 300-fold dilution within 30 to 50 metres of the discharge. Prior to discharge, wastewater will undergo tertiary treatment.
Outfall operation effects – Effects on benthic community	Low	Potential for minor changes in benthic community structure due to discharge however the environment is highly dynamic and species present are capable of persisting in this environment. Changes in community composition are not expected to be directly attributable to the discharge, rather, result from natural phenomena.
Outfall operation effects – Effects on birds	Negligible	Very small area of affect amongst a vast area of unaffected habitat. Birds that use the area are highly mobile. Only limited feeding behaviour of a small number of individuals observed.
Outfall operation effects – Effects on marine mammals	Low	Mostly negligible effects due to wastewater treatment, dilution, mobile nature of marine mammals, and significant unaffected areas. Low potential effect of noise during construction.
Outfall operation effects – Effects on commercial and recreational fishing	Negligible	Project area does not present significant commercial resource. Recreational fishing would need to occur directly over diffuser to notice any change. Fish stocks and community will not be affected.

Outfall operation effects – Effects on freshwater	Negligible	Closest freshwater habitat approximately 7.8 km to the south. Discharge expected to be fully dispersed within 50 metres of diffuser.
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Level of Effects

72 Table 3 provides an overview of the level of effects expected as a result of ODL's proposals. The level of effect takes into account the value of the ecological component, and the magnitude of the expected effect. My assessment is based on methods provided by EIANZ¹⁴.

73 Generally, only where the level of effects is Moderate or greater is mitigation necessary. An outline of mitigation measures proposed is given below.

Table 3: Summary of the level of effects of the proposed project.

Component	Value	Magnitude of Effect	Level of Effect
Construction effects on terrestrial environments	Moderate	Moderate	Moderate
Construction effects on marine environments – Suspended sediment	High	Low	Low
Construction effects on marine environments – Disturbance to fish, birds and marine mammals	Very High	Negligible	Low
Construction effects on marine environments – Loss of benthic biota	Low	Negligible	Very Low
Outfall operation effects – Water quality	High	Low	Low
Outfall operation effects – Effects on benthic community	Low	Low	Very Low

¹⁴ EIANZ, 2018, Ecological Impact Assessment (EclA) – EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, 2nd edn', Environment Institute of Australia and New Zealand, Melbourne.

Outfall operation effects – Effects on birds	Very High	Negligible	Low
Outfall operation effects – Effects on marine mammals	Very High	Low	Moderate
Outfall operation effects – Effects on commercial and recreational fishing	Low	Negligible	Very Low
Outfall operation effects – Effects on freshwater	High	Negligible	Very Low

Mitigation

74 As the majority of the effects are considered to have a very low to low level, limited mitigation is proposed. No specific mitigation is proposed to address the moderate level of effect on marine mammals due to their highly mobile nature, large home ranges, and negligible size of affected habitat in relation to the wider Canterbury Bight habitat. The following measures have been proposed to address construction effects on the terrestrial environment:

- 74.1 Preparation of a lizard management plan (LMP) outlining measures around vegetation clearance, salvage and relocation of indigenous lizards, restoration and enhancement of lizard habitat and post release monitoring if required. A DOC Wildlife Act Authority will also be required. The purpose of an LMP is to provide a methodology to be followed to ensure the impact of a project on lizards is as small as possible. Objectives are generally site specific and depend on the number and species of lizards encountered.
- 74.2 Checks of the gully in the coastal cliffs and the cliffs around the access and works areas for presence of little penguin prior to construction activities occurring. If penguins are present, measures will be developed by an appropriately qualified person to manage their presence, including but not limited to fencing works areas off, avoiding work around penguins and if necessary, relocating penguins. Relocation will require a Wildlife Act Authority and should be undertaken in consultation with DoC.
- 74.3 Ongoing benthic monitoring around the discharge point is also proposed. While it is not necessary as mitigation, monitoring the benthic environment will confirm the expected effects of the discharge and identify if unexpected changes have occurred. Any unexpected changes can be addressed once identified.

PART 2: RESPONSE TO ISSUES RAISED AND PROPOSED DRAFT CONDITIONS

Conditions

- 75 I have viewed several version of consent conditions, prepared by both the applicant and the s42A Officers. I have referred to the condition numbers in the latest version of the consent conditions, provided by the applicant with the evidence of Ms Sukhi Singh. I understand these to be a tracked change version of the conditions that were appended to the s42A Addendum.
- 76 The draft conditions included in the s42A report propose a number of conditions relating to my area of expertise. My comment on these are as follows:
- 77 Consent CRC201188 – Land use consent to use land for erection and placement of structures in the Coastal Hazard Zones
- 77.1 Construction Management Plan (conditions 6-9) - I support the inclusion of a condition to develop a CMP, especially for measures to manage adverse environmental effects, sediment and good environmental practices.
- 77.2 Lizard Management Plan (conditions 10-12) – I support the condition to provide an LMP prior to works commencing. Producing and LMP was the key recommendation of the herpetofauna assessment. I agree with the objective listed in condition 10.
- 77.3 Penguin checks (condition 16) – I support the inclusion of this condition to check works areas for penguin presence prior to work commencing. While it is unlikely penguins will be present in the works area (including the gully and coastal cliffs), there remains a possibility they may appear during the nesting season (July – February) and/or the moulting season (January – March). I note it is likely a Wildlife Act Authority from DoC will be required if penguins are observed. I also note the inclusion of a specific consideration of penguins in the CMP at condition 7(g).
- 78 CRC201190 – Coastal permit to disturb and deposit material to the foreshore or seabed, to erect and place structures and to occupy the CMA
- 78.1 CMP (conditions 6-9) - I support the inclusion of a condition to develop a CMP, especially for measures to manage adverse environmental effects, sediment and good environmental practices.

- 78.2 Water quality monitoring (condition 10) – I support continuous turbidity monitoring during construction if a dredging method is used. I support the requirement for a water quality monitoring plan to be developed.
- 79 CRC201194 – Discharge permit to discharge treated wastewater into CMA
- 79.1 Benthic monitoring (conditions 22-23) – Generally I agree with these conditions. I support the requirement for monitoring at least two months prior to commissioning the outfall and thereafter at five yearly intervals. I support locating three monitoring sites just outside the mixing zone, and three control sites 1000m north and south and 600m east of the outfall.
- 79.2 I do not support the requirement for the consent holder to ensure there will be no statistically significant difference in the presence and absence of the benthic biota just beyond the edge of the mixing zone and at the control sites. I question the practicalities of achieving this considering the dynamic nature of the environment. Benthic macroinvertebrate communities had a low to medium diversity and the number of taxa within each sample was variable. At one sampling site one sample contained one taxa while another contained eight. Statistically significant differences are entirely likely to result solely from natural variation over time, factors beyond the control of the applicant. It is equally likely that statistically significant differences between replicates of the same sample site will be detected. Statistically significant changes may or may not be ‘ecologically significant’. Without these changes being linked to physical or chemical parameters, any changes in the benthic taxa provide little meaningful information.
- 79.3 I suggest a ‘season’ be included in the condition, for example, requiring benthic monitoring to be completed during December – March, as it removes one source of variation and ensures results between years can be directly compared.
- 79.4 I suggest a requirement for a suitably qualified person or persons to undertake analysis of the data to determine if the outfall is affecting the benthic community. Discussion of the results in relation to previous results and the impact of these results on the environment should be included. I would expect that statistical analysis be completed on parameters such as number of species, number of individuals, diversity and evenness, however I consider it unnecessarily restrictive to expect no statistical differences in the benthic community. I would suggest a multivariate approach to determine

changes in composition and abundance of the community as a whole, rather than the univariate statistics suggested. This would eliminate some false positives and would test more realistic ecological changes. Benthic results should be analysed in conjunction with physical and chemical sediment results. Interpretation of the data by the suitable qualified person or persons would determine if any statistically significant changes can be attributed to the outfall or not.

79.5 I support the requirement for the number of replicates at each site to be discussed with the Canterbury Regional Council prior to the first monitoring occasion. This will ensure the programme is considered fit for purpose by all parties.

79.6 I support five yearly sediment monitoring for the parameters listed in condition 23 including the requirement to review monitoring frequency after two rounds of monitoring.

Issues raised by Submitters

80 Submissions on ecological values, particularly marine ecology, were received from several submitters. The key issues raised were:

80.1 Effects on the marine environment

80.2 Uncertainty around effects therefore the precautionary principle should be used

80.3 Construction and discharge will occur within a proposed Type 2 Marine Protected Area (MPA)

80.4 Insufficient information about the skink population

80.5 Impacts on recreational fish species

81 These matters are addressed below.

Effects on the marine environment

82 I believe effects on the marine environment have been adequately covered in the various assessment of effects documents and in this evidence.

Uncertainty around effects and precautionary principle

- 83 Some concern was raised around the level of certainty of the effects, as a result of both construction and the ongoing discharge, on ecology. Concern about the language, using terms such as 'predicted,' 'expected' and 'anticipated' was expressed.
- 84 The nature of an assessment of effects is that it is prepared prior to the activity occurring and therefore assessments are based on existing information, surveys, and the knowledge and experience of the person/people preparing them.
- 85 I have made educated judgements regarding the effects that are likely to be associated with the project. In doing this, I have also used monitoring and investigation results from other outfalls around New Zealand.
- 86 The authors of the additional ecological assessments of effects have also used their knowledge, judgement and results of investigations to form their opinions.
- 87 It is my opinion that the project will have very low to low effects on the ecological values of the environment for reasons set out in the various assessment of effects documents and this evidence, and therefore applying a precautionary approach is not necessary.

Proposed Type 2 (MPA) and proposed Kelp Protection Area

- 88 The site falls within proposed Type 2 MPA C1, as well as within the proposed Kelp Protection Area as proposed by the South-East Marine Protection Forum.
- 89 Type 2 MPA's are not no-take areas, but they do restrict activities that can occur within them.
- 90 It is my opinion that the effects outlined in the assessment of effects documents associated with this project will also be relevant to any effects on the proposed Type 2 MPA. Separate permissions will be sought under the relevant legislation the Type 2 MPA will be administered under, should this be necessary. I also understand that the relevance of the proposed Type 2 MPA on the application is being considered in the legal submissions to be presented on behalf of the applicant.
- 91 No kelp was found within the project area or during the marine sampling. I have no expectation that kelp would be present as there are no stable surfaces for kelp to

grow from, the substrate is too mobile. I believe it is possible that kelp may attach to hard surfaces associated with the outfall.

Limited lizard information

- 92 The assessment of effects identified potential lizard habitat as well as conducted searches for actual lizards.
- 93 The report recommended that a lizard management plan be prepared prior to construction commencing. The plan will include management measures around careful vegetation and habitat clearance, salvage and relocation of indigenous lizards, restoration and enhancement of lizard habitat, post-release lizard monitoring (where required) and reporting requirements.
- 94 When lizard salvage occurs, all species found will be captured and relocated as appropriate. The plan will not just be limited to McCann's skink, the only species found during survey. I consider this to be appropriate and further survey is not necessary.

Impacts on recreational fish species

- 95 It is my understanding, based on the recreation assessment completed by Rob Greenaway that recreational fishing activities are very rare within the project area.
- 96 The area is not suited to shellfish gathering due to the lack of soft intertidal sediments for shellfish to live in. It is also not suited to diving for encrusting shellfish (e.g. paua) due to the lack of hard surfaces for them to live on and the dynamic swell and current conditions.
- 97 Fishing activities would occur from the beach, where access is limited but possible, or through use of a motorised kontiki or similar, or a boat. It is my opinion that fish species caught by any recreational fishing activity in the area will not be detrimentally affected by the discharge. There may be some displacement from the area immediately around the diffusers, however a person would have to be fishing directly over this area to notice an affect.
- 98 Whitebait spawning areas and whitebaiting locations will not be affected. The closest suitable areas are at the Waitaki River mouth and the Waiho Box, much too far away to be impacted by the discharge.

Section 42A report

- 99 The technical reports in the S42A report the relate to my evidence were written by Dr Leslie Bolton-Ritchie (marine ecology), Jean Jack (herpetofauna) and Dr Leigh Bull (avifuana).
- 100 No specific issues regarding marine mammals, herpetofauna or avifauna were raised. Issues regarding marine ecology are addressed below.
- 101 Dr Bolton-Ritchie has stated she does not consider the benthic biota data collected for the AEE is adequate as a baseline to assess impacts of the discharge due to the low number of replicates at each site.
- 102 While the survey undertaken to inform the AEE could be used as baseline data, it was not designed for that purpose. I do not expect further sampling would reveal a different picture of the benthic community however more replicates will increase statistical robustness for comparisons between years.
- 103 I consider it appropriate that the first survey occur within one year of construction on the outfall being completed or prior to construction if achievable. This will reduce the chance of baseline data being collected too early, should construction of the project be delayed for any reason.
- 104 I agree with Dr Bolton-Ritchie that ongoing monitoring should occur at five yearly intervals. My reasons for disagreeing with the requirement for no statistical difference between the monitoring points just outside the mixing zone, and the control sites, has been given under my review of the draft conditions.
- 105 The concerns raised by Dr Bolton-Ritchie regarding the quality of the discharge and the potential adverse effects on ecosystems have been addressed by Dr Nathaniel Wilson.

SUMMARY AND CONCLUSION

- 106 For the majority of the terrestrial and marine ecological values within the area affected by the proposed outfall and discharge, the level of effect has assessed to be Low or Very Low. Marine mammals and herpetofauna are the only components where the level of effect has been assessed as Moderate, due to the Very High value associated with marine mammals and the potential for a population of McCann's skink to be killed if no mitigation is in place.

- 107 Construction effects will be temporary. Effects of the discharge will be limited to the mixing zone, an area with a radius of approximately 50m around the diffusers. Given the level of effects, and the very small area affected in relation to the wider habitat of the Canterbury Bight and east coast of the South Island, effects on ecology are not expected to be noticeable.
- 108 Mitigation in the form of a management plan and associated actions for lizards is appropriate to manage the effects on lizards.
- 109 No mitigation is required for marine mammals as they are highly mobile, no species solely rely on the affected area for their survival, and the vast majority of their habitat will remain unaffected.
- 110 Based on the low level of effect for the remainder of the ecological components, I do not consider further mitigation is necessary.

Annabelle Coates

28 May 2020