BEFORE A COMMISSIONER PANEL APPOINTED BY CHRISTCHURCH CITY COUNCIL AND CANTERBURY REGIONAL COUNCIL

In the matter of the Resource Management Act 1991

And

In the matter of an application by Christchurch City Council for resource consent to establish and operate a wastewater treatment scheme and associated discharges to land as part of the Akaroa Treated Wastewater Irrigation Scheme at 80 Old Coach Road, Akaroa, 11 Sawmill Road, Duvauchelle, 6583 Christchurch Akaroa Road, Akaroa, and Jubilee Park, Akaroa (RMA/2023/1347, CRC235038, CRC235039, CRC235040 and CRC235041)

SUBMISSION TO THE ATWIS HEARING PANEL
PRESENTED BY
MS SUKY THOMPSON, DR BRENT MARTIN, JAN COOK
ON BEHALF OF
FRIENDS OF BANKS PENINSULA INCORPORATED

11 February 2025

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Section 1. Introduction to Friends of Banks Peninsula Incorporated

1.1.1 Friends of Banks Peninsula Incorporated (FBPI) is a voluntary community organisation founded in 1990 to advocate on behalf of the environment of the Akaroa area.

1.1.2 We have been involved with many environmental issues over the past 35 years, starting with a campaign to protect Childrens Bay from an inappropriate marina development. We have taken a close interest in solid waste and wastewater management since our inception.

1.1.3 We have been involved with the proposals to replace the Akaroa wastewater system since the first working party was formed in 2007, and we have a thorough understanding of the current proposal and how it has been arrived at.

1.1.4 We operate in an open and transparent manner. We post information, important documents and our submissions on the FBPI website (https://www.friendsofbp.org.nz/).

1.1.5 In co-operation with other local groups, we have held numerous public meetings to inform the public about the wastewater proposals as they have developed since 2016, and to solicit their views.

1.1.6 Consistent messages from the public are that they want a wastewater system that treats the water to the highest possible standard, with the water to be re-used to alleviate the chronic water shortages that Akaroa faces almost every summer.

1.1.7 Any system that replaces the current system should be safe, resilient and manageable to operate, and set the community up well for a climate changed future.

1.1.8 A sewage system is an essential service and cannot be turned off if problems arise. It must operate effectively for an extremely long time.

Section 2. Opposition to the current ATWIS Application

2.1.1 FBPI lodged a substantial submission in opposition to the applications for resource consents lodged by the Christchurch City Council (CCC) for the Akaroa Treated Wastewater Irrigation Scheme (ATWIS).

2.1.2 Since then there has been a wealth of new reports and evidence. None of this has materially altered our position, but only added to our concerns. We therefore still request that the Panel decline consent for all the applications before it for the following reasons:

a) The Application in its current form sets out a system that fails to meet its stated objectives. It does not provide sufficient capacity to accommodate all wastewater flows, and hence it will experience regular and prolonged overflows of treated wastewater and unacceptably frequent overflows of untreated wastewater.

b) The Application is incomplete, confusing, contradictory and does not provide a full assessment of effects for what is proposed.

c) Regardless, for those aspects which are covered by the Application, there is a high risk of significant adverse environmental effects, because the key assumptions on which the Application is based are lacking in accurate evidence and overly optimistic.

d) The proposed system is novel and untried, but the Applicant has taken a risky rather than cautious approach.

e) The proposal fails to make efficient use of resources.

f) The proposal increases the vulnerability of the communities of Akaroa and Robinsons Bay to the effects of climate change.

2.1.3 Our submission covers the following topics:

a) The evolution of the Akaroa Wastewater proposal since 2007

b) The current proposal as it now stands

c) A summary of our concerns

d) The extensive footprint of the system

e) The environmental risks and uncertainties we identify around key assumptions underpinning the Application including the:

- standard of wastewater treatment,
- slope stability,
- nitrogen removal, and,
- non-deficit irrigation,

g) The capacity of the system to contain the treated wastewater

h) Our concerns with the untreated wastewater overflows and cumulative effects

i) The vulnerability of the proposed system to climate change

j) The feasibility of operating the system

k) The piecemeal approach to consenting taken by the Applicant

l) The environmental effects and positive benefits

m) Consideration of alternatives

n) Relief sought from the Hearing Panel

2.1.4 We have provided both expert evidence and a number of additional reports to the Panel and will reference these as relevant during our submissions. We also reference various other documents which we have provided.

Section 3. Evolution of the Akaroa Wastewater proposal since 2007

3.1 Background

3.1.1 Akaroa currently has a very simple wastewater system. Wastewater is gravity fed from the hill properties to a central pipe running along the flat town centre. Here three pumps transfer the wastewater to the treatment plant just beyond the southern end of the town. The treated wastewater from this plant is discharged to the harbour via a short outfall pipe.

3.1.2 The reasons for change are primarily driven by tangata whenua cultural issues. The plant is sited on a significant cultural heritage site, and the disposal of treated wastewater to the harbour is culturally offensive. Without these concerns it is likely that the current system would have continued to receive technological upgrades over the years, but major change would not be necessary.

3.1.3 CCC, Ngāi Tahu Parties and the Community have been trying to find a solution to the cultural issues since 2007.

3.1.4 We will now trace the key developments over this 17 year period from our perspective and describe how we have constructively contributed to a complex and protracted process.

3.2 2007-2015 – Land based irrigation for total flows considered infeasible

3.2.1 In June 2007 when the consent permitting the discharge of treated wastewater from Akaroa into the harbour expired, it was extended for 5 years to give CCC time to "*develop an integrated water strategy, based on the best options for providing water supply and wastewater services in a holistic, sustainable and affordable manner that has community support.*[1]"

3.2.2 A condition of the consent was that CCC ensured clear progress was made toward a long term solution for the discharge of wastewater. Options included discharge of an improved standard of wastewater to the harbour, land application to an area such as a forestry block, re-use in the community or a long outfall pipe past the harbour heads.

3.2.3 A Working Party was formed, in which FBPI and its fellow society the Akaroa Harbour Marine Protection Society participated. At about the same time, consulting firm MWH (who had already done some work on land disposal ideas) was engaged to consider options for relocating the Treatment Plant to a new site, and the disposal of treated wastewater via an ocean outfall. Their study released in 2008 concluded that an ocean outfall would be more expensive than land disposal.

3.2.4 In 2010 consulting firms Harrison Grierson, ecoEng and Golder Associates released their combined report "Wastewater Options & Risk Analysis Report".

3.2.5 This included a study by Geotech Consulting Ltd into potential slope stability issues in relation to land irrigation. These consultants looked into the effect of loading the land with additional water and comparing this with rainfall. They found that it is the "*cyclic variations in cumulative rainfall that is the key requirement in the initiation of widespread slope instability. Landslides can and do occur most winters, but a series of wet winters that steadily build groundwater levels is the pre-requisite to*

[1] Christchurch City CCC. Akaroa Water Strategy flyer, June 2008

widespread movement on a range of scales." [2]

3.2.6 They identified two cycles of successive wet years over the previous 100 years, and showed that 75% of fresh landslides occurred in one or other of these two periods These periods were in the 1940s and in the late 1970s.

3.2.7 From this they concluded that while summer irrigation (when evapotranspiration means that irrigation does not infiltrate to reach groundwater) would not increase the loadings, for the rest of the year – mid-March through December – irrigation should be limited to no more than 250mm, i.e. approximately 25% of average rainfall.

3.2.8 The Harrison Grierson report also included research on land disposal by Andrew Dakers of ecoEng, a specialist in the field of land irrigation. He researched four options considering various permutations of irrigation on 32ha of land including irrigation omitting the winter months, and a year round option involving storing wastewater of up to 8,000m^3 during wet weather with an overflow to the harbour via constructed wetlands for when the storage was full during prolonged wet weather.

3.2.9 In the subsequent round of public consultation, in June 2010, the public was presented with the option of either irrigating the treated wastewater to land or discharging it to mid harbour with an explanatory note that no options would fully eliminate the discharge of all treated wastewater to the Harbour.[3]

3.2.10 The Working Party, Rūnanga representatives and CCC staff then visited the treatment plant at Turangi where they were impressed by the treatment quality achieved by its modern plant.

3.2.11 By 2011 the Working Party concluded, recommending a treatment plant site south of the current site, a high level of treatment as good as that at Turangi, and a mid-harbour outfall with cultural pre-treatment. They suggested that the outfall be constructed so that it could be extended to the harbour heads eventually, and also that land trials continue. This was seen as a pragmatic start, with the caveat that neither measure was supported by the Rūnanga.

3.2.12 In 2011 CCC resolved to proceed with the mid-harbour outfall with measures to address cultural concerns, but continued to look for a new site for the treatment plant, eventually settling on the site to the north of Akaroa at the top of Takamatua Hill beside Old Coach Road.

3.2.13 In 2012 consultants Harrison Grierson was engaged to produce the concept design report. This identified that land irrigation is likely to be very difficult around Akaroa due to naturally steep landscape and that the combination of high quality treated wastewater and mid-harbour outfall will address the concerns relating to any potential effects on the Akaroa Harbour.[4]

3.2.14 Hence in 2014, CCC lodged its application for a new WWTP at Old Coach Road, a Terminal Pump Station behind the Recreation Ground, and a mid-harbour outfall.

3.2.15 In 2015 consents were approved for the WWTP and the Terminal Pump Station but the harbour

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[2] Harrison Grierson, Wastewater Options & Risk Analysis Report , February 2010, Appendix 4, Geotech Consulting Ltd, p113-115

[3] Christchurch City CCC, Akaroa's Wastewater, have your say consultation leaflet, June 2010

[4] CH2M Beca Ltd, Akaroa Wastewater Scheme Upgrading - Resource Consents Application and Assessment of Effects on the Environment

outfall was declined on the basis that it would have significant adverse effects for tangata whenua and CCC's consideration of alternatives was inadequate[5]. In coming to this decision, the Commissioners explained that the 2010 land study had been based on a relatively small area (32ha) and had misunderstood the cultural concern that any discharge of human effluent into the harbour is offensive. [6]

3.3 2016-2020 Land based solution beset with geotechnical and capacity issues

3.3.1 CCC subsequently released a new set of proposals in April 2016, based on using land in Takamatua. These included irrigation of all flows to either trees or pasture, with substantial storage in winter, and various options involving wetlands or coastal infiltration galleries discharging to the harbour.

3.3.2 The only options supported by Ngāi Tahu were the irrigation to land options, and the community did not support the coastal discharges.

3.3.3 The proposals were subsequently withdrawn after consultation when further geotechnical investigation revealed issues on two of the larger irrigation areas proposed

3.3.4 Alarmed residents, many of whom now had properties identified as suitable for irrigation, including around their homes and gardens, developed a "*Community Strategy toward an Acceptable solution to the disposal of Akaroa Wastewater"* and approached the local environmental society FBPI for support. The Community Strategy tried to take a positive and constructive approach. It identified that the wastewater flow data patterns did not match population patterns, and that it appeared as much 80% of the flows could be due to infiltration.

3.3.5 FBPI presented this strategy to a Community Board meeting in January 2017 and the Board then formed the Akaroa Treated Wastewater Reuse Options Working Party. FBPI was not offered representation on this Working Party. There were to be representatives of each of the Papatipu rūnanga, but others sitting on the Working Party would do so as individuals rather than as representatives of concerned organisations or the affected communities. Brent Martin and Suky Thompson participated in this Working Party as individuals, and kept the community and FBPI apprised of progress.

3.3.6 At the same time, CCC was in discussions with Mr Thacker, owner of the 114ha block of land at 11 Sawmill Road, Robinsons Bay regarding purchase for its use as an irrigation field. A letter recording discussions at the time notes Mr Thacker describing some of the upper northern areas continuously wet in winter. [7]

3.3.7 PDP were engaged to carry out geotechnical investigations on the Thacker property and this involved digging three bores and 12 test pits.

3.3.8 A Technical Experts group with engineers from CCC consultants and Ngāi Tahu operated in parallel to the Working Party, considering issues such as the Long Term Acceptance Rates for the soil. FBPI

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[5] Decision of Hearings Commissioners Collins and Langsbury, 9 July 2015, Cl 292 p63
[6] Decision of Hearings Commissioners Collins and Langsbury, 9 July 2015, Cl 235,236, p52
[7] Letter CH2M Beca to Bridget O'Brien Christchurch City CCC, 7 Feb 2017

engaged Andrew Dakers, principle engineer at EcoEng to participate in this forum.

3.3.9 The Technical Experts first joint statement issued in December 2016 stated: "*As part of the modelling revisions, soil infiltration assumptions used in the model and in the scheme assessment should be reviewed by a soil scientist knowledgeable on Banks Peninsula soils, with a focus on soil profile anomalies such as less permeable layers or pans. The person nominated to perform this task is Trevor Webb. Depending on the opinion of the soil scientist further physical sampling of soils may be required."*

3.3.10 Their second joint statement issued in February 2017 and referring to a water balance model developed by PDP stated: "*A particular aspect that requires checking is the Long Term Acceptance Rate (LTAR) of wastewater within the soil. LTAR is the terminal rate at which treated wastewater moves vertically downwards through sub-soils after a period of time (which could be months, or even years) once a stable soil ecology (usually referred to as biozone) has established in the soil due to residual wastewater components. It is usually expressed as mm/day, which is the same as L/m2.day. The LTAR is used to inform the recommended rate at which treated wastewater should be applied to land. A simplified explanation is that if the rate at which wastewater is applied to the land is greater than the LTAR and the evapotranspiration rate, then there is a high risk of the upper soils becoming saturated and possibly resulting in surface ponding and runoff. Clearly rainfall events will also have an impact on these risks. In summary, LTAR values depend not only on the quality of the treated effluent but also on soil texture, structure and soil profile anomalies such as less permeable soil layers (or "pans"). Rainfall patterns vary throughout the year and for different locations, and evapotranspiration varies according to types of plants grown, and wind, sunlight, air temperature and humidity at the site. All these factors must be taken into consideration to assess the risks and performance of a wastewater land application field. "*

3.3.11 Slope stability was another key factor in site selection. We attach in Appendix A a set of slides presented to the Working Party in March 2017. This presentation sets out that the land stability selection criteria being used – that land should have a slope of less than 15 ^{o} to 19^{o}, with the same applied to the downslopes and with no identified instability below. It was explained that due to the properties of the Loess soils, a small change in moisture content leads to a large change in strength. Slips could occur in the downslopes as a result of groundwater mounding creating reduced suction in the partially saturated zone.

3.3.12 Hence the idea of irrigation at very low rates distributed over the 500ha CCC owned Misty Peaks reserve on the hillside above Akaroa was rejected on the basis that on the steeper land of this reserve, even irrigation at very low rates was a land stability risk.

3.3.13 Mr Offer confirms this in his Applicant's evidence stating '*Much of the land on Banks Peninsula is not suitable for irrigation as it is too steep*.[8]*"* (19 degrees slope is set as an upper limit for irrigation in a relevant USEPA design guideline)

3.3.14 By 3 April 2017, CCC issued its second consultation on the "Akaroa Reclaimed Water Beneficial Reuse, Treatment and Disposal Options". This identified suitable areas for irrigation - large areas in

[8] Applicant's Evidence, Offer, Cl 3.33, p10

Robinsons Bay, including the Thacker land and land around homes on the valley floor, some smaller areas in Takamatua that could be supplementary to Robinsons Bay, and a large headland on the south-eastern side of the Peninsula at Pompeys Pillar.

3.3.15 Andrew Dakers issued a letter to FBPI which was included in its submissions to CCC, and which we now provide in Appendix B. This urges a cautionary and staged approach to land irrigation, given the risks to public health, slope stability and costs.

3.3.16 The FBPI 2017 submission focussed on the principles established in the Community Strategy referred to above and the re-use of wastewater to reduce the chronic water shortages in Akaroa. We pointed out that CCC had failed to distinguish between a disposal system and a beneficial reuse system. A disposal system distributes water to the receiving environment whether it needs it or not. In a beneficial reuse system water is a resource and irrigated or used according to the needs of the receiving environment. We stated our preference for a genuine beneficial reuse system, most particularly in Akaroa which has chronic water supply problems. We put forward ways we thought this could be achieved through distributed storage.

3.3.17 We included analysis by Dr Martin revealing that the drinking water volumes as measured by CCC were much greater than the wastewater volumes and submitted that "*we are therefore confident that once the purple pipe network was reticulated throughout Akaroa all the wastewater flows could be re-used for external non-potable uses, principally watering gardens*[9]*."*

3.3.18 Subsequent checking of this assertion by CCC revealed that the flow meter being used to measure the wastewater was faulty, and had been for an unknown length of time. As reported in Greg Offer's evidence: "*New flow meters were installed, and the new flow data indicated that actual flows were more than twice the previously reported flows. The flow error, and implications for the scheme, were reported to Ngāi Tahu at a hui on 2nd of August 2017, and also to the Akaroa Wastewater Working Party on 20th November 2017.*[10]*"*

3.3.19 CCC subsequently advised that earlier wastewater flow records prior to the amalgamation of Banks Peninsula District with CCC had been lost and that it had no idea of when the fault had occurred.

3.3.20 Harrison Grierson had advised of the faulty flow meter in February 2010 noting in a Technical Memorandum attached to their report that "*Based on the recent influent flow data provided by CCC, the daily wastewater flow in Akaroa ranges between 50 and 2500m³/day. It is understood that the flowmeter is faulty and the readings likely to be inaccurate*. *CCC is working with the flowmeter supplier to re-calibrate the flowmeter. However, for the purposes of this study, it has been decided to disregard the flow measurements and consider typical New Zealand per capita*"[11]*."* It would appear that this recalibration never happened.

3.3.21 This meant that there was no historic record of the wastewater flows, and that all work carried out between 2010 and 2017 was based on faulty flow information, including the 2015 consent application

[9] FBPI submission 30 April 2017, Section 7.2 p15

[10] Akaroa Wastewater Summary of Disposal and Reuse Options, CH2M BECA, 17 July 2020 Section 3.7 p20 attached to Applicant's evidence Greg Offer

[11] Harrison Grierson, Wastewater Options and Risk Analysis Report, February 2010

for the WWTP and TPS.

3.3.22 The doubling of the wastewater volume also meant that options previously being considered were no longer viable and the storage and land requirements had substantially increased.

3.3.23 CCC therefore extended its land search to Goughs Bay (on the outer Peninsula coast) and trialled Deep Bore Injection. The idea of Managed Aquifer Recharge was briefly considered, but rejected on the grounds of health concerns. Other alternatives brought to the Working Party by community members including storage in distributed tanks, irrigation to the large Council owned Misty Peaks reserve behind Akaroa, purple pipe, reverse osmosis treatment and cultural pre-treatment prior to harbour discharge and ocean outfall were either dismissed as infeasible or considered outside the terms of reference.

3.3.24 CCC's principal work continued to focus on the Thacker site in Robinsons Bay. PDP now developed their proposed irrigation rates and the storage model to calculate in more detail how much storage would be needed given the amount of irrigable land available (using the very limited actual data now available from the working flow meter),

3.3.25 CCC also proceeded to negotiate to purchase the land opposite the treatment plant site (referred to in the AEE as the Hay Paddock), because the increase in wastewater volume necessitated an untreated wastewater buffer tank to store water prior to processing through the new wastewater treatment plant.

3.3.26 In April 2019 it was thought that available land for irrigation on the Thacker Property was 30ha, and the storage requirement (even with a 20% I&I reduction) would be 40,000m^3 [12]. This seemed an impassable block until the idea of an overflow using a wetland releasing to Childrens Bay stream and enabling larger spills once every 10 years was added, thus bringing down the storage requirements considerably.

3.3.27 As Working Party members we requested access to the model being used to calculate the storage from the flow meter data, but this was denied on grounds that it belonged to the consultants, not CCC, and was commercially sensitive.

3.3.28 By early 2020 CCC had settled on 4 options:

1. The Inner Bays option included 40 ha of irrigable land 34ha on the Thacker property in Upper Robinsons Bay, 5.2ha at Hammond Point and a further 2.9ha at Takamatua. 19,500m^3 of treated wastewater storage was planned in a large open dam on the Thacker land. The overflow mechanism from the wetland to Childrens Bay stream would deal with wet years when the storage proved insufficient. The irrigation rates as determined by PDP back in 2018 were set at Summer – 2.75mm/day, Spring and Autumn 2.25mm/day and Winter 1.5mm/day. The maximum irrigation application per day was selected as less than the Long Term Acceptance Rate (LTAR) of the soils to avoid surface ponding when the PAW is at field capacity. We believe that the LTAR was based on field testing with 12 test pits and soil

[12] Letter CH2M Beca to Kylie Hills 4 April 2019 p3(Working Party 2019_04_04 meeting)

descriptions as given in the infiltration testing results carried out on the Thacker property in late 2016 and early 2017.

2. The second option was irrigation to 33 hectares at a remote farm at Goughs Bay. The wetland and overflow would not be needed for this option.

3. The third option was irrigation to 48 hectares at a remote farm at Pompeys Pillar. Again the wetland and overflow would not be needed.

4. The fourth option was a revised Harbour outfall based on routing the treated wastewater overland back through the town to an outfall pipe from Glen Bay (which Dr. Martin had suggested at the Working Party would be less expensive than the 2015 proposal and facilitate re-use).

3.3.29 The Working Party released a joint statement, which expressed its disappointment in the final options, especially as an increasing impact of climate change will be scarcity of water and none of the options included reuse..

3.3.30 The statement reported mixed views on the Inner Bays irrigation scheme option, with some members considering it unacceptably risky, negative impacts on affected communities and concerned that a complex and untried native tree irrigation system would be placed in the centre of communities, close to houses and streams and with little margin for error or expansion capability. While acknowledging community concerns, other members of the working party, including Rūnanga appointees, supported this option and saw considerable environmental and ecological benefits.

3.3.31 The Goughs Bay option had more support than any of the others, but there were still mixed views on this, with concerns regarding the lack of detailed design and research, about the high pressure pipeline, costs and the potential impacts on the environment and community.

3.3.32 It is worth noting that there had been very little discussion about the high I&I levels in Akaroa during the 3 years that this Working Party had been meeting. CCC wastewater staff at the time did not consider that I&I was overly high.

3.3.33 By the time the Consultation Document was released in 2020, the cost of the Harbour outfall/purple pipe option, which had earlier been costed at half that of the Inner Bays scheme, had been inflated to $45m-$52m. The Inner Bays Scheme was costed at $54m to $63m. This has now risen to $107m, of which $15m already spent on the process.[13]

3.3.34 The four options were more fully described in the “Akaroa Wastewater Summary of Disposal and Reuse Options” report by CH2M Beca released in July 2020. Mr Offer has included this with his Applicant’s Evidence, but this does not include the report Appendices.

3.3.35 This report states that Membrane Filtration has been adopted as a required treatment process since 2014 and had been specifically included in the concept design, with the Membrane type being described as Hollow Fibre ultra-filtration.[14] Treatment of wastewater to a very high standard using ultrafiltration membranes for 100% of flow with no bypass during wet weather was given as the risk

[13] Applicants Evidence, Hills. Cl 20.2, p43

[14] CH2M Beca, Akaroa Wastewater Summary of Disposal and Reuse Options, 17 July 2020Table 2-3, page109

mitigation for the key risk that wastewater quality poses risks to receiving environment.[15]

3.3.36 The Consultation Document refers to 'highly treated wastewater' throughout and states "*Akaroa's wastewater will be treated to a level that is among the highest anywhere in New Zealand."*

3.3.37 Raw wastewater buffer storage of 6,000m^3 was described as providing an ARI of approximately 1 in 15 years based on modelling of wastewater flows for the period 1972-2019.[16]

3.4 2020 - I&I emerges as key issue

3.4.1 It was only later after the Beca report setting out the consultation options in more detail was released in July 2020, that FBPI read that 61% of the wastewater being processed was storm and ground water infiltration[17] due to the poor state of the Akaroa pipe network.

3.4.2 Hence submitters to the 2020 consultation, including FBPI, overwhelmingly requested that CCC fix the pipe network to reduce the I&I rather than treating and pumping so much stormwater and building large and expensive storage dams. The high levels of I&I meant that the sizing of the entire system was determined by rainfall, rather than by the levels of human sewage. The size and risks of the storage dam were a major concern.

3.4.3 FBPI's 2020 submission once again focussed on reducing the volume of wastewater and a beneficial re-use solution to address the chronic water shortages in Akaroa and proposed a four stage plan based on a) reducing I&I, b) constructing a purple pipe re-use system with discharge of excess to harbour via wetland, c) treating the water to a potable standard using a reverse osmosis system, and d) eventual recharge of the potable supply upstream of the water intake. The submission was endorsed by 324 people.

3.4.4 There was minimal community support for the Inner Bays scheme. In addition to the number of supporters of the FBPI submission, the majority of individual submitters (53%) favoured the harbour outfall with purple pipe solution. The Ngai Tahu parties supported the Inner Bays scheme, but also supported I&I reduction.

3.4.5 Despite the lack of community support and the high costs, CCC elected to proceed with the Inner Bays Irrigation Scheme, recommending that the infiltration first be reduced to less than 20% in line with the best practice guidelines then advocated by Water New Zealand[18].Other recommendations were that it report regularly to the community on progress; reduce water use by introducing metering; reduce the storage volume through I&I reductions; water conservation and potentially additional wetlands; investigate creating local employment to plant and maintain the trees; approves irrigating public parks and toilets; and set up a Community Reference Group to ensure that community concerns were listed to and where possible addressed. We include the Resolution in Appendix C

3.4.6

[15] CH2M Beca, Akaroa Wastewater Summary of Disposal and Reuse Options, 17 July 2020Table 13-1, page149
[16] CH2M Beca, Akaroa Wastewater Summary of Disposal and Reuse Options, 17 July 2020, page1115
[17] CH2M Beca, Akaroa Wastewater Summary of Disposal and Reuse Options, 17 July 2020Table 2-3, page 8
[18] Water New Zealand I&I 2015: Infiltration & Inflow Control Manual Volume One, March 2015

3.5 2021-23 Development of application alongside limited I&I reduction

3.5.1 CCC now proceeded to develop its Inner Bays proposal whilst also trying to bring down the I&I levels

3.5.2 A Community Reference group was set up, with Terms of Reference limiting its input to largely cosmetic matters. Little else of the aspirational recommendations seems to have been pursued or achieved.

3.5.3 The land required for the scheme was purchased including the Thacker land at Upper Robinsons Bay (114ha), a strip of the neighbouring Reid land (4ha), a long narrow block of land below the site for the WWTP (the 'Hay Paddock', proposed wetland area and land below),, and the land at Hammond Point. CCC was not able to obtain the land on the Takamatua valley floor that had formed part of the 2020 consultation option.

3.5.4 As a result of revised flow modelling completed by PDP in January 2022, storage in covered tanks (first suggested by FBPI) was adopted rather than the highly unpopular open dam, covered tanks having now been shown to reduce capacity requirements (by preventing rain from increasing the volume of stored water). Covering the tanks also met the Community Reference Group preference as mitigation for odour and midges

3.5.5 Another development was the discovery that the Akaroa drinking water treatment plant at L'Aube Hill was not working to its design specifications, and was instead spilling a large volume of retentate water into the wastewater system, contributing to the high levels of I&I. This was a problem CCC thought it could fix.

3.5.6 The ATWIS application was lodged by CCC on 1 June 2023.

3.5.7 FBPI obtained a copy soon after this and was shocked to find substantive changes in the capacity parameters from the 2020 proposal.

a) The area of land available for irrigation had been reduced from 40ha to 35.7ha (the landowner in Takamatua had proved not to be a willing seller)

b) The concept of the wetland overflowing to Childrens Bay 1 in 10 years had been dropped. The system was now presented as a closed one, with all flows being irrigated to a land area reduced in size by more than 4ha.

c) CCC only proposed to construct 12,000m3 of treated storage stating this would suffice based on modelling wastewater flows using rainfall records over a 50 year period.

d) The I&I reduction goal had been changed to a reduction by 20% - a very significant difference from the CCC resolution recommending a reduction to 20%.

3.5.8 After investigating the detail we realised that:

a) The irrigation rates had been increased by 12% over that previously considered within LTAR to account for the lesser area of land. This was hard to discover, as the Appendix F giving the storage modelling was still based on the 2020 rates and 40ha of land.

b) The sizing of the storage was based on CCC achieving a further 20% reduction in I&I, and a 75% reduction in the retentate from the drinking plant.

c) However, there was little information in the AEE on how successful the I&I reduction work (critical to the system sizing) had been to date. Preliminary results as of April 2022[19], were given, but nothing to show what had been achieved in the year prior to application lodgement in June 2023, thereby omitting the very wet 2022 winter.

3.6 2023 – Flow modelling shown to be incorrect

3.6.1 FBPI data analyst Dr Martin therefore decided to examine the wastewater flow and storage modelling, concerned that the flows had been estimated based on metered data from a very limited time period of mid-2017 to 2020 – and that this was a period when the weather had been very dry.

3.6.2 By now it was late August 2023, and metered flow data was available for the additional years of 2021 to mid-2023, which included two wet winters.

3.6.3 Dr Martin replicated the modelling used by Beca and PDP and validated it by recreating the same results published by PDP for the year 1978 in Appendix F of the AEE.

3.6.4 He then applied his model to calculate the storage requirements and compared this with the storage requirement using the actual flows (with the anticipated I&I reductions applied) for 2017-2023. This showed that while PDP's model was reasonably accurate in dry years, it had greatly underestimated the storage requirement in wet years.

3.6.5 Further analysis revealed that the Beca/PDP model, based on dry years, had failed to take into account the long time it takes for the soil to drain during wet winters when the ground is saturated, and therefore groundwater infiltration continues for a prolonged period in wet years compared with dry years. The chart below comparing modelled with actual flows for the wet year of 2022 demonstrates this.

[19] AEE Section 4.3.1, p24

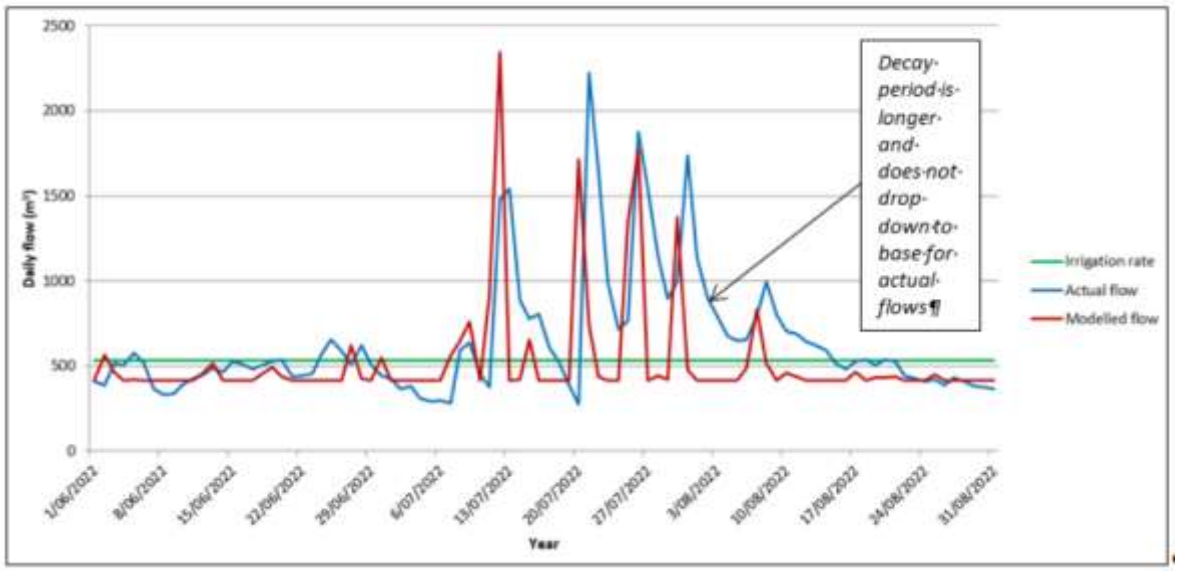

Figure 1 Modelled versus Actual Flow Winter 2022[20]

3.6.6 He further advised that based on a simpler (but more accurate) regression model of winter rainfall versus storage, 12,000m^3 would be inadequate in 22 of the 51 years modelled.

3.6.7 Dr Martin alerted CCC of his findings on 1st September 2023, but they appeared unwilling to engage on the matter despite repeated attempts to do so. He subsequently sent his full report to CCC and CRC on the 1st October 2023, and we have supplied it to the Hearing Panel with the documents submitted by FBPI. Dr. Martin's report is entitled *Evaluating the Water Storage Requirements for the Akaroa Treated Wastewater Irrigation System applying actual flow data from 2018-2023*. 20 August 2023

3.6.8 Dr Martin was subsequently informed by CCC that the flow meter used for their reported flow data was faulty, and could not be relied on back to 2021. The data from this meter had been published on the CCC website and was the data supplied to CRC to report wastewater volumes as required by the conditions of the discharge consent for the Akaroa WWTP. (CRC204086)

3.6.9 CCC then supplied Dr Martin with the data from flow meter PS616, the last meter on the Akaroa pipe network before it reaches the existing WWTP. This meter measures all flows except from 1 house at Takapuneke and the leachate from the former landfill above it, and therefore provided a reasonable proxy for total flows. Dr Martin repeated his modelling with the PS616 data, but this did not change the conclusions; the storage was still undersized in 22 of the 51 years.

3.6.10 What it did reveal however, was that the existing system had the capacity to deliver flows to the treatment plant that were above the new network cap of 3,562m^3 used in the PDP modelling. This raised concerns that the Terminal Pump station might also be undersized and give rise to additional raw overflows.

3.6.11 The second report entitled: *Addendum to Evaluating Water Storage Requirements for Akaroa Treated Wastewater Irrigation System Using Actual Flow Data from 2018-2023, 29 November 2023*was also sent to CCC and CRC.

[20] Martin, *Evaluating the Water Storage Requirements for the Akaroa Treated Wastewater Irrigation System applying actual flow data from 2018-2023*. 20 August 2023, Figure 5, p7

3.6.12 We have provided both of Dr Martin's reports with our evidence to the Hearing.

3.7 2023-2024 Changes to the lodged application

3.7.1 Substantive changes have been made to the Application since it was lodged in 2023.

3.7.2 These changes are poorly documented, often in the form of emails. A revised AEE with a full description and revised effects has not been provided. These changes include:

a) The findings of the Beca Akaroa Wastewater Scheme Design Flow Basis Update Report, released in 2024 and updating the total wastewater flow volumes based on the additional years for which metered flow data is available. This new report:

- confirmed the findings of Dr Martin's reports that the wastewater flows were much larger than thought at the time the application was lodged due to the long time it takes for elevated soil moisture levels to drain after prolonged wet weather
- changed the basis on which flows are modelled, removing the 20% I&I reductions and 75% retentate because CCC had completed its reduction programme and the later data now reflected what it had managed to achieve.
- showed that even with 20,000m^3 of treated storage, there would be overflows in approximately 21 of the 50 years.

b) Acknowledgement that treated wastewater overflows will occur and will require a discharge consent, but that this would be applied for in the future alongside the Duvauchelle application.

c) Advice that the Duvauchelle and ATWIS systems would be combined, with the raw wastewater from Duvauchelle being sent to the Akaroa WWTP for treatment and then storage at Robinsons Bay. The storage at Robinsons Bay has been increased by 4,000m^3 volume accordingly, but there is no change proposed to the irrigation field as it is proposed that flows commensurate to those from Duvauchelle would be sent back there for irrigation, subject to a later consent.

3.8 2024 - I&I situation

3.8.1 We now discuss the current state of the I&I levels, as the wastewater flow volumes are still predominantly determined by I&I, particularly in the years when overflows are predicted to occur.

3.8.2 Mr Hills provides a summary of the current I&I situation in Section 14 of his evidence.

3.8.3 He includes the requirements of the current Akaroa WWTP discharge consent (CRC204086) that CCC must reduce I&I to below 50% by 31 October 2022 and below 40% by 31 October 2025.

3.8.4 He sets out the formula prescribed in the consent for calculating this in his Clause 14.4. We repeat this here, as understanding how the I&I is being calculated is critical to evaluating the effectiveness of reduction measures to date.

CRC204086 (6)

a. The volume of inflow and infiltration from the Akaroa wastewater network exiting the Akaroa Wastewater Treatment Plant shall reduce to:

Below 50 percent inflow and/or infiltration by 31 October 2022; and
Below 40 percent inflow and/or infiltration by 31 October 2025.

b. The inflow and infiltration percentage shall be determined as follows:

$$\%\ \text{Inflow and Infiltration Flows} = 100 \times \frac{\text{Inflow and Infiltration Flows}}{\text{WWTP Flows}}$$

Where:

- *Inflow and Infiltration Flows = WWTP Flow – Legitimate Wastewater Flow.*
- *The WWTP Flow shall be as measured at the WWTP outfall flowmeter.*
- *Legitimate Wastewater Flow = Commercial Flow + Residential Flow + Water Treatment Plant Backflush Flow.*
- *The Commercial Flow shall be measured as the boundary water meter flow for commercial properties connected to the Akaroa wastewater network. Where the meter read dates do not align with the period of assessment, the average daily flows from the most recent meter reads must be used.*
- *The Residential Flow shall be calculated as the permanent Akaroa population (refer to Statistics New Zealand for the most recent census data) multiplied by a factor of 240 litres per person per day.*
- *The Water Treatment Plant Backflush Flow shall be calculated as 10% of the total water abstracted from streams and bores to supply the water treatment plant until permanent metering is commissioned at which point the flowmeter data shall be used.*[21]

3.8.5 Mr Hills presents a set of Annual Averages showing the I&I as a percentage of total wastewater flow[22]. On a first glance these would indicate the consent conditions have been met.

3.8.6 FBPI does not consider that they have been. The formula given in the consent condition does not state that I&I is to be presented as an annual average. The use of annual averages masks whether meaningful I&I reduction has been achieved, because a dry summer without I&I offsets a wet winter when the amount can be large. It is the wet winter, or any prolonged wet period, that drives the storage requirement and creates overflows.

3.8.7 We thank Mr Hills for supplying the detailed data used to calculate his annual averages. The spreadsheet supplied aggregates monthly estimates of the I&I using the consent formula above. Legitimate Wastewater Flow is subtracted from Total Wastewater flow, and the difference is assumed to be the I&I.

3.8.8 We identify that in calculating the monthly I&I figures, there is an adjustment such that if the calculated I&I for a month is negative, it is then set to 0. This has happened in 36 out of the 89 (40%) months in the data set.

3.8.9 The most likely explanation for this "negative I&I" is that the Legitimate Wastewater Flow has been overestimated. Legitimate Flow is the sum of Commercial, Residential flows and Water Treatment Backflush flows. However, none of these are based on accurate measured data throughout the 7 years presented in Mr Hills evidence. Akaroa's highly seasonal population is based on estimates throughout, commercial meter data is only available from 2023, and then is not a daily metered figure, and backflush flows also appear to be inferred until 2023. The annual averages presented

[21] RESOURCE CONSENT CRC204086, Canterbury Regional Council, Granted to Christchurch City Council, To discharge contaminants to water, 24 May 2022

[22] Applicants Evidence, Hills, Cl 14.5, p29

have not been qualified with any statement regarding the uncertainty in the underlying data..

3.8.10 If the Legitimate flows have been overestimated, then this means that the I&I levels are higher than presented. A possible alternative explanation is that the Legitimate Wastewater Flow estimate is more or less correct and the negative I&I figures represent wastewater leaking out from the pipes. The reality could be a combination of both.

3.8.11 Regardless, it would seem that Mr Hills is aware of the perils of annual averages, as he also presents the monthly figures for July 2022 and July 2023 as 69% and 70% I&I respectively. Later in his evidence he states that *Wet weather I&I has not improved as significantly.*[23]

3.8.12 Given the lack of progress in reducing I&I during wet conditions, and the uncertainty around the data being used to assess I&I levels, we question how the requirement to reduce I&I to below 50% by October 2022 has been met. We question whether CRC has performed any review of the data received and of its suitability for monitoring the consent condiitons.

3.8.13 Of equal concern to FBPI is that CCC and CRC have not developed a more robust methodology to measure I&I. The current methodology relies on the weather to demonstrate effects. It does not inform on how well the pipe network is behaving in advance, instead it requires wet weather to find this out. If the winters of 2022 and 2023 had been dry, I&I daily or monthly levels might well have been below 50%. The reduced measurement then serves to create a sense that all is well, until a subsequent wet winter produces massive overflows. This is not a problem currently, because the harbour outfall can dispose of very high volumes of water. It will however be a significant problem if CCC moves over to a fixed capacity land based system, because high levels of I&I will result in greater overflows.

3.8.14 As Mr Hills informs, the planned work on the public network is now complete and CCC is only addressing inflow from private properties. In our view (and informed by sample figures provided by CCC) this will do little to address the issue as the contribution by private issues is likely to be only a small proportion of total I&I.

3.8.15 We think it unlikely that the long drainage tail shown in Figure 1 above that contributes to high I&I in wet periods is due to problems such as gully traps being overwhelmed, as these would occur as an immediate response during a storm. It seems more likely that it results from the gradual drainage of the soil and ongoing infiltration into the pipe network underground.

3.8.16 We do not accept that I&I is just a fact of life. Any infrastructure will inevitably have a limited life span. We submit that now is the time for substantial investment to completely repair, and replace where necessary, the aged sewer pipe network that is no longer fit for task, along with any associated issues with the stormwater network.

3.8.17 Substantially avoiding and properly measuring I&I will be critical to the sustainability and management of a fixed capacity system such as is currently proposed. Therefore the **development of a more robust measurement method that does not rely on wet weather events to measure the extent of I&I would be preferable in setting any conditions around I&I reduction.**

[23] Applicant's Evidence, Hills, Cl14.12 p31

3.8.18 A further insidious issue is that, as well as letting groundwater in, the damaged old pipes are likely to be leaking raw sewage out into the surrounding environment and into the stormwater network. This has been implicated in the increasing frequency of high levels of faecal contamination at Akaroa's beaches and coastline. This leaking network will only get worse in future as pipes age and as more extreme climate change driven storms occur.

3.8.19 CCC has stated that there will be no raw sewage overflows from the ATWIS, but this ignores the fact that it has not comprehensively addressed the leaking sewer pipe network which is responsible for raw sewage spills in wet weather and implicated in the seepage of raw sewage in Akaroa.

3.8.20 The issue of I&I and the risks it creates for the environment and for the ATWIS system have not been resolved.

3.9 Contributions of FBPI

3.9.1 As described above, FBPI has engaged constructively with the process for many years, (even during the time when we were denied formal representation on the Working Party). During this time we have held or attended public meetings to keep our communities informed of progress and garner their feedback. We have made numerous representations to the Banks Peninsula Community Board and to CCC.

3.9.2 As a result we have a thorough understanding of the system both at an overview level and down to the detail of different aspects.

3.9.3 The involvement of FBPI and the expertise provided by Dr Martin and others has been pivotal in exposing the faulty flow meter, the capacity issues and the level of I&I. We have essentially acted as an external reviewer over the process for many years, and this has involved working through huge numbers of technical documents.

3.9.4 All of the work of FBPI has been undertaken on a voluntary basis, and in addition, we have raised over $100,000 from community members to fund legal and expert support during the 2020 consultation and this current consent process. We believe this demonstrates the high level of concern regarding this proposal in the Akaroa area community.

Section 4. The Application as it now stands

As we have stated, the Application is incomplete, confusing, and contradictory, both as it was lodged and even more so after all the subsequent changes. We set out below what we understand the proposal to be, and therefore what we are basing this submission to the Panel on.

4.1 Schematic of design

4.1.1 We generally agree with the schematic provided in Figure 2, Cl 31 of the CRC s42A report which includes the various updates in red.

4.1.2 However, it omits the overflow paths now identified so we reproduce it below with these added in pink.

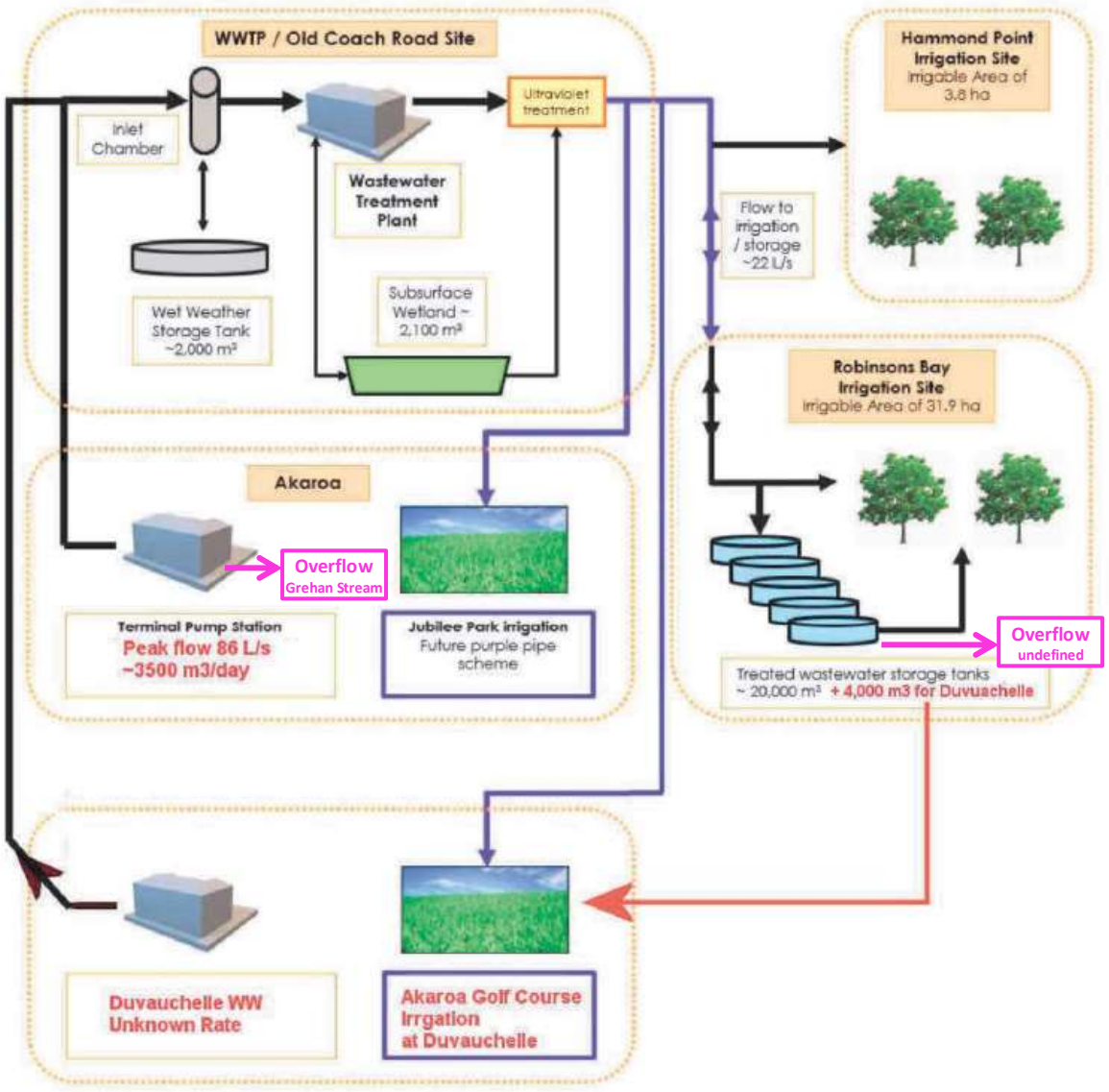

Figure 2 Proposed system

4.1.3 We now provide more detail on each component.

4.2 Akaroa and Duvauchelle combined flows

4.2.1 Wastewater from both the Akaroa and Duvauchelle networks is proposed to be piped and pumped to the proposed new Akaroa WWTP for treatment.

4.2.2 Modelled flow volumes are:[24]

Table 1 Modelled Flow Volumes for Akaroa and Duvauchelle

Source	Average Flow	Peak Flow
Akaroa[25]	653m^3/day	4,817m^3/day
Duvauchelle	80m^3/day	1,040m^3/day
Total	733m^3/day	5,857m^3/day

4.2.3 From these figures we note:

a) Duvauchelle has even higher levels of I&I than Akaroa. Peak flows for Duvauchelle are 13 times average flows, compared to just over 7 times for Akaroa

o) Adding Duvauchelle flows increases the total average daily flow by 12%, and the peak flow by 22% compared to Akaroa on its own.

4.2.4 The Akaroa wastewater includes both domestic and commercial wastewater plus leachate from the former landfill off Ōnuku Road, above the current treatment plant.

4.3 Terminal Pump Station (TPS)

4.3.1 The TPS is to be situated beside the Grehan Stream in the Freedom Camping area and boat store carpark near the town entrance. It is a large structure with dimensions are 13m x 17.5m x 7m high, and positioned approximately 800mm above the existing ground level.[26]

4.3.2 All wastewater flows from Akaroa will be piped to this location, given a primary filtration treatment and then pumped up the hill to the WWTP. The TPS will be opened and material filtered will be removed by truck.

4.3.3 The Applicant holds consents CRC152814 (discharge construction phase and developed phase stormwater to water) and CRC150049 (discharge of odour) for the Terminal Pump Station granted as part of the 2015 decision, and renewed in 2019, but not a land use consent to operate from the Regional Council. There are no conditions in the CRC150049 limiting the times or frequencies when the Terminal Pump Station can be opened, or that odour must not be "*readily discernible to the general public"* as set out in the original decision, We presume that these were removed after the Applicant appealed the discharge conditions.

4.3.4 We note that this area beside the Terminal Pump Station is used much more heavily than it was in 2015 when the two consents were obtained, because since that time it has become the designated freedom camping area for Akaroa. The designated area is often full or overflowing, and is used 24

[24] Beca Akaroa & Duvauchelle Combined Wastewater Schemes Feasibility MCA Assessment Report 13 Feb 2024, p2-3
[25] Beca Akaroa Wastewater Scheme Design Flow Basis Update Report, 8 April 2024, Table 5-2, p29
[26] AEE, CH2M Beca 2014, Akaroa Wastewater Scheme Upgrading -Resource Consents Application and Assessment of Effects on the Environment p44

hours a day, year round.

4.3.5 The TPS includes an emergency outfall into the Grehan Stream, but no discharge consent is in place to cover emergency or non-emergency discharges, and the AEE for the 2015 application did not describe the effects of this discharge.

4.3.6 The CRC s42A report states that the TPS requires a land use consent under LWRP Rule 5.84, and that this land use is a discretionary activity[27]. However the need for land use consent for operating the Terminal Pump Station and its associated discharges is not referred to in the ATWIS application, and there is no assessment of the effects. Ms Mitten has not given it any consideration in her s42A report.

4.3.7 CCC has recently increased the TPS maximum pumping capacity from 65L/s as set out in the 2015 decision to 85L/s. This change was reported in an email from Janan Dunning to Joanne Mitten on 8 October 2024. The increase in pump size was advised in the Beca Akaroa Design Flow Basis Update Report as needed for CCC to achieve the1 in 5 ARI design standard for overflows that it had informed Beca it was seeking.

4.3.8 The Terminal Pump Station with the revised pump is therefore expected to overflow untreated wastewater 1 in 5 years based on weather patterns used in the flow modelling.

4.4 Wastewater Treatment Plant (WWTP)

4.4.1 The Applicant holds consents CRC150050 (discharge contaminants (odour) to air and a land use to store effluent) at the proposed new Wastewater Treatment Plant site Lot 3 DP 459704 adjacent to the upper stretch of Old Coach Road.

4.4.2 The evidence of Mr Hills, states that it still requires a land use consent under the regional plan due to a subsequent change to that Plan[28]. We understand after clarification during the hearing that this refers to Rule 5.84 in the LWRP. However, the CRC s42A does not include the WWTP in the list of items requiring land use consent under Rule 5.84. Our reading of Rule 5.84 and the existing consent CRC150050, is that Mr Hills is correct. The existing consent provides for the land use to store wastewater, but not the other activities and effects (except the discharge of odour to air) associated with the WWTP, including operating the WWTP.

4.4.3 We therefore draw the attention of the Panel to the lack of information or assessment of the WWTP under LWRP 5.84 in the Application and the CRC s42A.

4.4.4 The treatment process now proposed is Intermittent Decanted Aerated Lagoon (IDAL).[29] This new information was provided in the Applicant's Evidence by Mr Mellish and has not previously been put before the public, nor to the experts contributing to the S42A reports.

4.4.5 It is a significant change from the ultra-filtration process proposed in the 2020 consultation design.

4.4.6 From our inquiries, we understand that the ultra-filtration process, promoted by the Applicant in 2020

[27] CRC s42A, Cl263-264, p40
[28] Applicant's Summary of Evidence, Hills, Cl 15(c), p2
[29] Applicant's Evidence, Mellish, Cl4.3 p6

as providing highly treated wastewater, was deleted as a potential WWTP option during a review conducted by GHD in 2022. The reason for this is not stated in that report. It describes five options that had been put through an MCA process, and of these five, only MBR (the ultra-filtration option) had been described as "High quality effluent achieved".

4.4.7 In February 2024 we were informed via the LGOIMA process that a modified Ludzack-Ettinger process was proposed for the new Akaroa wastewater scheme with supplementary clarification, filtration and UV disinfection.[30] We note that this is a biological nutrient removal process often used with MBR.

4.4.8 The choice of IDAL, a Sequencing Batch Reactor process, is therefore a very recent change, and we are unsure of the implications in terms of the treatment standard it will provide for removal of pathogens, nutrients and emerging contaminants, compared to the previous ultra-filtration process. We are concerned that the quality of treatment will not be as high as with ultrafiltration.

4.4.9 This hearing process incorporates the opportunity to set the conditions on the quality of treated wastewater outflowing from the new WWTP and we return to this later.

4.5 Raw Wastewater buffer tank

4.5.1 Once it was discovered that wastewater flows were much greater than set out in the 2015 application, the treatment plant as consented was too small to buffer the volume of incoming flows. Hence, the concept of a separate raw buffer tank was introduced to hold the excess raw wastewater during very high flows until the WWTP had capacity to treat it. Due to the small size of the treatment plant site, further land was needed to house this substantial tank. This land is the Hay Paddock opposite the treatment plant.

4.5.2 The buffer tank was sized at 6,000m^3 in the 2020 proposal.[31] However the size in the Application is 2,000m^3 and we do not understand how the much smaller volume has been arrived at. This was done *before* the IDAL process was selected, so is not related to that decision. What we do note here is that the size has not changed since the application was lodged despite substantial changes to the anticipated flow volumes.

4.6 Treated storage

4.6.1 The Application is particularly confusing with regard to the amount of treated storage to be provided.

4.6.2 The AEE, as lodged, stated that 12,000m^3 would be constructed initially, but consent was sought for up to 20,000m^3 to provide headroom. However, the conditions in Appendix X of the lodged Application set out the minimum volume of storage to be constructed as between 8,000m^3 and 12,000m^3, not 12,000m^3 to 20,000m^3.

4.6.3 On March 5 2024, a letter from Janan Dunning of Stantec to CRC planners Leah McEnhill and Kelly Walker stated that CCC now planned to treat the wastewater from Duvauchelle at the ATWIS WWTP and to store the treated wastewater at Robinsons Bay. The letter states modelling had identified that

[30] LGOIMA Response from CCC to FBPI Question 5, dated 15/2/24

[31] Beca Akaroa Wastewater Summary of Disposal and Reuse Options, Prepared for Christchurch City Council, 17 July 2020

an additional 4,000 m^3 of treated storage should be provided for Duvauchelle's wastewater volume but then proposed to increase the treated storage volume to 27,000m^3 [32].

4.6.4 On 2 April 2024 communication from Janan Dunning to Jo Easterbrook at CCC states that: "*The proposal is to increase the scheme's treated wastewater storage capacity due to the Duvauchelle scheme conveying wastewater to the new treatment plant at Old Coach Road. The applicant now proposes: 24,000 m^3 of treated wastewater storage in ten x 23 m diameter covered tanks up to 9 m high at the roof apex*" [33].

4.6.5 In the Applicant's Evidence, Mr Hills states in Clause 12.14 that, in light of the scenarios assessed in the Beca Akaroa Design Flow Update report, the Applicant has determined storage should be increased to 24,000m^3. However, he then goes on to provide information that contradicts the emails from Janan Dunning, stating that in March 2024, the Applicant informed CRC of their intention to vary the application to "*increase storage to 24,000m^3 and future-proofing to include a minor portion of wastewater originating from the Duvauchelle catchment for when the Applicant sought to process that at the WWTP*"[34].

4.6.6 We suggest that the 4,000m^3 will in fact be needed for Duvauchelle.

a) The Beca *Duvauchelle Wastewater Scheme Design Flow Basis Update Report* dated 13 February 2024 shows that with 4,000m^3 of storage and irrigation field of 6.4ha, Duvauchelle would experience overflows in 17 of the 50 years examined.[35]

b) The daily wastewater actual flow volumes from Akaroa and Duvauchelle for the years 2022-2024 presented in Appendix C show that the peak flows are experienced at the same or very similar times, suggesting to us that the additional 4,000m^3 of storage will be needed for Duvauchelle and that flows from the two communities will only infrequently offset each other by using the storage at different times.

4.6.7 Regardless, our understanding is that the Applicant is now requesting consent to install treated storage at Robinsons Bay to hold 24,000m^3 of treated wastewater flows from both the Akaroa and Duvauchelle networks.

4.6.8 This is to be provided in 10 tanks, each with a diameter of 23m with a domed top and total height of 9m. Each tank will therefore hold 2,400m^3. To give an idea of scale the size of an Olympic swimming pool is 2,500m^3.

4.6.9 We can find no information in the Application or Applicants Evidence regarding the type of tanks to be used or the materials that they are made from. The seismic Importance Level (IL) rating will be 2 or 3 depending on the New Zealand Loadings Code NZS1170.[36] Our enquiries suggest this is an important distinction, with IL2 tanks being made of plastic and IL3 tanks of steel and requiring a concrete base and having a very different appearance. All illustrations in the AEE and evidence

[32] Letter from Janan Dunning Stantec to Leah McEnhill/Kelly Walker CRC, 5 March 2024, p3
[33] Email from Janan Dunning to Jo Easterbrook, 2 April 2024, subject TRIM: RMA/2023/1347 - 80 Old Coach Road, Akaroa: LVIA Addendum
[34] Applicant's Evidence, Hills Cl 12.14-12.15 p24
[35] Beca, Duvauchelle Wastewater Scheme Design Flow Basis Update Report 13 February 2024, P1
[36] AEE, p18

appear to be the plastic tanks.

4.6.10 The tanks are to be sited on two cut platforms, with 25,000m3 of excavations having been done to create this, and with that 25,000m^3 fill retained on site.

4.7 Constructed Wetland

4.7.1 The purpose of the wetland has only recently become clear with new information presented at the Hearing on 28 January 2025[37]. This clarified the purpose as:

a) to store additional water when the treated storage tanks are full, and,

b) "*provide a means of restoring mauri to treated wastewater in the event it needs to be discharged to Akaroa Harbour*"[38]

4.7.2 This is a substantive change from the Application as lodged, which states it will provide emergency storage for an additional 2,100m^3 f treated wastewater., but no outlet mechanism is described.

4.7.3 We disagree with the earlier evidence from Mr Hills that the Application includes a discharge from the wetland and provides for a 1 in 10 year overflow[39]. This is new information. There is no mention in the AEE of overflowing 1 in 10 years nor of a discharge path from the wetland. To the contrary, the AEE states that ATWIS is a 100% land based system[40].

4.7.4 The first time any overflow of treated wastewater, or a discharge path to the harbour, is mentioned by the Applicant is in response to the CRC RFI question 14. This question was additional to the earlier RFI questions sent on 1 August 2023, and was sent on 2 October after CRC had received Dr Martin's report identifying that the system proposed was likely to experience frequent overflows.

4.7.5 The Applicant's response states:

"The scheme provides substantial and adequate storage within the buffer tank, subsurface wetland and treated wastewater storage tanks at the Robinsons Bay Valley Irrigation site. Modelling undertaken to date by PDP and BECA has indicated that the volume of storage proposed will be adequate and therefore the proposed scheme is resilient and robust. While not expected, if more storage is shown to be needed following commencement of the scheme operation there is the capacity to add further storage tanks.

In the unlikely event that all proposed storage capacity is overwhelmed such as a result of prolonged and intense rainfall, the applicant could potentially initiate a controlled discharge of treated wastewater to the harbour – any such discharge would be considered an emergency response. Such discharge would be limited to treated wastewater which has passed through the wetland facility to the harbour, conveyed via the 'purple pipe' supplying treated wastewater to Akaroa for reuse, and discharged via the terminal pump station. ***It should be stressed that the applicant has undertaken significant modelling using professional engineers to identify that there is sufficient capacity within the storage proposed to ensure that such discharges of treated***

[37] Applicants supplementary evidence, Hills, Cl4 p 2
[38] Applicants Evidence,Supplementary Evidence Hills, Cl4, p1
[39] Applicant's Evidence, Hills, Cl13.3, p26
[40] AEE, p57

wastewater will not be necessary based on provision of 20,000m3 treated wastewater storage, and any additional storage in the wet weather tank and subsurface wetland. While the necessary infrastructure will exist within the scheme to enable an emergency discharge, the need for such discharges is not anticipated based on modelling of 47 years of data, hence no application for a discharge permit has been made. *The applicant believes they have proposed a resilient, pragmatic and robust scheme to irrigate all treated wastewater to land".*[41]

4.7.6 Acknowledgement that overflows would in fact be much more frequent and would require a discharge consent was only raised on 15 April 2024, in the cover email from Janan Dunning to Kelly Walker accompanying the Beca Akaroa Wastewater Scheme Design Flow Basis Update Report. This email states

"The conclusions note that in extreme weather events the scheme's substantial treated wastewater storage capacity of ~26,000 m^3 (24,000 m^3 in covered tanks and ~2,000 m^3 in the subsurface wetland) could be exceeded. In such cases treated wastewater that has been diverted to storage in the subsurface wetland may need to be released to the harbour so wastewater treatment can continue and to prevent the scheme's infrastructure from being overwhelmed. As discussed with you in our last meeting, CCC will apply for a discharge permit in due course as part of the applications for the Duvauchelle Wastewater Scheme currently being prepared, and provides the attached report for CRC's visibility and awareness."

4.7.7 Despite this, the discharge to harbour path from the wetland was not shown on the diagram entitled "Planned Network of Current Application"[42] supplied as part of the visual aid package on the first day of the hearing. It has only been explained in the supplementary evidence from Mr Hills provided on January 28, 2025 in response to the Panel's request.[43]

4.7.8 Regardless, it is clear now that there will be storage exceedances causing discharges of treated wastewater to the harbour. In response to the Panel questions, Mr Hills indicated that 75% of the time the retention length for treated water in the wetland would be 2 to 3 days, but in times of intense rain it could be less. It was conceivable but unlikely that water would ever just pass through.[44]

4.7.9 Our understanding from the PDP *Combined Akaroa & Duvauchelle Storage Exceedance Discharges* dated November 2024 is that the total capacity of the wetland is 2,208m^3, that it will have a permanent water depth of 300mm to maintain the plants, and therefore the capacity to take additional water when the treated storage is full to 1,800m^3.[45] This 1,800m^3 is the maximum available freeboard, but in practice this may be less because the wetland is uncovered, and will therefore also receive rainwater.

4.7.10 Ms Tikao stated in her submission that the design of the wetland was still undergoing change, so we are unclear how this affects the capacity.

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[41] CRC RFI response Q14a
[42] Applicants Evidence to hearing, ATWIS Location Maps of Scheme and Existing Water Assets, Planned Network of Current Application, p10
[43] Applicants Evidence,Supplementary Evidence Hills, Cl4, p1
[44] Hills, Verbal evidence, 28 January 2025
[45] PDP 2024, Combined Akaroa & Duvauchelle Storage Exceedance Discharges report p12

4.7.11 She also discussed a rock channel connecting the wetland outflow to the harbour discharge location which would provide further cultural treatment. This is also described in the *PDP Combined Akaroa & Duvauchelle Storage Exceedance Discharges* document[46],.Our understanding is that this rock channel does not form part of this Application. Clarification is needed on this matter also.

4.7.12 There is also the matter of whether the discharges need to pass through the WWTP again after the wetland. PDP have explained that the amount of faecal coliforms may increase through the wetland due to regrowth or birds and other animals, and that :"*there is potential for increased E.coli and suspended solids in the wetland effluent, particularly if higher flow rates allow mobilisations of previously deposited solids.*"[47] They suggest post-wetland treatment should be considered in the detailed design and provide diagrams of how water could re-pass through the treatment plant.[48] Mr Hills did not address this issue in his supplementary evidence.

4.7.13 We understand therefore that while a harbour discharge outflow mechanism from the wetland does form part of this Application, we are unsure what it physically is. This needs to be clarified.

4.7.14 We also understand that despite the Applicant intending to discharge treated wastewater from the wetland to the harbour and providing a mechanism to do so, it has not included a discharge application with this Application, but intends to apply for this discharge consent[49] in the future. Whether as part of the Duvauchelle application or separately is unclear and also needs to be clarified.

4.7.15 In response to questions, Mr Hills stated that in the absence of a discharge consent, discharge to harbour via the wetland could be used under the emergency powers of the RMA, and could be triggered by events such as a power cut, earthquake, or a high rainfall event.

4.7.16 Should consent be granted to this Application, the Applicant would construct and use the harbour discharge mechanism regardless of whether a discharge consent has been obtained, because it is during times of heavy and prolonged rain events when the treated storage is full that it will be needed. However, this will be on a predictable basis, not an emergency basis.

4.7.17 See Section 4.10.4 below for our understanding of the actual overflow frequency and volumes.

4.8 Pipes and pumps

4.8.1 The AEE provides a description of the pipe network from the Terminal Pump Station to the Treated Storage tanks at Robinsons Bay. It also indicates there will be a return path from Robinsons Bay to the WWTP.

4.8.2 The AEE states there will be odour discharged from pipe vents, but no map of the air vent locations.is given. As we heard from another submitter, this is a concern for nearby residents.

4.8.3 The network diagram indicates the flow rate to the irrigation field will be 22L/s but there is no further explanation for this limitation or how it relates to the throughput capacity of the IDAL treatment plant.

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[46] PDP 2024, Combined Akaroa & Duvauchelle Storage Exceedance Discharges report p22
[47] PDP 2024, Combined Akaroa & Duvauchelle Storage Exceedance Discharges report p18
[48] PDP 2024, Combined Akaroa & Duvauchelle Storage Exceedance Discharges report, Figure p20
[49] Applicant's Evidence, Hill Cl 13.4 p 25

4.8.4 There is no description of the pumps required to pump the treated wastewater from the WWTP to the treated storage tanks which are at a higher elevation than the WWTP, nor the pump to elevate the treated wastewater from the storage tanks to the upper irrigation areas that are above the tanks.

4.8.5 A better understanding of the pipes and pumps is needed to establish any bottlenecks in the system, and to assess noise, odour discharge and resilience.

4.9 Irrigable areas and rates

4.9.1 The land at the Jubilee Park will only be irrigated in summer via sub-surface drippers, and it is unclear whether this will be installed initially as the AEE marks this as *"future purple pipe scheme"* on the Schematic in Figure 3-1.[50] Here a deficit regime is to be used, meaning there will always be some capacity in the soil should heavy rain occur. As this irrigation is largely immaterial to the capacity issues involved with the ATWIS scheme, we have not addressed it further here.

4.9.2 The main irrigation areas are 35.7ha in Robinsons Bay of which 31.9 ha is at 11 Sawmill Road and 3.8ha at Hammond Point. We focus on the main irrigation area at 11 Sawmill Road and for clarity we reproduce the map from the Visual Aids supplied by the Applicant at the Hearing.[51].

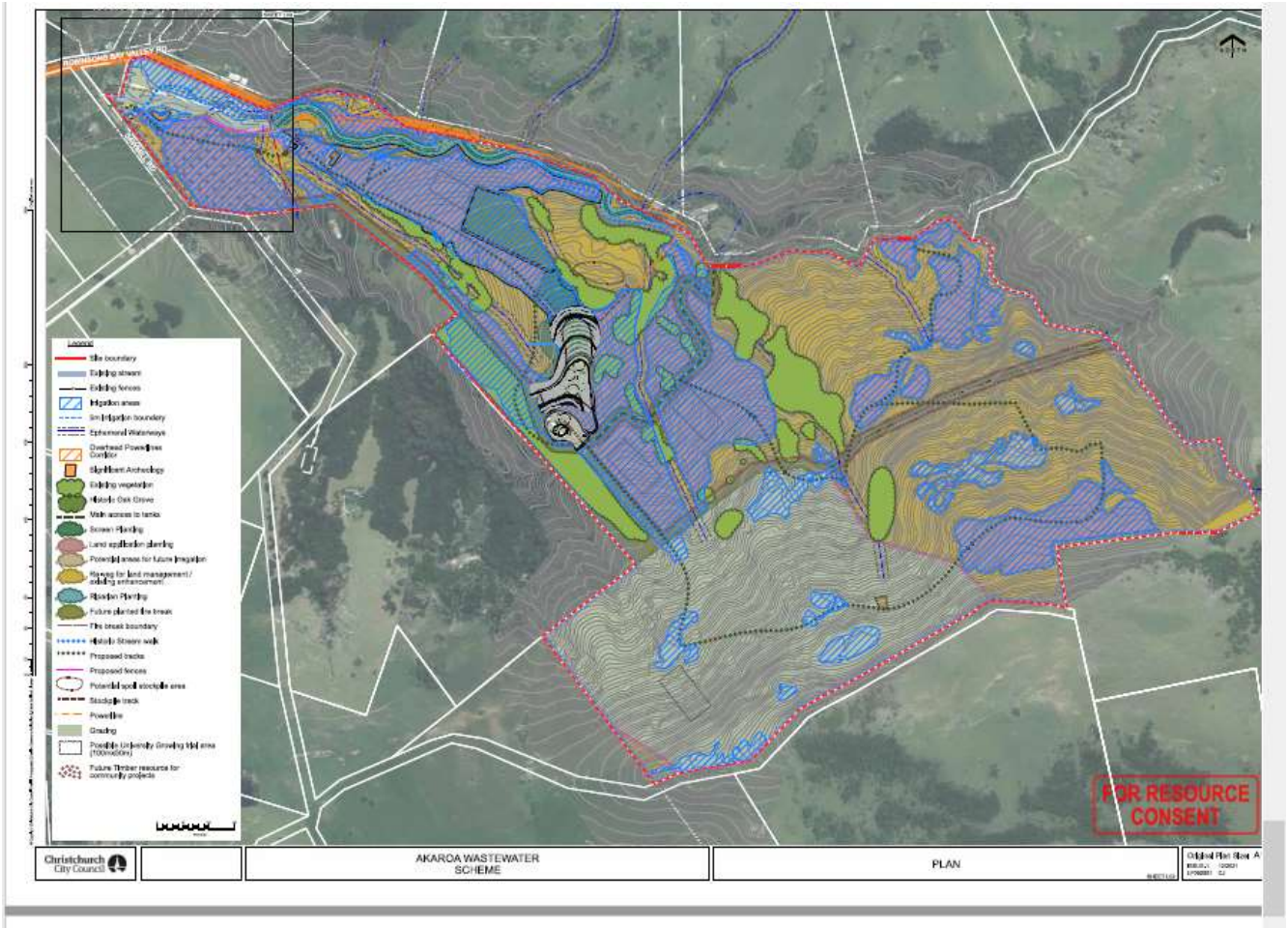

Figure 3 Landscape plan showing irrigation areas in pink from Applicants evidence

4.9.3 Some clarifications are needed as to what areas now form part of the Application for irrigation,

[50] AEE Figure 3-1 p8

[51] Applicants Evidence at Hearing, ATWIS Location Maps of Scheme and Existing Wastewater Assets, P14

a) In response to questions from the Panel, the Applicant clarified that consent is only sought for the areas which are shown in pink crosshatched with blue lines on the landscape map above, and not for any other areas marked as potentially irrigable on various landscape maps, including those areas marked with cross hatched blue lines only, and the shaded areas indicated as "less suitable". **This statement needs to be re-confirmed and included in any conditions if it is indeed the case, as it directly contradicts other evidence. The Applicant cannot then rely on these areas for expansion of the irrigation field without further consents**.

b) Also in response to questions, Mr. Woods indicated that the areas immediately around the storage tanks were to be irrigated for the purpose of establishing and maintaining them. The extent of these areas needs to be defined, and they need to be marked appropriately on the map if they do not form part of the disposal irrigation field.

c) We also note that there are some discrepancies between the areas marked pink on this map as the land application planting, and on the irrigation areas map in Figure 5, Appendix A (Aqualinc Report) of the AEE.

d) The existing wetlands within the irrigation areas are not marked on the landscape or irrigation map and it is unclear whether they are to be irrigated

e) We do not understand why the irrigation area closest to Sawmill Road has been marked with the symbol indicating "Future Timber resource for community projects". This is not further explained in the Application.

4.9.4 The irrigable areas are to be planted in rows of kānuka 2m apart.

4.9.5 Irrigation lines are recommended to be laid at 0.5m spacing between the rows of kānuka with drippers spaced between 0.3m to 0.5m apart along each line. This means there are four dripper lines for each row of kānuka. We calculate that irrigation lines laid over 35.7ha at 0.5m spacings, equates to 700kms of line. With drippers spaced 0.5m apart there will be 1.43 million drippers; if spaced at 0.3m apart there will 2.38 million drippers.

4.9.6 The irrigation rates are: Summer – 3.08 mm/d, Autumn and Spring – 2.41 mm/d, Winter – 1.68 mm/d. The proposed conditions set out that these rates are monthly averages.

4.9.7 The irrigation areas will be split up into irrigation blocks, with the irrigation taking place on different blocks at different times. Further details on how this is to me managed and operated are to be given in an Irrigation Management Plan, but this is yet to be provided.

4.9.8 The proposed conditions set out a maximum daily limit of 1,100m^3 per day and a maximum annual application rate of 220,800m^3 per year[52].

4.9.9 Irrigation is to take place on a non-deficit basis. We discuss the detail of how and when irrigation will take place in 11.2 below.

[52] Draft conditions circulated at November hearing, Consent CRC235040, Condition 2

4.10 Additional areas to be planted

4.10.1 In addition to planting the 35.7ha for irrigation, the Applicant is also proposing to plant a further 23ha of riparian and infill planting. This 23ha area contributes toward the calculated nitrogen removal expected from the system, and will also be destocked.

4.10.2 It is unclear where exactly these areas are, as the landscape map given in Appendix C does not have a category that shows this. Instead it has categories labelled Riparian Planting, Re-veg for land management/existing enhancement, Existing Vegetation, Historic Oak Grove, Future Fire Break and the Less Suitable Areas. These areas combined are approximately 60ha.

4.10.3 It is unclear whether all these areas are to be planted under the proposal. Mr Pizzey has stated in his legal submissions that destocking and planting will take place over a total of 82ha, but this is not the figure used by Dr Dark, who makes clear that the preferred scenario referred to in the Application involves destocking and planting an additional 23ha.[53]

4.10.4 We ask the Panel to clarify exactly where the Applicant plans to destock and plant, and which areas make up the 23ha assumed to contribute toward total nitrogen removal.

4.10.5 We would also like clarification about the timing of planting, and what areas are to be fenced off from stock, including existing wetlands and native forest patches.

4.11 Treated storage exceedances

4.11.1 Before discussing the frequency and volume of storage exceedances it is necessary to establish the baseline. Are we considering exceedances from Akaroa flows alone, or Akaroa and Duvauchelle combined, and are we considering the treated storage capacity for Akaroa or the capacity for the combined flows?

4.11.2 The Beca Akaroa Wastewater Scheme Design Flow Basis Update Report released in April 2024 sets out modelling in Table 6-2 under Scenario A1 showing that with 20,000m^3 of storage and an irrigation area of 35.7ha, there would be 21 seasons with overflows out of the 50 years modelled. A lower figure of 11 seasons was also reported, based on reducing the flow volumes by 10% to account for the inherent uncertainty in the modelling.[54] The overflows are expressed in numbers of seasons, not individual overflow events - there may be multiple overflows potentially lasting many days in each season.

4.11.3 A separate report, the Beca *Duvauchelle Wastewater Scheme Design Flow Basis Update Report*, dated 13 February 2024, sets out in Table 7 under Scenario 4, that with 4,000m^3 of storage and an irrigation area of 6.4ha, the Duvauchelle system would overflow in 17 of the 51 years modelled[55].

4.11.4 A third report, the Beca *Akaroa & Duvauchelle Combined Wastewater Schemes Feasibility MCA Assessment Report* dated 17 February 2024, sets out in Table 2 that, with a storage volume of 24,000m^3 and 42.1ha of irrigation (35.7ha at Robinsons Bay and 6.4ha) at Duvauchelle, overflows would be expected in 21 seasons of the 50 modelled. Again a lower range with a 10% reduction in

[53] Applicants Evidence, Dark, Cl3.51(b), p12
[54] Beca Akaroa Wastewater Scheme Design Flow Basis Update Report, 8April 2024 Table 6-2, p34
[55] Beca Duvauchelle Wastewater Scheme Design Flow Basis Update Report, 13 February 2024, Table 7, p10

flows indicated 11 seasons.[56]

4.11.5 As we have already noted above, the now proposed storage provision of 24,000m^3 is intended to house both Akaroa and Duvauchelle flows.

4.11.6 Mr Offer from Beca has now stated in his evidence that the 10% reduction in modelled flows previously used to provide a lower bound of storage exceedance frequencies has been dropped.[57] This we agree with. When 2023 was included in the modelled outputs, the storage for that year was substantially under-reported even without the 10% reduction applied, showing this reduction lacked validity.

4.11.7 We do not however agree with the number of storage exceedance seasons set out in Mr Offer's evidence (or evidence from other of the Applicant's experts that relies on this). In this evidence he states that modelling indicates storage exceedances in 12 seasons of the 51 years modelled (equating to 1 in every 4.3 years). In coming to this conclusion, he has included the entire storage volume of 28,000m^3. This includes 24,000m^3 in Robinsons Bay, 2,208m^3 in the wetland and 2,000m^3 in the untreated buffer tank.

4.11.8 We do not consider it reasonable to include the 2,000m^3 untreated buffer tank in the treated storage calculations because

a) it has its own purpose the buffer the treatment plant, and there can be no guarantee that it will be empty when required. (For example this buffer tank may be used while the IDAL tank is processing or emptying).

b) The untreated buffer tank was not included in the calculations previously done in the previous three reports listed above and appears to have been included now purely to make the overflow figures look better.

4.11.9 Further, the Applicant has made it clear that the 24,000m^3 in Robinsons Bay is to accommodate flows from both Akaroa and Duvauchelle, and its intention is to apply for the Duvauchelle system within the coming year. However, in Mr Offer's calculation, as he has made clear in his evidence, this does ***NOT*** include the wastewater flows for Duvauchelle. He has therefore included the added storage for Duvauchelle but not the flows from Duvauchelle.

4.11.10 This gives a very misleading picture, substantially underestimating the likely frequency of the overflows that can be expected from the system, as it is only applicable to the short period when the system may potentially be operational with the full 24,000m^3 treated storage capacity but without the Duvauchelle flows. A valid assessment of storage exceedances needs to include the Duvauchelle flows alongside the increased storage provided for them.

4.11.11 We therefore base our understanding of the treated storage exceedances on information given in the *PDP Combined Akaroa & Duvauchelle Treated Wastewater Storage Exceedance Discharges* report prepared for the Christchurch City Council in November 2024. FBPI obtained this report through the

[56] Akaroa & Duvauchelle Combined Wastewater Schemes Feasibility MCA Assessment Report, 17 February 2024, Table 2, p7

[57] Applicant's Evidence, Offer, Cl 3.19 p9

LGOIMA process shortly before the hearings commenced. **We have supplied this report with our evidence, and request the Panel to review it.**

4.11.12 This modelling includes the wastewater flows from both Akaroa and Duvauchelle, a combined treated storage capacity of 25,800m^3 (24,000m^3 at Robinsons Bay and 1,800m^3 at the wetland fluctuating with rainfall), and irrigation at the prescribed Akaroa and Duvauchelle rates on 35.7ha at Robinsons Bay and 6.4ha at Duvauchelle. This concurs with the preferred option set out in the *Akaroa & Duvauchelle Combined Wastewater Schemes Feasibility MCA Assessment Report* produced by Beca in February 2024[58] and a recent community update from CCC stating that the Duvauchelle application will be for 6.4ha of tree irrigation.[59]

4.11.13 Based on the *PDP Combined Akaroa & Duvauchelle Treated Wastewater Storage Exceedance Discharges* overflow seasons (now referred to as Storage Exceedances) for the combined flows are predicted to occur in 21 of the 52 years modelled from 1972 – end of July 2023,[60]or 1 in 2.5 years. As before, these storage exceedances may include multiple days of overflows and multiple events. We reproduce here Table 6 from this document. [61]

[58] Beca, Akaroa & Duvauchelle Combined Wastewater Schemes Feasibility MCA Assessment, February 2024
[59] CCC, Project Update, Duvauchelle Treated Wastewater Irrigation Scheme, December 2024
[60] PDP, 2024. Combined Akaroa & Duvauchelle Treated Wastewater Storage, Exceedance Discharges – Short-List Options Assessment. Prepared for Christchurch City CCC. Pattle Delamore Partners Limited. October 2024, Table 6, p10-11
[61] PDP, 2024. Combined Akaroa & Duvauchelle Treated Wastewater Storage, Exceedance Discharges – Short-List Options Assessment. Prepared for Christchurch City CCC. Pattle Delamore Partners Limited. October 2024, Table 6, p

Table 2 Storage exceedances forecast by PDP in the Akaroa & Duvauchelle Combined Storage ExceedanceDischarges – Short-List Options Assessment

Table 6: Modelled Annual Discharges as Proportion of Total Flows		
Year Modelled	**Total Annual Exceedance Discharge Volumes [a] (m^3)**	**Exceedance Discharges as a Proportion of Total Annual Treated Wastewater Volume**
1974	17,900	6%
1975	12,500	4%
1976	7,300	3%
1977	17,500	6%
1978	40,000	13%
1981	3,400	1%
1983	4,800	2%
1986	19,800	6%
1992	13,000	5%
1994	6,100	2%
1999	900	0.3%
2000	1,400	0.5%
2008	900	0.3%
2010	23,500	9%
2012	12,800	5%
2013	9,500	3%
2014	4,500	2%
2017	10,300	4%
2021	3,900	2%
2022	11,100	4%
2023[2].	6,100	3%

Notes:
a) To nearest 100 m^3
b) 2023 data only available to 01/08/2023.

4.11.14 Note this is based on the assumption that irrigation on 6.4ha at Duvauchelle proceeds. If the Duvauchelle irrigation application is not consented, but the ATWIS is still used to treat and store its flows, then overflows will be greater. We discuss potential concerns with the progress of the Duvauchelle application later in Section 16.

4.12 Untreated overflows

4.12.1 Our understanding of the untreated wastewater overflows is that the current design average recurrence interval (ARI) at the Terminal Pump Station is 1 in 5 years. These are not emergency overflows, but are predicted by the modelled Akaroa flows set out in the Beca 2024 report and the now increased pump capacity of 86L/s. CCC has argued that these overflows do not form part of its consent application. We take a different view as we will discuss later. As is the case currently,

additional (emergency) untreated overflows can be expected due to equipment failure or extreme unpredicted weather.

4.12.2 Mr Ellwood has identified that the raw storage capacity at the WWTP could be overwhelmed.[62] This is based on the 22 L/s outflow to Robinsons Bay limiting the output of the WWTP to 2,160m^3 per day. He notes that an event of 3,335m^3 per day may result in the raw storage being fully used. We are unclear what the source of this limit is. Depending on the source of the limitation, the change to the IDAL treatment process may not change this limit. If this limit is still extant, then the raw storage capacity at the WWTP being insufficient to cope with this bottleneck would contribute to the raw overflows.

4.12.3 We note that the 3,335m^3 value presented by Mr Ellwood was exceeded twice in July 2023 as measured by the PS616 inflow meter on the current WWTP (23 July 2023 4,091m^3 and 9 July 2023 3,554m^3 recorded)

4.13 Issues, ambiguities and missing consent applications

4.13.1 The lack of a discharge consent application for the treated overflows means the location and effects of these remain undefined and unassessed.

4.13.2 The lack of a land use assessment (under LWRP Rule 5.84) for the Terminal Pump Station means that the volumes and effects of untreated overflows remain undefined and unassessed, including the potential cumulative effects from treated overflows in the same area.

4.13.3 It appears that the WWTP also requires further assessment and a land use consent to operate under LWRP Rule 5.84.

4.13.4 The lack of a consent application for Duvauchelle means that the total amount of treated storage needed is ambiguous and treated overflows for the combined system can only be based on reports rather than a definitive application. Duvauchelle is not being considered in a consistent way and hence different figures on storage requirements and exceedances are presented.

4.13.5 The lack of a clear diagram and analysis of the capacity of each stage of the treatment train (including pumps, pipes, tanks and plant) mean that it is not possible to carry out an analysis identifying bottlenecks in the system

4.13.6 The ability for the new IDAL treatment method proposed to incorporate tertiary treatment, the processing capacity and the standards it will achieve during times of high flows need defining.

4.13.7 There is no Irrigation Management Plan.

4.13.8 There are ambiguities around which areas are to be planted, and which of these areas contribute to nitrogen removal.

4.13.9 The Applicant has stated that the less suitable 5ha on the Robinsons Bay valley site no longer forms part of the consent sought. This needs to be clarified in writing.

4.13.10 The CRC s42a report states that odour consents are required for discharge of odour to air from the

[62] CRC S42A, Ellwood, Cl 43,44

wetland, Robinsons Bay Valley and Hammond Point. We understand from the evidence of Mr Dunning that the application CRC204086 has been extended to include this[63], but cannot see where this has been documented.

4.13.11 **We submit that the intent of LWRP Rule 5.84 is that a community wastewater treatment system including its discharges is assessed as a discretionary activity and therefore the effects of the scheme, including its discharges, must be considered as a whole. This includes all components and all discharges, including those that are currently partially consented.**

4.13.12 **Throughout public consultations and in its Application CCC has clearly and consistently stated that the Terminal Pump Station and the Wastewater Treatment Plant are already consented. We submit that the CCC's failure to identify that additional consents are necessary has mislead the community and submitters into believing these aspects of the Scheme are not up for any further discussion.**

[63] Applicants Evidence, Dunning Cl 3.4(b), p6

Section 5. Receiving environments

An understanding of the current qualities of the receiving environments is needed In order to assess the impact and effects of the proposal on these environments.

The proposal will place infrastructure behind the Akaroa Recreation Ground area adjoining Childrens Bay, at Old Coach Road, Hammond Point and Robinsons Bay, and may discharge wastewater into the streams and coastal areas of Robinsons Bay and Childrens Bay. Note the following does not include the additional infrastructure required at Duvauchelle.

5.1 Childrens Bay/Akaroa Recreation Ground Amenity

5.1.1 The Terminal Pump station in the carpark near the entrance to the town is on reclaimed land over Akaroa's old capped landfill. This will be a large building, 13m x 17.5m x 8m high.

5.1.2 This area is currently used for many different forms of recreation. Land based facilities in the immediate vicinity include Akaroa's only freedom camping area, a boat storage area, tennis courts, the mini-golf course and the skatepark. In close proximity are the playcentre, main town carpark, recreation ground, and other recreational facilities including croquet, etc. The recreation ground is used for sports and for many events such as Akaroa's French Festival. The marine area is heavily used for boating, and includes the boat ramp with a short walkway area and the boat store. The beach to the south is used to launch kayaks and other small craft..

5.1.3 This area is low lying and prone to flooding in wet weather, exacerbated by storm surges and high tides. The Historical Flooding Research and Mapping project conducted as part of CCC.s Akaroa Harbour Settlements Study in 2008 concluded, *The Recreation Ground is reclaimed land, and hence drainage of this area is more difficult. It has flooded and ponded so many times in the past that shallow winter ponding on the ground alone was neither newsworthy or memorable, but just part of the normal experience of Akaroa* "[64] Note that as shown on the image below, flooding can and does also occur in summer.

[64] Thompson, Akaroa Harbour Settlement Study Areas, Historical Flooding Research and Mapping Project, 5 February 2008, p37

[65]

Figure 4 Akaroa Recreation Ground in flood January 2002

5.1.4 Terminal Pump Station overflow will be into the Grehan Stream which runs through the centre of the car parking area. This is where untreated wastewater overflows will occur.

5.1.5 Childrens Bay beach is long sandy strip changing to mudflats below the tide line. It is accessed by a well-marked walking track opposite the heavily used freedom camping area in the main carpark.. This connects to a very popular walking track around the Takamatua headland.

5.2 Old Coach Road amenity

5.2.1 The WWTP is to be located beside the Old Coach Road just below the junction with SH75.

5.2.2 The untreated wastewater buffer tank and the wetland are to be located in the paddock opposite (referred to as the Hay Paddock), which SH75 wraps around. While this site is likely to be screened from the main highway, it is visible from Long Bay Road, and also from the upper residential areas of Akaroa.

5.3 Robinsons Bay natural character and amenity

5.3.1 Robinsons Bay is a quiet rural community with a high quality environment.

5.3.2 The Te Reo name for the bay is Nga ka kai au. This was one of the best bays in the harbour for flounder and the name originated from the practice of threading the caught fish with an au – a strong, cord or bone needle.[66] The bay is still known for its pātiki - flounder and īnanga - whitebait .

5.3.3 Robinsons Bay itself is a popular spot for swimming, fishing and boating. Its long wharf was repaired by the community after the earthquakes to enable these activities to continue.

5.3.4 Robinsons Bay has a highly significant heritage, as the site of the first power sawmill in Canterbury. The sawmill site and much of the infrastructure associated with it (mill ponds, tramway, blacksmith shop, workers cottages, early exotic trees) was on the land at 11 Sawmill Road, the main irrigation

[65] Thompson, Akaroa Harbour Settlement Study Areas, Historical Flooding Research and Mapping Project, 5 February 2008, p33, Photo credit Jan Shuttleworth

[66] Ogilvie, Gordon, Placenames of Banks Peninsula and the Port Hills, 2017, Canterbury University Press

area. This site has been signposted as an Historic Place since the early 1990s and includes an interpretation panel, historic fencing, and the remains of the old waterwheel.

5.3.5 Adjacent to the site is the historic, Heritage NZ listed, Pavitt Cottage (the first sawmillers home) and nearby is the Schoolmasters House. Both buildings and sites are listed in the District Plan.

5.3.6 Today the valley floor is home to a number of lifestyle type residences, while the headlands, Hammond Point and Archdalls Road/Ngaio Point, are more densely occupied small settlement zones.

5.3.7 The predominant land uses are sheep and beef farming and some forestry. There are no noisy or odour generating rural activities.

5.3.8 Native forest is regenerating readily and naturally in areas where grazing has been retired or is light.

5.4 The freshwater and coastal environment

5.4.1 The natural environments potentially impacted by this scheme are identified as primarily the Robinsons Bay stream and Robinsons Bay coastal estuary. The Grehan Stream and the Chlldrens Bay coastal estuary may also be impacted by overflows of untreated wastewater, and potentially also treated wastewater. We therefore consider the common elements of these natural environments and then their separate qualities.

5.4.2 The bathymetry and current diagrams given in the AEE supporting CCC's 2015 Akaroa wastewater application show the shallow and poorly flushing nature of both the Childrens Bay and the Robinsons Bay coastal estuary in the upper reaches of Akaroa Harbour.[67]

[67] AEE, CH2M Beca, 2014, Akaroa Wastewater Scheme Upgrading -Resource Consents Application and Assessment of Effects on the Environment, p25-26

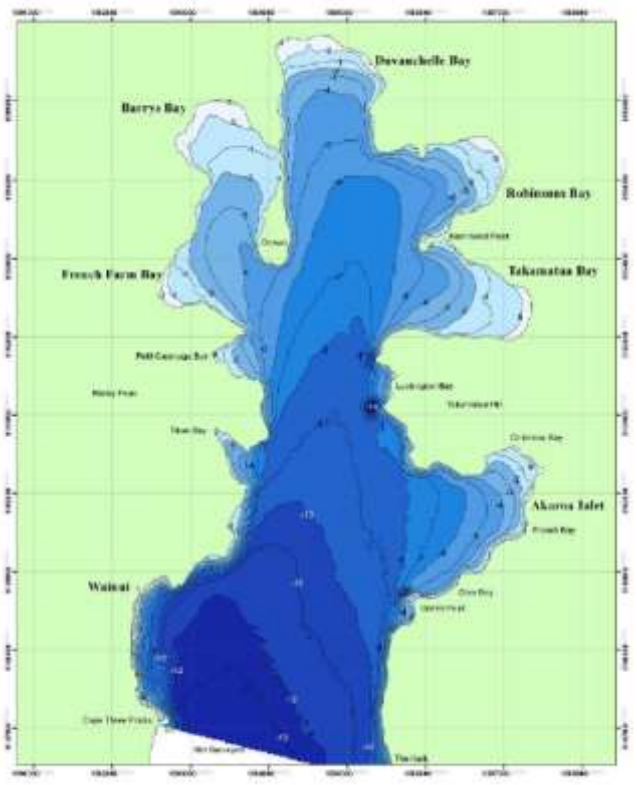

Figure 3-9 Bathymetry of upper Akaroa Harbour relative to mean sea level [68]

Figure 5 Bathymetry of Akaroa Harbour from 2015 AEE

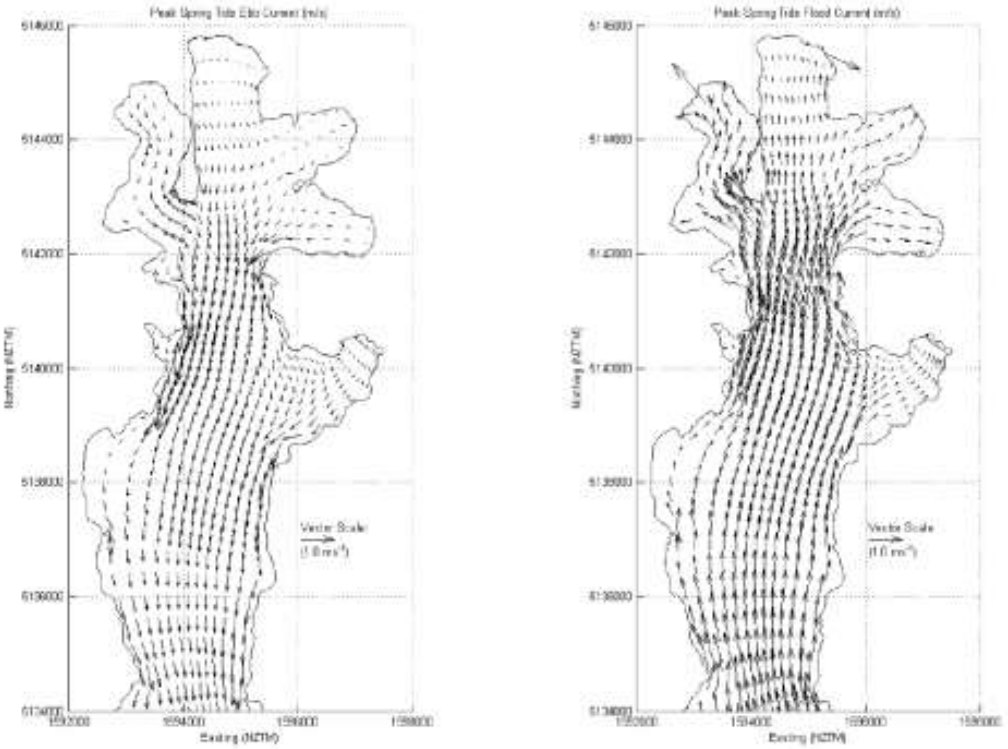

Figure 3-10 Peak and Ebb Tide Current Patterns for a Spring Tide [69]

Figure 6 Peak and Ebb Tide Current patterns from 2015 AEE

[68] 2015 AEE, Figure 3-9, p25
[69] 2015 AEE Figure 3-10 p26

5.4.3 The 2015 AEE comments that *There is a stronger ebb-tide flow around Green Point where the existing short outfall is located south of the township. This is confirmed by the previous measurements of Hicks & Marra (1988)*[70]. We highlight this as it is an important consideration when comparing whether the effects of the runoff, overflows or discharges via streams to the shallow coastal estuaries of Robinsons and Childrens Bay will have greater or lesser effects on the harbour than the existing outfall which discharges into the stronger current around Greens Point.

5.4.4 Both Robinsons Bay and Childrens Bay contain the nationally threatened Zostera muerlleri (seagrass) which is an important habitat for juvenile fish and is in decline.

5.5 Particular qualities of Robinsons Bay freshwater and coastal environment

5.5.1 The freshwater and coastal environments of Robinsons Bay are in good health, as set out by the various experts who have conducted ecological reviews.

5.5.2 EOS Ecology, who carried out the freshwater assessment for the AEE, report that of the four potentially affected streams they reviewed (Robinsons Bay, Takamatua, Childrens Bay Creek and Grehan Stream), "*Aquatic invertebrate values were relatively low for all sites except those in Robinsons Bay Stream. Robinsons Bay Stream supported four regionally endemic species, with Neocurupira chiltoni, Costachorema peninsulae, Nesameletus vulcanus, and Zelandobius wardi found at the most upstream site in this stream.* Furthermore: *Two of the regionally endemic macroinvertebrate species found in Robinsons Bay Stream have a threat classification of 'threatened - nationally endangered' (the mayfly Nesameletus vulcanus and the stonefly Zelandobius wardi), while one is 'threatened - nationally vulnerable' (the caddisfly Costachorema peninsulae), and another is 'at risk - naturally uncommon' (the regionally endemic net-wing midge Neocurupira chiltonil"*[71]

5.5.3 Ms Hayward, CRC s42A states that Robinsons Bay stream has moderate to high ecological values[72].

5.5.4 The AEE Appendix I finds the estuary ecological values of Robinsons Bay to be moderate, largely due to the presence of seagrass beds and relatively diverse macroinvertebrate communities. Seagrass (Zostera muellerii has a national threat status of 'At Risk - Declining' in New Zealand and provides valuable habitat and food resources for many estuarine taxa[73] . It also finds that Robinsons Bay has a high abundance of molluscs.

5.5.5 Ms M Burns (reporting to the CRC S42A) considers Robinsons Bay to have high to very high ecological values not least because of the presence of Zostera muerlleri (seagrass), which is an important habitat for juvenile fish and is in decline[74]. Ms J Burns, the expert who carried out the assessment for the AEE, has subsequently raised her view of Robinsons Bay to have high ecological values in light of Ms M Burns comments.

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[70] AEE, CH2M Beca, 2014, Akaroa Wastewater Scheme Upgrading -Resource Consents Application and Assessment of Effects on the Environment,P 26
[71] AEE Appendix H, p1
[72] CRC s42A hayward cl 8 p192
[73] AEE Appendix I, p1
[74] CRC s42A Burns cl 15-17 p158

5.6 Summary

5.6.1 The experts agree that the receiving environments of Robinsons and Childrens Bay both have important ecological values, are highly sensitive environments and are used for recreation.

5.6.2 A consequence of the proposal is that treated wastewater that is currently discharged to a harbour location where there are strong tidal currents will now be released to high quality environments in the upper harbour draining to estuaries that are shallow and poorly flushing

5.6.3 Care must therefore be taken to ensure that all environmental effects are minimised and that these environments are not adversely affected over the lifetime of this consent.

Section 6. Overarching concerns

In this section we introduce our concerns about the proposed system

6.1.1 The proposed system has a sprawling and intrusive footprint, affecting communities from Akaroa through to Duvauchelle with extensive earthworks, pipeworks, roadworks, tanks, irrigation fields, pumping stations and disruption over some years, and oversized unsightly infrastructure, potentially omitting odours.

6.1.2 The proposal to irrigate municipal wastewater exclusively to New Zealand native trees at this scale is a world first. There is no similar wastewater disposal system to which it can be compared. Hence the system is based on modelling, which relies on key assumptions about the ability of the land and native trees to absorb both the nutrients and the volume of wastewater to be irrigated. We therefore set out our analysis of the validity of assumptions for four key areas of environmental risk:

a) the wastewater treatment standard

b) slope stability, given that irrigation is to take place on steep slopes that are *e"xtremely susceptible to changes in moisture content, with minimal increases sufficient to significantly reduce shear strength properties"*[75] and the large scale earthworks proposed for the tank platform in the centre of the field.

c) nitrogen uptake of native trees in the irrigation fields, given that the fields drain to the sensitive receiving environment of a high quality fresh water stream and a shallow estuary in the upper harbour, where currents are much weaker than those in the area of the existing harbour outfall.

d) non-deficit irrigation proposed for the sloping loess soils for at least 30 years, elevating the moisture for irrigated areas by 53% on average annually.

6.1.3 The proposal lacks capacity. The Application as lodged had anticipated containing **all** treated flows within the irrigation system, but this is no longer expected to be the case and significant volumes of overflows are anticipated to an as yet undefined location. There has been insufficient reduction of the I&I to achieve a 100% land based system.

6.1.4 There will be raw wastewater overflows from the Terminal Pump Station designed with a 1 in 5 year ARI also without an assessment of effects

6.1.5 The land based irrigation system proposed will be more vulnerable to the effects of climate change, including extreme storms, than the current harbour discharge.

6.1.6 There is no backup plan in the case of serious system failure.

6.1.7 The proposed system will be complex to operate, monitor and manage..

6.1.8 The Applicant is taking a piecemeal approach to consenting, making it impossible to properly assess the full environmental impacts of the overall project.

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[75] AEE, Appendix Q, p28

6.1.9 The Assessment of Effects provided in the AEE is out of date due to the significant changes in the application since it was lodged, and the CRC s42A report subsequently fails to make an adequate analysis of the risks presented or to consider the community wastewater treatment system and its discharges as a whole under LWRP 5.84.

6.1.10 Taken cumulatively, these concerns present substantial risks and uncertainties.

6.1.11 The remainder of this submission examines each of these concerns in more detail. We conclude with a consideration of the alternative options that might provide a less intrusive, less risky and less costly solution, and the relief sought from the Panel decision.

Section 7. Extensive Footprint and amenity values

We are concerned about the extensive footprint of the proposal, and the impacts it will have on amenity and heritage in the affected communities – both during construction and the ongoing operation.

7.1 Extensive footprint

7.1.1 In contrast to the current Akaroa and Duvauchelle wastewater systems which have small footprints, the proposed system requires large and intrusive infrastructure that will be highly visible and spread over multiple locations.

7.1.2 Earthworks modifying the landscape are needed to accommodate the treated storage tanks, and the untreated buffer tank.

7.1.3 The tanks will be visible from many locations.

7.1.4 The large Terminal Pump Station is located in a prominent high use recreation area.

7.1.5 Extensive earthworks are also required along the main highway to accommodate the pipes.

7.2 Amenity values and the importance of built form standards

7.2.1 The rural provisions of the Christchurch District Plan (CDP) were largely carried over from the Banks Peninsula District Plan. This was notified in 1997 and then went through an extensive community process, culminating in the so-called 'landscape' decisions of the Environment Court in 2008 (Briggs v CCC, C 45/2008, Briggs v CCC, C 113/2008).

7.2.2 The FBPI participated in all of the Rural Taskforce and other community meetings, all of the mediations and all of the Environment Court hearings.

7.2.3 The Court largely agreed with the mediated agreements that were reached by a wide range of parties. This involved considerable negotiation and compromise and the agreed provisions were developed as a 'package'. The trade-off for a lesser extent of identified coastal natural character and outstanding natural landscape areas was the identification of the balance of the rural zone as a *'Rural Amenity Landscape'* and of important ridgelines. This recognised that agricultural productive land is an important component of the rural landscape character and amenity of Banks Peninsula and this has been carried over in the objectives and policies in the CDP.

7.2.4 The rules package was designed to enable pastoral farming and small scale horticultural activities and the buildings necessary for these, while also protecting the rural landscape character and amenity from intrusive development. This largely relies on the subdivision and residential density provisions, and built form standards.

7.2.5 FBPI has taken an active role in protecting the Akaroa rural and coastal environment from inappropriate development and believes that close adherence to the built form standards is critical to this.

7.3 Storage tanks exceed the standards

7.3.1 The 10 storage tanks proposed at Robinsons Bay substantially breach built form standards for the

Rural Zone set out in the CDP.

a) The tanks will be 9m high. Each tank exceeds the maximum permitted building height limit of 7.5m set out in rule 17.4.2.4 by 20%.

b) Each tank will have a footprint of 415m^2. This exceeds the maximum building footprint of 300m3 in rule 17.4.2.10 by 38%

c) The site coverage of the tanks will be 4150m^2. This exceeds the maximum site coverage of 2000m^2 in rule 17.4.2.9 by more than 100%

7.3.2 The Applicant's landscape assessment in Appendix M makes no mention of the degree to which the tank farm exceeds these permitted standards. Despite commenting that *"Development becomes particularly sparse at higher elevations"*, the landscape assessment then goes on to state, *"The introduction of the tanks and associated earthworks may not be entirely unexpected, with tanks commonly seen throughout the rural landscape."* We note that this assessment was based on tanks 22m in diameter with a height of 6m.

7.3.3 Mr Greenshield makes similar assessments in 3.6 of his evidence, based on an increased tank size of 23m diameter and 6m height.

7.3.4 Mr Greenshield further stated at the hearing that colouring the tanks a similar green to the kānuka would provide mitigation, but acknowledged that he had not checked whether they are manufactured in this colour. He suggested they could be painted, but provided no information as to whether this was feasible.

7.3.5 We strongly disagree with these statements. There are no tanks or tank farms on anything like this scale anywhere in the Akaroa Harbour rural environment and, we would contend, no other built development at this scale. We consider that the introduction of tanks of this scale, of an industrial nature, and with the associated massive earthworks, will be a completely new kind of built development. They will be a highly visible to residents in Robinsons Bay and from the many other public viewpoints including the Summit Road, Okains Bay Road, and SH75.

7.3.6 Classifying the adverse effects of this development, which exceeds the height, footprint and site coverage standards by such substantial margins, as minor, undermines the intent of the built form standards. It would create a precedent for future developers wanting to exceed the standards. For example, houses and sheds are commonly seen in the rural environment and therefore it would be argued that a house or shed (or even 10 grouped together) that was much larger than the standards permitted and painted in a colour matching the surrounding landscape would be acceptable, with minor adverse effects.

7.3.7 We see this as flawed logic, and are disappointed that the CCC can so lightly dismiss the standards in the CDP, which were painstakingly developed and intended to protect the highly valued rural landscapes of Banks Peninsula from intrusive development.

7.4 Support for other parties addressing amenity and heritage

7.4.1 Apart from the matters above, we do not take our submissions on amenity and heritage further, but refer the Panel to the submissions of the Akaroa Civic Trust, Robinsons Bay Ratepayers and

Residents Association and Robinsons Bay Community Heritage Trust. This is not because we don't consider these matters to be important, but to save duplication of information.

Section 8. Highly treated wastewater assumption

In this section we consider the proposed IDAL treatment system, whether the wastewater emanating from the plant will consistently meet the assumption that it will be highly treated and the sizing of the raw wastewater buffer tank.

8.1 IDAL Treatment Plant

8.1.1 Various experts for CRC[76] state that the high level of treatment at the WWTP mitigates the potential effects of runoff and drainage of nitrogen and phosphorus from the proposed system. Achieving a high level of treatment is a cornerstone of the proposal.

8.1.2 The Applicant states that the wastewater will be very highly treated. While this may be true for some contaminants, it is not for phosphorus and nitrogen. Condition 16 of CRC235040 currently sets out that the annual mean concentration of Total Nitrogen shall not exceed 10mg/L over a rolling 12 month period. This compares poorly to modern wastewater systems. For example, the Rotorua wastewater system produces effluent with total nitrogen averaging 5.4mg/L, with an intention to reduce this to 4.3mg/L.

8.1.3 The IDAL process is a very recent change to the system, only introduced by way of the Applicants Evidence at the hearing. It has not been peer reviewed, or considered by the CRC experts.

8.1.4 Mr Mellish states that the IDAL process can remove 90%-95% of nitrogen, but this has not been reflected in the proposed conditions which remain at a removal standard of 10mg/L (which equates to approximately 80%).

8.1.5 In his evidence Mr Mellish states that during times of high flow the plant automatically adjusts to shorten aeration and settling times, relying on the diluting effects of high inflows to achieve the required standards.[77] In our view this reduced version of treatment is not materially different from bypass flows, and we suggest much more information is needed on how well it achieves both pathogen and emerging contaminant removal. There is no evidence that it can carry out the full processing on the summer peaks which are due to human sewage and not I&I.

8.1.6 Mr Mellish does not state what the maximum flow throughput is of the IDAL plant proposed, what standard would be achieved during high inflows, nor does he comment on the flow analysis done by Mr Ellwood as part of the CRC s42A report.

8.1.7 He states that the IDAL plant proposed is sized based on flows generated by the network and modelled by Beca in the Akaroa Updated Design Flow report. However the report he references is only for the Akaroa flows, and he does not clearly address whether the IDAL plant and raw buffer can cope with the additional peak flows from Duvauchelle which represent up to a 22% increase in the total flows.

8.1.8 Mr Mellish states that the IDAL process is used in Russell. We note that a recent report by PDP into

[76] CRC S42, Ellwood Cl 29 p5, Burns Cl 37, p6, Scott Cl10 p2
[77] Applicant's evidence, Mellish CL 4.7

the performance of the Russell plant identifies the following as key issues:[78]

a) Overloading of the system during high flows which reduces the available residence time for wastewater within the settling period which can result in carry-over of solids.

b) Solids carry-over can cause heavy loading of the filter media which potentially impacts performance. It may also result in the filters and the UV unit being bypassed which would further impact on performance.

8.1.9 The hearing has raised questions about the other contaminants in the wastewater, micro-plastics, PFAS and POPs, whether these have been measured in the existing wastewater stream to create a baseline for monitoring, and how they would be removed by the IDAL system if deemed necessary. . Mr Mellish states the IDAL system will not remove microplastics[79] which we understand would have been the case with ultrafiltration

8.1.10 The wastewater being processed is not limited to domestic and commercial sources, but also includes the leachate from the former landfill, which may contain agricultural chemicals, a source of PFAS.

8.1.11 Mr Mellish states that a two year period would be needed to establish a baseline, and suggests that this commences immediately, particularly given that part of the Akaroa wastewater stream includes leachate from the former landfill at Ōnuku Road.

8.1.12 Mr Mellish states that tertiary treatment processes could be added to the IDAL plant if needed.

8.1.13 Given the tight footprint size[80] of the WWTP site, the potential for adding more treatment processes should not be assumed and needs to be assessed.

8.1.14 The potential impact of adding tertiary processing on the WWTP throughput would also need to be assessed.

8.2 Untreated wastewater buffer tank

8.2.1 Having an adequate raw buffer tank is critical to achieving wastewater treatment standards. While the single IDAL tank is processing or emptying, incoming wastewater will be stored in this tank. Having sufficient capacity helps ensure that the IDAL plant can carry out full rather than reduced treatment.

8.2.2 The 2,000m^3 size of the untreated wastewater buffer tank was set out in the original AEE lodged in June 2023, and as we have already noted in Section 4.5, represents a substantial reduction from the 6,000m^3 previously calculated as adequate by Beca when the ultra-filtration process was planned, and was determined prior to the decision to opt for the IDAL treatment process.

8.2.3 In its response to the CRC RFI the Applicant stated that the WWTP was capable of processing 22L/s. The buffer tank would be used when flows arriving from the TPS exceeded this. Based on the

[78] PDP, Assessment of Environmental Effects – Kororāreka/Russell Wastewater Treatment Plant, prepared for Far North District Council, December 2023
[79] Applicant's Evidence, Mellish, Cl9.3 p19
[80] GWH, Akaroa WWTP Preliminary Process Design Report, 18 November 2022 p16

flow modelling at the time from 1972-2021, the buffer tank would have been needed in 38 events, and in the worst case would take 4 days to empty. It also stated that the operational contingency, should the buffer tank approach its limit, would be to increase the WWTP throughput above the design BOD and N removal design flow.[81]

8.2.4 Three significant increases in the volumes of water being delivered to the WWTP have been introduced since then. These include:

a) Beca's re-modelling in April 2024 which identified increased wet weather flow volumes;

b) the proposed addition of Duvauchelle contributing an additional 22% at times of peak flow (up to 1,040m^3 per day)[82], and,

c) increasing the pump capacity of the TPS from 65L/s to 86L/s.

8.2.5 The Applicant set out in the letter from Mr Dunning to Ms McEnhilll and Ms Walker that despite the addition of the Duvauchelle flows no changes will be needed to any of the other elements described in the ATWIS application at the WWTP or the Old Coach Road storage site.[83]. However the Applicant has provided no evidence to support this statement.

8.2.6 In the absence of evidence we do not find it credible that the untreated buffer tank would still be sufficient. The Applicant should be required to provide evidence that the buffer tank is sufficiently sized to ensure that there is not an unacceptable decrease in treatment quality as a result of the increased flows.

8.2.7 Mr Mellish notes in 7.3 of his evidence that the 2000m^3 buffer tank will be reviewed during the design of the treatment plant to ensure that all flows receive full treatment. This raises a question as to what is being consented and whether, if this tank does need to be increased in size, it is feasible to fit it onto the Hay Paddock site along with other required infrastructure.

8.3 Summary of concerns regarding treated wastewater quality

8.3.1 The IDAL treatment process has been introduced at a late stage with no detail provided about its sizing, throughput, nutrient, pathogen or emerging contaminant removal, or the decrease in performance during times of high flows

8.3.2 The treatment plant site is tightly constrained and may not have space for additional treatment processes.

8.3.3 There is no baseline monitoring to establish what the treatment process needs to cope with.

8.3.4 There is uncertainty about the sizing of the untreated wastewater buffer tank given the increased flow volumes since it was designed. This raises the risk of untreated overflows, or of a reduced level of treatment.

8.3.5 We therefore submit that a detailed peer review should be conducted of the WWTP to check that it has been adequately sized and will have the capacity and ability to safely treat all anticipated flows.

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[81] CRC RFI response, Q14b

[82] Beca, Akaroa & Duvauchelle Combined Wastewater Schemes Feasibility MCA Assessment Report. 13 February 2024

[83] Letter from Janan Dunning Stantec to Leah McEnhill/Kelly Walker CRC, 5 March 2024, p2

Section 9. Slope stability assumption

In this section we consider the shortcomings in relation to geotechnical assessment and the lack of certainty around slope stability within the irrigation areas and at the tank platform.

9.1 Limited geotechnical assessment

9.1.1 Loess soils are highly dispersive, and their strength decreases rapidly with added moisture[84]. This necessitates a thorough assessment of the suitability of the irrigation areas and storage tank platforms.

9.1.2 Limited initial test pit work was done on the main Robinsons Bay site in late 2016/early 2017. This appears to have been used to determine safe irrigation rates that would be below the Long Term Acceptance rate of this land.

9.1.3 Since then, remarkably little geotechnical assessment has been conducted on the proposed irrigation and storage sites considering that one of the most problematic issues with land irrigation identified from the outset has been the instability of Peninsula loess soils and steep slopes. Despite this, the geotechnical assessment carried out by the Applicant to date only assesses a portion of the area in Robinsons Bay proposed for irrigation .

9.1.4 Mr. Dean has stated that what had been done was not even sufficient for a feasibility study[85]. We do not therefore agree with Mr Pizzey that it would be irresponsible to do further work at this stage. Understanding whether the project is geotechnically feasible is critical. In our view it would be irresponsible to issue a consent for this project if it was not geotechnically feasible. It would result in an unworkable project.

9.1.5 The geotechnical risk is greatly exacerbated by the proposal to use non-deficit irrigation over many years, including during wet winters, and that at the mid-level of the irrigation area there is to be a large cut and fill platform holding a massive weight of stored water.

9.1.6 The ATWIS system proposes to irrigate an average of 576mm per year of treated wastewater onto loess soils at Robinsons Bay and Hammond Point. This represents an increase of 53% over the average annual rainfall of 1,085mm per year. In a previous geotechnical study[86], it was noted that around 75% of Akaroa Harbour's recent landslides occurred when the average rainfall over a three year period exceeded the long-term average by around 400mm, and on this basis they recommended limiting non peak summer (mid-March - December) irrigation to no more than 250mm, with rates possibly being able to be increased if several years of testing demonstrated that this would be safe. In contrast for the period of 2018-2022, the Applicant's modelling assumes an average irrigation rate of more than 500mm during this period, i.e. more than double the recommended safe rate, and equivalent to long-term average rainfall higher than that experienced over the two three-

[84] Dean cl 22 p4, Application appendix Q geotechnical investigation report p28
[85] Dean, cl 12, p2
[86] Geotech Consulting, Preliminary Geotechnical Appraisal of potential slope stability issues in relation to the proposed wastewater irrigation of areas of land near Akaroa, Jan 15, 2010

year periods when the majority of recent slips occurred.

9.1.7 Geotechnical risk has not been comprehensively assessed by the CRC s42A report. In agreeing with the Applicant that the scheme has been designed around any geotechnical risks[87], CRC planner Ms Mitten fails to take proper note of the expert advice received from Mr Ellwood suggesting comparing the current saturated soil conditions to the proposed discharge scenarios, as irrigation will extend the duration of saturated conditions[88]. This essentially is the same concern as identified by Geotech Consulting Ltd back in 2010 as part of the Harrison Grierson study, that the majority of landslips occurred when soils had been saturated at a deep level due to a succession of wet years.[89]

9.2 Use of upper slopes

9.2.1 We are particularly concerned about the inclusion of irrigation areas above the 200m contour line and the northeastern most areas.

9.2.2 The previous owner of the property, Mr Thacker, who had farmed the land for over 30 years, identified to CCC consultants prior to the purchase both continuously wet areas and potential rock slides in some of the areas now being considered for irrigation.[90] He warned about use of the upper slopes. He noted that the land on the upper slopes gets saturated during winter and remains so, indicating poorly draining materials.[91]

9.2.3 Hence, these areas were not included in the geotechnical investigations carried out on the site in 2016 and 2017 which stated: "*On the higher elevation slopes underlain by loess and loess colluvium, the risk of instability is greater than on the valley floor. Slopes inclined at less than 15° have been used as one of the criteria in selecting the study areas. However the dispersive nature of the loess is likely to result in some erosion and potential instability in these higher areas. It is of note that reworked loess, such as loess colluvium, is more susceptible to erosion and instability than in situ loess".*[92]

9.2.4 These areas were also not included in the 2020 Inner Bays proposal[93]. They were added in by the Aqualinc irrigation consultants on a site walk over and now make up over 20% (approx. 6.88ha) of the proposed irrigable land on the Robinsons Bay site. We identify them on the map below.

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[87] CRC s42A p81
[88] CRC s42A Ellwood cl64 p207
[89] Harrison Grierson, Wastewater Options & Risk Analysis Report , February 2010, Appendix 4, Geotech Consulting Ltd, p113-115
[90] 8 February 2017 - Attachment - Akaroa Treated Wastewater Reuse Options Working Party - Report on 11 Sawmill Road p6
[91] Beca Akaroa Wastewater Summary of Disposal and Reuse Options . 17 July 2002, Appendix L Inner Harbour Investigations PDP Infiltration Testing Results for Akaroa Treated Wastewater Disposal Via Irrigation – Thacker Land, March 2016,
[92] CH2M Beca, Akaroa Wastewater Disposal Alternative Sites Stage 2 - Geotechnical Report2020, 4 Nov 2016, p10. 2020 Beca report, Appendix L
[93] Applicant's Evidence, Offer, C2HM Beca2020 Figure 5-7, p48

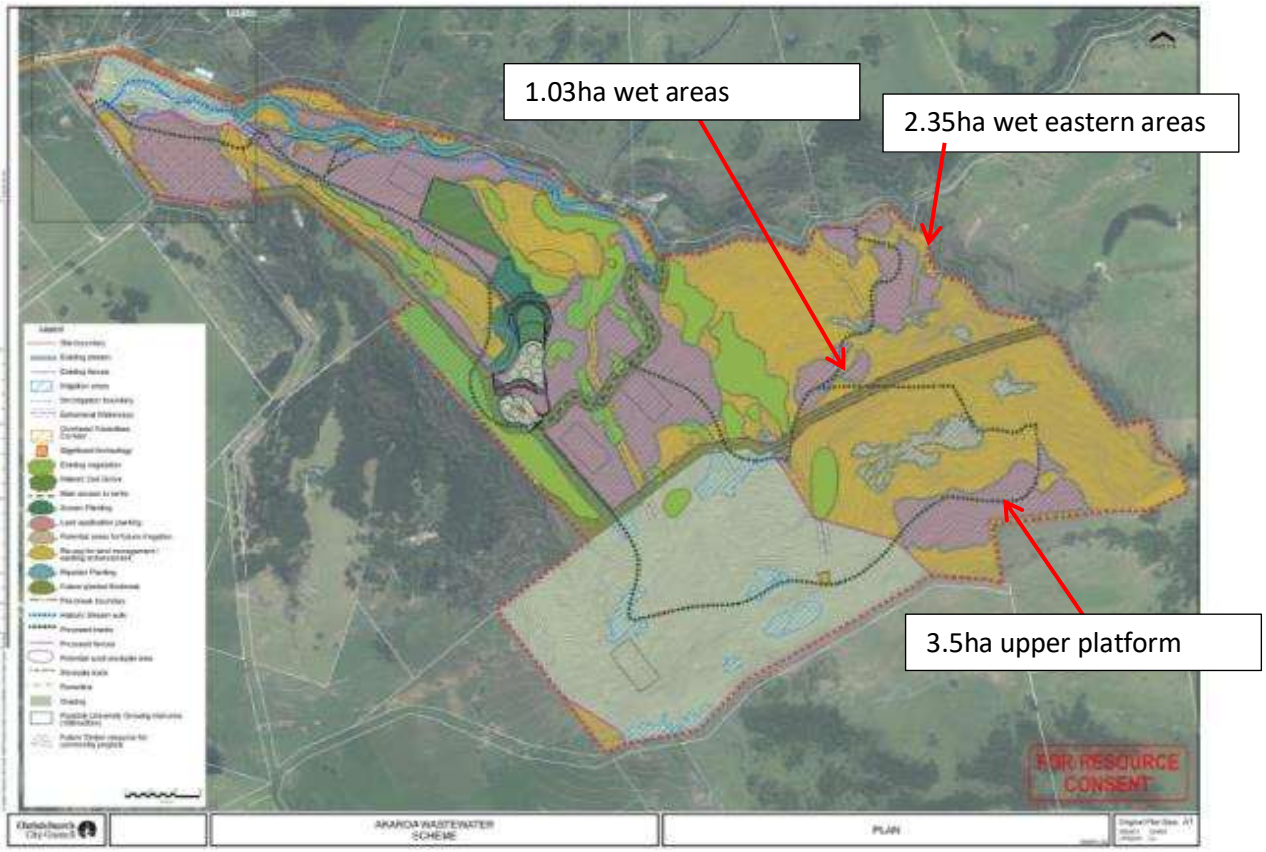

Figure 7 Upper and North-eastern irrigation areas of concern

9.3 Slopes greater than 19°

9.3.1 We are also concerned that some of the areas selected for irrigation have slopes of greater than 19° or downslopes that are greater than 19°. These were important factors in site selection initially to avoid groundwater mounding increasing instability as shown in Appendix A.

9.3.2 The diagram below shows the irrigation areas outlined in purple with colour coding indicating different categories of land slope:

- Green ≤ 19°
- Orange ≤ 30°
- Red > 30°

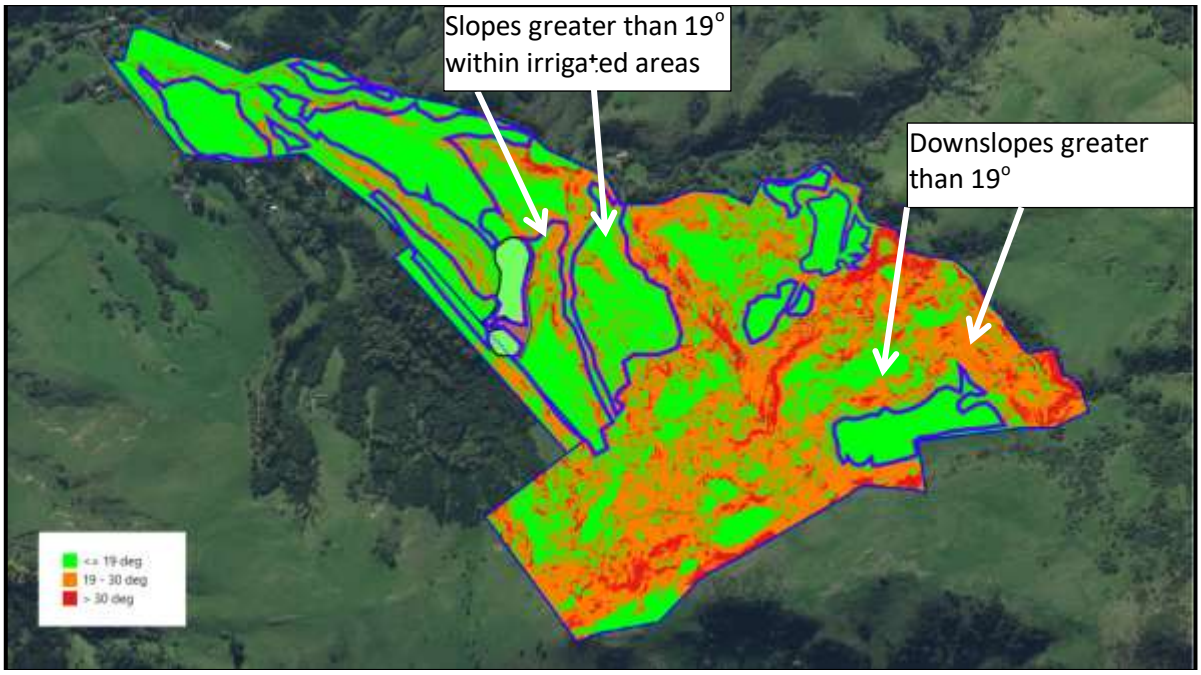

Figure 8 Slopes in Irrigation areas

9.3.3 As can be seen in the map above, the irrigation area immediately to the east of the tank platform contain slopes of greater than 19° as does its neighbour. Several irrigation areas in the upper areas have downslopes exceeding 19° and occasionally greater than 30°.

9.4 Increased ground water drainage affecting slope stability

9.4.1 The impact of increased soil moisture on slope stability is set out, in bold, in the Applicant's geotechnical report, which states: ***"Both types of loess*** *[loess cohesion and loess colluvium]* ***are extremely susceptible to changes in moisture content, with minimal increases sufficient to significantly reduce shear strength properties"***[94]**.**

9.4.2 It goes on to describe how slope instability on Banks Peninsula often occurs following periods of high rainfall or other increases in soil moisture.

9.4.3 Ms Van Dijk also notes that the application rates have changed over time as the size of the available irrigation area has shrunk[95] and that the original (lower) irrigation rates were determined by PDP as being suitable and below the long-term acceptance rate (LTAR).

9.4.4 However, it is not made clear anywhere what the LTAR actually is, nor what limiting factor(s) constrain it[96]. Given the irrigation rates determined by PDP in June 2018, we believe it was based on their test pits on the Robinsons Bay site in 2017. We cannot find any consideration given to LTAR since 2018.

9.4.5 Aqualinc estimate drainage will increase from 460mm to 843mm[97], an increase of 383mm or 83%,

9.4.6 Aqualinc report that the measured infiltration rate of the soils at 22mm/day is much higher than the

[94] AEE, Appendix Q, p20
[95] Van Dijk cl 15 p3
[96] Van Dijk cl 17 p3
[97] AEE, Appendix A Aqualinc report Figure 9

irrigation rate 3.08mm/day in summer. However, this does not appear to take into consideration the impact this has on the lower soil layers. Mr Dean and Ms Van Dijk describe how increased drainage increases moisture levels in the lower soils.

9.4.7 Ms Van Dijk states that drainage from irrigation will lead to increased moisture in the subsoil, causing decreased soil structure and putting the soil at increased risk of slips and tunnel erosion[98]. This agrees with the earlier work by Beca and PDP addressed in the presentation reproduced in Appendix A

9.4.8 Dr Riddle has identified that: the application of wastewater onto loess soils already at field capacity can result in the generation of conditions needed for tunnel gullies to form. This movement of water erodes tunnels in the hillside which eventually give way, resulting in gullies. Tunnel gully erosion and slips in general are possible with constant wastewater application onto wet, steeper areas at Robinsons Bay[99].

9.5 Identified risks not properly considered or mitigated

9.5.1 Despite the limited scope of the Applicant's geotechnical assessment, Mr Dean notes that it *does* identify geotechnical risks that would limit the usability of some of the (minimal) areas assessed, and may rule some out altogether, leading to a reduction in irrigable area.[100]

9.5.2 In the Applicant's evidence, Mr Woods[101] has accepted Mr McIndoe's suggestion that if there are problems in one area, irrigation in another area could be increased. This approach effectively reduces the total area being irrigated, essentially overriding the irrigation limits that have been established and increasing the irrigation and nutrient burden on the areas where irrigation is increased.

9.5.3 Furthermore, the suggestion is based on Mr McIndoe's assertion that the irrigation capacity of the areas is only at 71% utilisation. This is based on an annual average. While there is plenty of spare capacity in dry conditions, there is no spare capacity in wet winters when the system is already under sized and will experience storage exceedances.

9.5.4 Mr Dean notes that mitigation as a result of failures detected through monitoring may have a significant impact on the capacity of the irrigation fields, placing the viability of the scheme in doubt[102].

9.5.5 Mr Woods also refers to the planting of native vegetation that will stabilise the slopes as one of the key controls to prevent destabilisation of slopes[103]. We discuss the validity of this assumption in 17.12.23 below

9.5.6 Given that the proposed system is already unable to manage all wastewater flows and will experience regular, large storage exceedances, there is a significant risk that these overflows will

[98] Van Dijk cl32 p6
[99] CRC S42A, Riddle, Cl 21, p3
[100] Dean cl25 p6
[101] Applicants Evidence. Woods, Cl7.3, p18
[102] Dean cl 61 p12
[103] Applicants Evidence, Woods, Cl4.10, p16

increase over time because mitigation (such as repairing compromised areas or adding further irrigation areas or storage) may take some time to achieve, or may be found to be not practicable.

9.6 Storage tank platform risk

9.6.1 There are serious geotechnical risks relating to the storage tank platform. In addition to the general slope stability risks already noted, the weight of water contained in the ten tanks (2,400 tonnes *per tank* when full – the equivalent of approximately 13,000 average-weight cars or 600 houses) adds further risks. Based on the wastewater flow modelling, the tanks are likely to be completely full 1 in every 2.5 years. This will be the time when the land will be the most saturated.

9.6.2 Dean suggests that, given this loading, the proposed cut angles will be unlikely to have a sufficient factor of safety against failure, including during earthquakes[104].

9.6.3 The geotechnical assessment carried out by the Applicant contradicts the system design. As Mr Dean notes, the geotechnical assessment in Appendix Q identifies geotechnical risks in the tank platform areas, concluding that this area should not be irrigated. However, Aqualinc consider it "*most suitable".* [105]. The area immediately around the tanks has been identified as part of the irrigation field (see Figure 2 above).

9.6.4 During the hearing, the Applicant's geotechnical engineer Mr Woods stated that irrigation in the areas around the tank platforms would only be for the purposes of maintaining the growth of plants used to stabilise the banks, not year round wastewater disposal. These areas should therefore be subtracted from the 31.9ha identified as irrigation areas on the Robinsons Bay site. We estimate this is at least 0.5ha.

9.6.5 We note that in discussion at the hearing a reducing regime of inspection for the tank platform was suggested by Mr Woods starting with monthly and reducing to annually, possibly with the site operators checking after heavy rain.

9.6.6 We are concerned that under this approach the loss of strength of the storage tank platform may only be detected after it has been compromised,[106] and it relies on people without geotechnical knowledge to make an assessment after the event in what could be difficult conditions such as following a major storm.

9.6.7 Mr Woods suggested at the hearing that the tank platform could be strengthened with a retaining wall if geotechnical assessment showed that it was likely to fail (either prior to or after construction). We consider this to be a risky and potentially very expensive approach. Resources would be better directed to further reducing I&I, so as to reduce the size and number of tanks required.

9.6.8 Mr Dean recommends a reduction in the size and number of storage tanks at this site to reduce the platform area and loadings[107]. We strongly support this recommendation.

9.6.9 Mr Woods conceded at the hearing that tanks may need to be moved further back from the edges

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[104] Dean cl34 p8
[105] Dean cl42 p9
[106] Dean cl59 p12
[107] Dean cl73.3 p13

from that currently shown on the diagrams, or some could be relocated to the fill area.

9.6.10 We question whether this would require further geotechnical assessment given loadings would be increased on those areas of the platform to which the tanks were being moved. We also note that the diagram on page 17 of the Visual Aids and Diagrams document circulated at the hearing, and which Mr Woods referred to in the hearing[108]showed the original 10 tanks with a 22m diameter (prior to the size increase to 23m diameter to accommodate Duvauchelle flows), so there is less room to manoeuvre than he indicated.

9.6.11 We do not support the relocation of tanks to the fill area because of the elevated risk of overloading disturbed loess, nor placing them in closer proximity to each other as this would increase the likelihood of a failure of one tank affecting another creating a cascade effect.

9.6.12 We are also concerned about the seismic rating of the tanks themselves. We recommend these should be meet the IL3 standard, given they are part of a critical service.

9.7 Summary of concerns regarding slope stability

9.7.1 The environmental effects relating to geotechnical risk fall into two categories:

1. Slope stability failure, leading to a functional loss of part or all of the irrigable area, and sediment reaching the stream and/or estuary
2. Tank platform failure.

9.7.2 Slope stability failure could result in a reduction of the system's capacity either at any one time or possibly permanently[109], necessitating an increase in overflow discharges. This may occur either because of damage caused by tunnel erosion or landslide, or because monitoring indicates irrigation of some or all areas must be reduced or, potentially, cease altogether because of an identified slope stability risk. Slope instability in *un-irrigated* areas may also be affected by irrigation and/or heavy rainfall leading to progressive failure through irrigation fields[110].

9.7.3 Slope stability failure affecting the irrigable areas may have environmental effects, such as silt and contaminants entering Robinsons Bay via the stream or coastline (Hammond Point site).

9.7.4 The Applicant's geotechnical consultant has adopted a monitoring approach to risk mitigation[111], and suggests deferring further geotechnical assessment and subsequent alterations to the design. This approach fails to consider the impact that the identified risks may have on the viability of the system, by reducing its overall capacity and increasing overflow discharges, with their associated environmental effects. Mr Dean considers there will almost certainly be unquantified risks that impact overall viability[112].

9.7.5 More critically, there appears to have been no consideration of the risks posed by failure of the tank platform, including flooding of properties and the irrigation fields downhill, or of an emergency plan in

[108] Applicant's Evidence at Hearing, Visual Aids, p17
[109] Dean Cl 70
[110] Dean cl27 p6
[111] Applicant's Evidence, Woods, Cl 9.1, p23
[112] Dean cl72 p13

the event of catastrophic tank and slope failure[113].

9.7.6 The potential effects from geotechnical issues range from more than minor (increased overflow discharges, contamination of stream and coastal areas) to high potential impact (storage tank collapse). This is an unacceptable level of risk that needs to be mitigated through avoidance, not a monitor and adapt approach.

9.7.7 Mr Dean recommends several conditions, including[114]:

a) Substantial additional geotechnical studies, with particular regard to the storage tank platforms

b) A reduction in the number and size of the storage tanks

c) A reduction in proximity of the irrigation around the storage tanks, with greater setbacks

9.7.8 Mr Dean also notes that the identified risks will be exacerbated by irrigating above field capacity, and that issues identified during operation may have a significant impact on the irrigation field capacity, potentially affecting the scheme's overall viability[115].

9.7.9 For this reason, we agree with Ms van Dijk that these risks can be reduced by limiting irrigation to when soil moisture is below field capacity. We discuss this further in Section 11.

9.7.10 Such an approach will reduce, but not eliminate, the geotechnical risk. A detailed assessment of the impact of reduced irrigable areas resulting from slope stability issues should be carried out to inform the overall viability of the proposal.[116]

[113] Dean cl 73.6 p14
[114] Dean cl73 pp13-14
[115] Dean cl 61 p12
[116] Dean cl73.8 p14

Section 10. Nitrogen removal assumption

In this section we consider the level of uncertainty around soil denitrification and tree uptake assumptions. In our view the assumed nitrogen removal is overstated and not supported by the evidence.

10.1 Denitrification assumption

10.1.1 As already discussed, the output standard from the WWTP is currently set to an annual average of 10mg/L. (this is equivalent to 10g per m^3). As set out in the AEE Appendix A, this equates to a dissolved inorganic nitrogen concentration (DIN) of 8.6 g/m^3 , giving a total of 57.5 kg N/ha/y on the Robinsons Bay site, DIN load of 49.5 kg/ha/y and a total DIN load of 1,580 kg/y over the whole site.[117]

10.1.2 Monitoring to date shows that currently the Robinsons Bay stream has low nitrate-N concentrations of 0.03g/m^3 based on available water quality measurements, and the stream and estuary it flows into are in good health.

10.1.3 Mr Dark has identified in his evidence that *nitrate-N is a key contaminant of concern for waterbody health.*[118]

10.1.4 The extent to which this will occur depends on the concentration of N in the irrigation water and the level of treatment by the irrigation field via permanent uptake by the trees and denitrification in the soil.

10.1.5 Aqualinc considered 5 different scenarios of irrigation field treatment for the main field, these being:

- Existing land use (grazing with low to no use of synthetic fertiliser)
- Base case which includes N removals of 13.5kg/ha uptake/denitrification from the trees planted on the 31.9ha plus 2 kg per ha from destocking.
- Preferred case which is the Base case with 23ha of additional riparian and infill planting assumed to take up another 13.5kg/ha, and another 2kg per ha removed from destocking this area as well.
- Destock 2 which is the preferred case with a further 63.2ha destocked removing another 2kg/ha
- Conservative – assuming no uptake or offset on any part of the property

10.1.6 They then present a table showing the changes in the Nitrate-N concentrations in the Robinsons Bay Stream for each case which we reproduce in Table 3 below:[119]

[117] AEE, Appendix A, Aqualinc, Table 3, p2
[118] Applicant's Evidence, Dark, Cl 3.14
[119] AEE, Appendix A, Aqualinc, Table 4, p3

Table 3 Change in Nitrate concentrations in Robinsons Bay Stream (Table 4 from AEE Appendix A)

	Existing Stream Nitrate-N (g/m^3)	Change in concentration (g/m^3)	Resulting concentration (g/m^3)
Existing land use	0.030	0.000	0.030
~~Preferred scenario~~ --- Base case	0.030	0.086	0.116
Destocking 1 Preferred scenario	0.030	0.057	0.087
Destocking 2	0.030	0.047	0.077
Conservative	0.030	0.126	0.156

(Note: We have annotated the table in red, because the original labels in Appendix A of the AEE are confusing. In Section 10.5 of the Aqualinc report Destocking 1 is described as CCC's preferred scenario, and the row labelled Preferred Scenario is described as the Base Case. We have therefore corrected the labels accordingly to avoid further confusion.)

10.2 Nutrient risk

10.2.1 The assumption that 13.5kg/ha/y will be achieved through uptake from denitrification (10kg/ha/yr) and uptake by the trees (3.5kg/ha/yr) is based on the work of Meister and Robinson presented in Appendices R,S and V of the AEE.

10.2.2 In our view, the potential impacts of nitrogen have not been adequately assessed and mitigated because:

a) The potential nitrogen loss through soil denitrification is a matter of high uncertainty and is not supported by evidence

b) The fresh water nitrogen limit in the CRC LWRP has not been applied

c) Monitoring and adaptation is not appropriate for nitrogen because of the long period it can take to become apparent, meaning mitigation is too late to halt the effects

10.3 Soil denitrification assumption

10.3.1 Meister and Robinson[120] estimate Soil denitrification at 10kg/ha/yr. This figure is arrived at from a literature review of five separate studies looking into the removal of nitrogen from Treated Municipal Wastewater (TMW).

10.3.2 Denitrification rates for the five studies, one local (Whakarewarewa) and four international, are provided in the AEE Appendix V Table 1. We reproduce this table below.

[120] Application Appendix V Nitrate Assessment, Meister and Robinson.

Table 4 Denitrification rates in TMW-irrigated forest systems (reproduced from AEE Appendix V Table 1)

Site	Soil	TMW rate (kg N/ha/yr)	Denitrification rate (kg N/ha/yr)	Reference
Whakarewarewa (NZ)	Pumice	298	1.7-2.4	[19]
Falmouth, Massachusetts (USA)	Inceptisols(mesic Typic Dystrochrepts and mesic Typic Udipsa-ments)	370-480	2-21 (as N_2O), total N will be higher	[20]
Central Appalachians (USA)	fine-loamy, silicious, mesic, Typic Hapludult	62.9	22.1	[21]
Geogria (USA)	Typic Kanhapludults with A horizon textures ranging from fine-sandy loam to sandy-clay loam	407	5-10	[22]
Shepparton (Australia)	Brown Sodosol (clay loam)	123-160	17.0-77.7	[23]

10.3.3 As can be seen, the denitrification figures for the five studies present a wide range of values, from 1.7 kg/ha/yr to 77kg/ha/yr.

10.3.4 No analysis or explanation of the variance observed in these different sites is given in the Appendix V.

10.3.5 The authors have not explained how they reached the conclusion from these widely varying figures that the denitrification at Robinsons Bay would be at least 10kg/ha/yr. They have merely stated: *The authors suggested that denitrification would be significantly higher on less free-draining and finer-textured soils. Such soils occur at Robinsons Bay. It is therefore likely that denitrification at Robinsons Bay will be at least 10 kg/ha N.*[121]

10.3.6 The report also includes a disclaimer in bold at the start stating: *Disclaimer: A robust quantification of N fluxes from TMW-irrigated native vegetation in Robinsons Bay would require experiment(s) to determine the rate of denitrification. As such, the numbers provided in this report should be considered as estimates only.*[122]

10.3.7 We have read the papers referred to in Appendix V, summarised in the Table above. The wide range of denitrification results from a number of factors:

a) The application rate of both water and nitrogen varies widely between the studies. Several studies observe that denitrification rates are positively correlated with both nitrogen and water loads.

[121] AEE, Appendix V, P4
[122] AEE, Appendix V, P1

b) All the studies included unirrigated control sites and irrigated sites, and reported denitrification for both. However in the table, some figures report the total denitrification rates, others report the difference between unirrigated and irrigated sites. The denitrification occurring on the unirrigated sites is removing naturally occurring nitrogen and is a therefore an underlying constant across both. Therefore the appropriate figure to consider is the difference between the unirrigated and irrigated denitrification rates.

10.3.8 The 1.7 kg/ha/yr figure listed for Whakarewarewa is for the control (unirrigated) area. The 2.4kg/ha/yr is the total removal from the irrigated area. The correct figure for removal achieved from the irrigated area is the difference, 0.7kg/ha/yr. This equates to less than 0.25% of the nitrogen in the irrigated wastewater.

10.3.9 The figure quoted for the Appalachians is also the total denitrification from the irrigated forest, not the difference caused by irrigation. The actual figure is 8.9kg/ha/yr, although this also likely overstates the level of treatment as is discussed below.

10.3.10 Several studies note that denitrification rates increase dramatically under anaerobic conditions brought about by saturating the soil. However the Applicant explicitly states that saturation is to be avoided for the ATWIS system, and various experts have required this for reasons of slope stability, odour and leaching rates. Studies under anaerobic conditions are therefore not informative. These include the upper value for Falmouth and the entire Shepparton study.

a) The Falmouth study presents a removal range for the differences in the irrigated areas of between 2 to 21kg/ha/yr. The higher removal area reporting 21kg/ha/yr is for a grassed area where the soil was so compacted that it was waterlogged, so should not be considered relevant to Robinsons Bay. The relevant denitrification levels for irrigation to trees are 2-3kg/ha/yr (<1% of the nitrogen in the irrigated wastewater).

b) The results for Shepparton are highly variable ranging from 17-77kg/ha, but again from a site that is not comparable as the soil has an extremely low moisture conductivity. This system was flood irrigated, and only from October to April; in the remaining months the low infiltration rate made it infeasible to irrigate, despite the area having annual rainfall of only 500mm/yr and winter PET rates of 1.8mm, which is significantly higher than the rate for Canterbury for the same period (1.0mm). This study is therefore not comparable and should be discounted.

10.3.11 Other useful insights gained from these studies were:

a) "*Upland denitrification accounted for <1% of total wastewater N applied annually*" (paper 19, Whakarewarewa)

b) "*Soil was a major sink for wastewater N in year 1, but in year 2 soil N retention fell to near zero, and N leaching losses greatly increased*" (paper 20, Falmouth)

c) "*Even at relatively low loading rates N saturation will eventually occur*." (paper 20, Falmouth)

d) "*Once an ecosystem has become overloaded with N, wastewater application rates would have to be drastically reduced for several years in order for the ecosystems to recover the capacity to retain added N*" (paper 20, Falmouth)

e) "*During the 2-year period, the forest ecosystem experienced a net leaching loss of N that ranged from 14.8 to 105 kg N ha^{-1} year^{-1}, depending on the application rate. It is likely that this mature hardwood forest will continue to lose N, and that little or no additional N will be sequestered*" (paper 21, Appalachians)

f) "*Even after soil N processes equilibrate to new levels of hydraulic loading, little or no additional N will be sequestered by this forest system. Success of this system from a regulatory standpoint will simply be a function of sufficient dilution in groundwater to meet an arbitrary standard*" (paper 21, Applachians)

g) "*The contribution of denitrification to the removal of wastewater applied N was estimated to be only 2.4% on a landscape basis*" (paper 22, Georgia)

10.3.12 These insights suggest nitrogen removal via denitrification is at best a few percent, and that the overall nitrogen loss can in some cases be *negative*, because the additional leaching caused by the application of water increases leaching of nitrogen previously stored in the soil.

10.3.13 The conclusion reached in several of the studies is that long-term irrigation to trees cannot be relied on to mitigate the level of nitrogen in the wastewater over the long term.

10.3.14 We therefore question the extent to which the assumption of 10kg/ha/yr denitrification from land planted in trees, and upon which the Application is based, can be relied upon.

10.3.15 In addition to the 10 kg/ha/yr, Meister and Robinsons assess the uptake of the trees at 3.5kg/ha/yr. This was based on the assumption that the average plant biomass would be 5t/ha/yr and the average plant N concentration is 0.7%, similar to pinus radiata, making a total uptake of 35 kg/ha/yr. The authors note that in the first 5 to 10 years there will be minimal return to the soil (during the time of rapid growth) but as the forest matures the net removal would only be 10% of this – meaning 3.5kg/ha/yr.

10.3.16 In his evidence, Prof Robinson states that it is not only a literature review that has led to the removal estimate, but also the Duvauchelle tree trial. We question the relevance of this trial to the system proposed given that:

a) wastewater irrigation at the trial took place when these trees were first planted rather than after they had been established as is planned for ATWIS,

b) the mix of species used is different,

c) the density of planting is much greater,

d) the terrain is much flatter, and,

e) the lack of measurement of nitrate leached to the adjacent stream.

10.3.17 There are also questions over whether the irrigation method used is consistent with that proposed for ATWIS given that there appear to have been some extended periods when the trial has not been

irrigated:

a) In November 2019 Prof. Robinson informed us: *The trial will continue for at least two more years (with irrigation at the same rate). We are currently repairing the irrigation system*[123].

b) In October 2020 Prof. Robinson informed us*: Currently, the plot is not being irrigated because the irrigation is being re-routed via the road, instead of over an adjacent farm. The intention is to buy the plot and continue irrigation in perpetuity*[124].

a) At the hearing Prof. Robinson was unable to answer as to whether irrigation had continued since 2020.

10.3.18 We requested via LGOIMA to CCC the records of when irrigation to this trial took place, and were advised that Council do not have a record of when the irrigation stopped, and could only confirm it was not operating in 2024..

10.3.19 Finally, the tree trial alternated control plantings (which were not irrigated) and irrigated plantings in rows horizontally down the gentle slope as shown below.

Figure 9 Tree Trial layout[125]

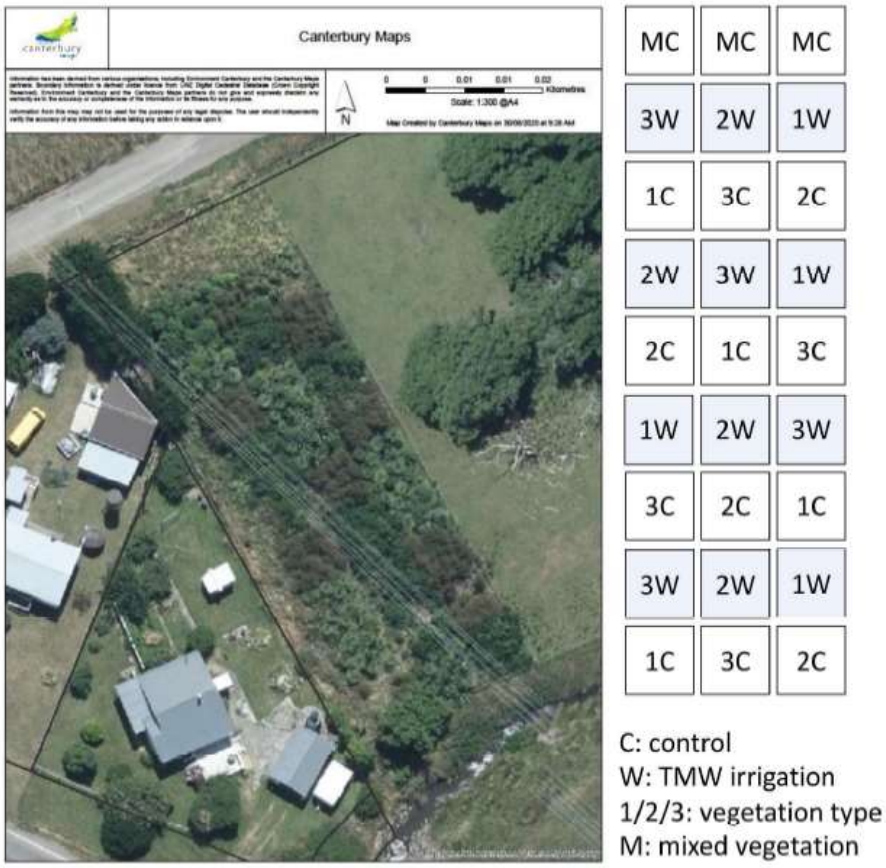

Figure 2: Recent satellite photo of the field site with visible treatment blocks (left) and schematic overview of the trial (right).

10.3.20 Appendix R states that the height of native vegetation irrigated with wastewater was significantly

[123] Email from Prof. Robinson to Brent Martin, 18th October 2019
[124] Email from Prof. Robinson to Brent Martin, 5th October, 2020
[125] AEE, Appendix R, Figure 2, p7

greater than the controls[126], implying that the irrigation with wastewater and the nitrogen it contains did not affect the adjacent control plantings (or at least not to the same extent). The Application however is based on the assumption that the 23ha of adjacent unirrigated areas to be planted *will denitrify and uptake nitrogen from the wastewater applied to the irrigated areas at the same rate as the irrigated areas*, which appears to contradict the findings of the trial.

10.3.21 Hence both the total denitrification and tree uptake figures (combined to give a total treatment rate of 13.5kg/ha/yr on both irrigated and non-irrigated areas) have been based on assumptions rather than directly relevant empirical evidence. This applies to both the 31.9ha area to be irrigated at Robinsons Bay and the 23ha of additional planting that is not being irrigated.

10.3.22 We are therefore concerned that the scenario set out in the Application, Destocking 1, has been chosen. It is based on the figure of 13.5 kg/ha/yr being removed and the consequent effects on the Robinsons Bay stream have then been relied on by experts assessing freshwater effects (Dewson et al)

10.3.23 It is our view that, given the level of uncertainty around nitrogen removal (which is acknowledged by Meister and Robinson), the Conservative Scenario assuming no denitrification or tree uptake is the most relevant one.

10.4 Expert concerns about nitrogen pollution

10.4.1 In AEE Appendix H EOS Ecology state that the main operational effect of the ATWIS on freshwater ecological values is the potential for increased nitrate levels in the Robinsons Bay Stream, from drainage through the soil profile or surface water runoff of the irrigated treated wastewater.[127]

10.4.2 Increased nutrient concentrations from leaching caused by drainage and/or surface water runoff have the potential to negatively affect the freshwater and coastal environment in Robinsons Bay, mainly through increased nutrient levels. Both the Applicant's and CRC's experts identify specific risks to the environment which are likely to be more than minor.

10.4.3 Dr Scott, CRC s42A report concurs that: "*The modelling approach is very coarse, and highly uncertain. Small changes in some of the inputs lead to large changes in outputs. For example, using of a low flow value, rather than mean annual flow, to calculate the annual flow volume in Robinsons Bay Stream would give much higher annual average DIN concentrations (0.6 to 1.0 mg/L) for the various planting and destocking scenarios. This is one aspect where the modelling is less conservative.*" [128]

10.4.4 Dr Scott also notes that *"The annual averaging approach also obscures short term event-driven changes. Measured DIN concentrations in Robinsons Bay Stream were much higher under wet conditions than in dry weather sampling. The modelled annual mean dissolved inorganic nitrogen (DIN) concentration for CCC's preferred Destock scenario was 0.08-0.1mg/L (compared to a measured mean 2021/2022 concentration of 0.03mg/)."*

[126] AEE, Appendix R, p26
[127] AEE, Appendix H, p47
[128] CRC S42A, Scott, Cl53, p8

10.4.5 We note this at or above the limit of the receiving water standards for Banks Peninsula streams of 0.09mg/L set out in Schedule 5, Table s5A of the Canterbury Land and Water Regional Plan.

10.4.6 Ms Hayward, CRC S42A report assessing the freshwater ecology notes the uncertainty around the level of nitrogen uptake from the irrigation field, and states: *I therefore consider that all scenarios that modelled increased nitrogen concentrations in streams (more than doubling concentrations) to have potentially moderate effect. [129] Increased nitrogen may stimulate plant growth including macrophytes and algae/periphyton)*. She considers that the potential effects on periphyton growth have not been well assessed in the AEE.[130]

10.4.7 Ms M Burns, CRC s42A report, states that "*The New Zealand Coastal Policy Statement (2010) Policy 11 states that adverse effects should be avoided on indigenous taxa that are listed as threatened or at risk in the NZTTC List. This is the highest level of protection in the Coastal Policy Statement"*[131], and "*In Robinsons Bay there is the potential for localised increase in nutrients which could stimulate the growth of nuisance macroalgae that could affect intertidal ecology including the at risk Zostera muelleri (seagrass) beds"*[132].

10.4.8 Ms Burns identifies the following concerns regarding effects on the health of Robinsons Bay from a number of uncertainties:

a) Discharging to land in saturated conditions

b) Irrigation management during different climatic conditions, on steeper areas and soil type and depth

c) Uncertainty of modelled effects of nitrogen on freshwater

10.4.9 Ms M Burns also acknowledges the "*Uncertainty of modelled effects of nitrogen on freshwater and that these could increase the potential magnitude of effect of nitrate-nitrite nitrogen".*[133] She recommends monitoring is done on a quarterly rather than annual basis.[134]

10.4.10 The Applicant's Freshwater Ecologist Dr Dewson states that the preferred irrigation scenario (by which we assume she means Destocking 1) will result in a mean stream flow that is 2% higher and stream nitrate-N concentration for Robinsons Bay Stream that is approximately 190% greater than the existing median nitrate-N concentration. This she considers would still be within the typical range for the variation in nitrate-N concentrations in the stream based on 12 months of water quality monitoring.[135] We question this logic, given that the new *range* of nitrogen levels will significantly exceed the current range.

10.4.11 Dr Dewson did also consider the Conservative Scenario and concluded the effects on the freshwater ecology would be more than minor under this[136]. However, she then concludes that the Applicant's

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[129] CRC S42A, Hayward, Cl15, p3
[130] CRC S42A, Hayward, Cl9, p2
[131] CRC s42A, Burns Cl 16 p3
[132] CRC s42A Burns Cl 35, p 6
[133] CRC S42A, Burns Cl26-17, p 4
[134] CRC S42A, Burns Cl33, p 5
[135] Applicant's Evidence, Dewson, Cl 2.6, p7
[136] Applicant's Evidence, Dewson, Cl 3.14 p12

Preferred Scenario would suffice. What she has failed to consider is the level of uncertainty around whether 13.5kg N/ha/yr would be removed by the irrigation field under the Preferred scenario.

10.4.12 Dr Dewson accepts that, during heavy rainfall, surface runoff from the irrigated area will occur. However she considers this will not be an issue as reduced water quality during these discrete and relatively short lived events is already an existing stressor on the stream and will not exacerbate the situation because runoff will be substantially diluted by rainfall.[137] We suggest this needs to be more carefully considered given that the nitrogen loading from the treated wastewater is estimated to be much higher than from normal grazing

10.4.13 Dr Riddle concludes that Nitrogen losses via leaching will likely occur, but within the realm of many other intensive land uses in Canterbury[138]. He bases this on the Meister and Robinson study and acknowledges, but has not delved into, the level of uncertainty.

10.5 CRC LWRP

10.5.1 The CRC Land and Water Regional Plan (LWRP) specifies receiving water standards that apply to discharges to water. For Banks Peninsula, the limit for dissolved inorganic nitrogen (DIN) is 0.09mg/l.[139]

10.5.2 This limit has not been referenced in the Application. Under the Applicant's Preferred Scenario the DIN is expected to be 0.087mg/l, so fractionally below the standard.

10.5.3 Given the uncertainties around this figure, and the need to avoid adverse effects on the Robinsons Bay stream and coastal environment, we would expect it to have been considered and discussed.

10.5.4 The LWRP standard would not be met under the Conservative scenario, which we have suggested should be adopted given the uncertainties around the nitrogen removal. The DIN for the Conservative scenario is 0.156mg/L

10.6 Monitoring and adaptation is inappropriate for nitrogen removal

10.6.1 There is real concern expressed by both the Applicant and CRCs experts about the increased level of nitrogen that will be leached to the Robinsons Bay stream and flow out to the shallow bay, and the impact this could have in terms of the sensitive and current high quality environment of both.

10.6.2 However these experts have recommended a monitor and adapt methodology for dealing with the potential issue of excessing nitrogen building up in the stream and coast.

10.6.3 As explained by Meister and Robinson, nitrogen has several pathways it can follow before finally leaving the system as either gaseous nitrogen (denitrification) or leaching. One of these is nitrogen buildup in the soil, which can mean the system appears to be working in its early years, only to start to fail as the nitrogen in the soil reaches saturation. This is what happened in Whakarewarewa in Roturua:

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[137] Applicant's Evidence, Dewson, Cl 5.11, p18
[138] CRC S42A, Riddle, Cl42, p 5
[139] LWRP, Schedule 5, Table S5A, p484

"During the early operational years, nutrient leaching was minimal. The soils retained most of the nitrogen (N) and phosphorus (P) applied in the first three years, with around eight tonnes (t) of N and less than 1 t of P leaching to groundwater/streams each year. In the early years the LTS (land treatment system) was performing better than anticipated, as the soils held more N than anticipated. Subsequently the efficiency of N removal has declined and the adverse effects of water saturation became increasingly evident in the low lying areas of the LTS. From 1993-2002 the amount of N leaching has steadily increased, rising to around 45 t N/yr in one year, thereby significantly exceeding the 30 t N/yr consent limit. This situation led to the BOPRC issuing an Abatement Notice to the RLC for non-compliance."[140]

10.6.4 This highlights the risk with adopting a "monitor and adapt" response to nitrogen: nitrogen saturation in the soil will take time to occur, after which no more nitrogen will be taken up. By the time a problem has become apparent, the irrigation area may be nitrogen saturated, and will take years to return to functioning.

10.7 Summary of concerns regarding nitrogen removal

10.7.1 The New Zealand Coastal Policy statement gives the threatened and at risk seagrass beds in Robinsons Bay the highest level of protection, stating that adverse effects are to be avoided.

10.7.2 The Application has not taken a Conservative approach to nitrogen leaching, but instead its Preferred scenario relies on the highly uncertain assumption that 13.5kg/ha/yr of nitrogen will be removed by the soil and trees on the irrigation field, and in the surrounding unirrigated 23ha of planting.

10.7.3 Even with this assumption, experts are expressing concern about the high levels of nitrogen expected to leach into the stream and the impact it may have in stimulating the growth of harmful periphytons on the stream and the coastal environment it flows into.

10.7.4 However, their suggested approach to monitor (albeit more frequently) and adapt is unlikely to be effective in practice, as by the time leaching effects show up in the stream (potentially several years later) nitrogen is likely to have saturated the area. This is the problem encountered by other failed land-based systems

10.7.5 We therefore consider that a Conservative approach must be taken, on the assumption that there may be no, or minimal, denitrification or uptake in the irrigation field itself.

10.7.6 This would then fail the water standard in the LWRP of DIN 0.09mg/L for Banks Peninsula streams

10.7.7 The only appropriate mitigation therefore is to reduce the total N load on the irrigation field either by tightening the nitrogen standard for the WWTP in the conditions or reducing the volume of wastewater irrigated on the Robinsons Bay site.

[140] Rotorua wastewater treatment plant applications for resource consents and assessment of environmental effects August 2018, p3.

Section 11. Non-deficit irrigation assumption

Within this section we consider how the proposal to use non-deficit irrigation increases the risks already identified and why deficit irrigation is a more appropriate approach.

11.1 Terminology

11.1.1 In this section we use the following terminology.

a) Soil is at **field capacity** when all the small water-holding pores are filled. Adding more water increases the soil moisture beyond field capacity by filling the larger pores in the soil.

b) **Drainage** occurs when this extra water drains out of the larger pores to the lower soil layers, and eventually to a water body – either a surface water body or groundwater. The higher the soil moisture beyond field capacity, the faster it drains out.

c) Soil is **saturated** when no more water can be added to the soil, so it either ponds (on the flat / in indentations) or runs off (down slopes - **runoff**). Runoff in this case means overland flow.

d) When soil moisture is below field capacity, it is in **deficit** – more water can be added without ponding or draining out.

e) **Deficit irrigation** means that irrigation ceases when the soil moisture level is at or below field capacity, i.e. watering only when there is a deficit that can be filled.

f) **Non-deficit irrigation** (as proposed) does not maintain the soil moisture at or below field capacity.

11.1.2 We reproduce below the diagram provided by Mr McIndoe with his Applicant evidence which gives a similar explanation.

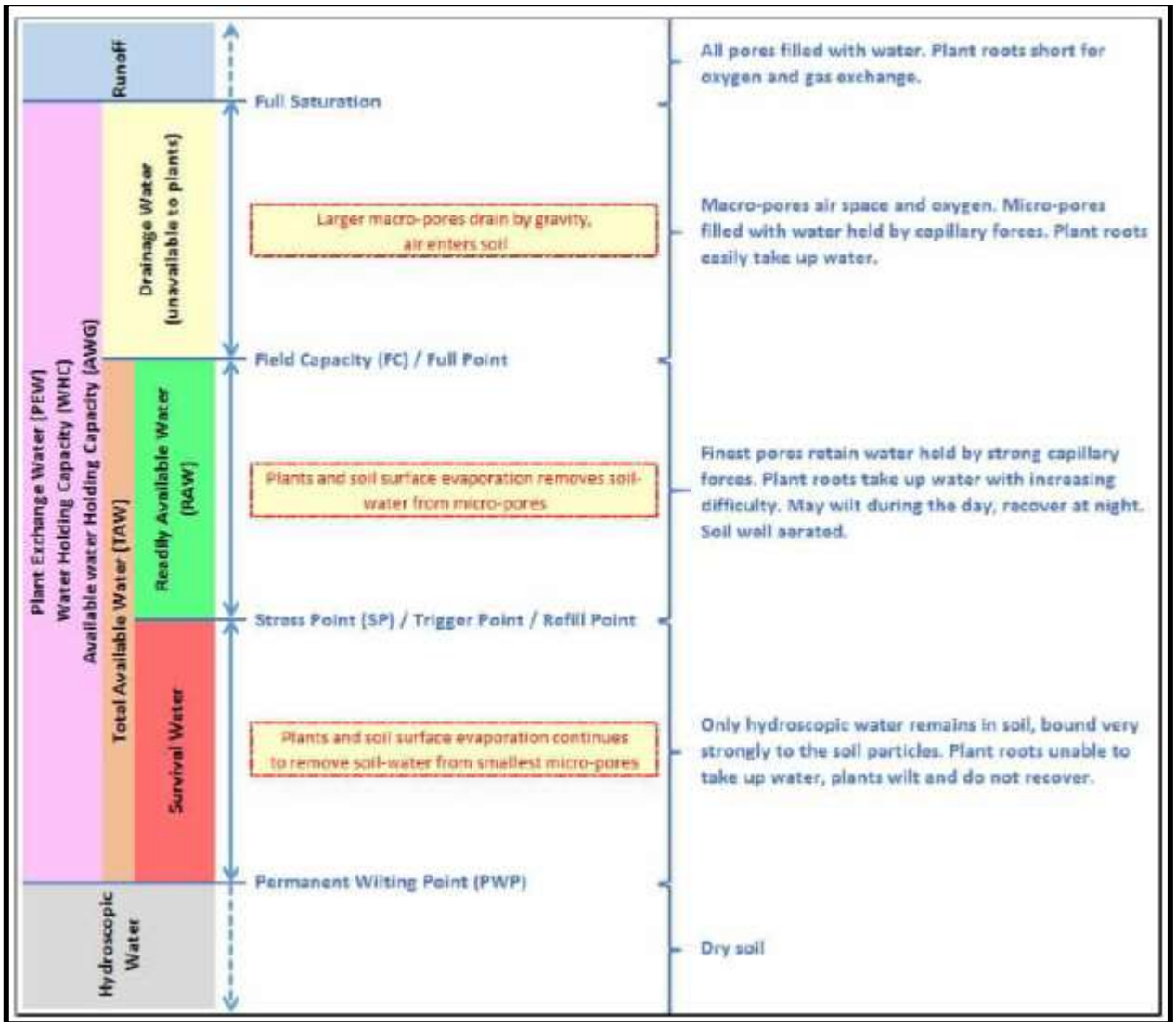

Figure 10 Mr McIndoe's soil moisture diagram

11.1.3 The Application proposes to irrigate above field capacity to saturation, and only cease when ponding and runoff are evident. This occurs at full saturation once there is no ability for the soil to drain. There is no prior cut-off proposed when heavy rain is *forecast,* even in already wet conditions.

11.1.4 Applying non-deficit irrigation (above field capacity) as proposed has two consequences:

1. Drainage increases. As already noted, Aqualinc estimates that drainage will increase from 460mm to 843mm[141], an increase of 383mm or 83%, This includes drainage to groundwater, affecting slope stability. It also reduces the residence time of the nutrients in soil, increasing the likelihood that there will be nutrients from the irrigated wastewater available to be removed by runoff when rainfall occurs soon after irrigation.
2. When it rains, saturation will be reached more quickly, or the ground may already be saturated, resulting in ponding and/or runoff, leading to a direct loss of nitrogen and other contaminants to water bodies.

[141] AEE, Appendix A Aqualinc report Figure 9

11.2 Concerns expressed by experts

11.2.1 Concerns relating to over-irrigation are identified by many of the CRC and CCC experts and the experts engaged by FBPI. The experts are concerned about slope stability, nutrient runoff and odour.

11.2.2 We list here concerns from those experts involved in producing the CRC s42A report, who state that irrigation either below saturation or avoiding ponding and runoff is required to avoid adverse effects (all emphases ours):

a) Dr M. Burns, CRC S42A report (assessing the coastal ecology) states: *Overall, I consider that the risk of adverse effects on coastal water quality and estuarine ecology are low provided that… wastewater is applied* ***at low rates to unsaturated soils***[142]:

b) Dr Hayward, CRC S42A report (assessing the freshwater ecology) states: *I consider there remains* ***some risk of overland flow and run-off to waterways on occasions***.[143]

c) Dr Scott CRD S42A report (assessing ground water) concludes: *If wastewater is treated to a high standard and applied* ***at low rates to unsaturated soils****, the health risks to private drinking water supplies from wells, springs, seeps or creeks is low.*

d) Dr Riddle, CRC s42A report (assessing the ability of the soil to cope with the application rates and annual amounts) states "t*he* ***application of wastewater onto loess soils already at field capacity can result in the generation of conditions needed for tunnel gullies to form.****.* He suggests the use of soil moisture sensors to avoid applying water during saturated conditions, but notes that this has not been used in the irrigation modelling used to calculate the storage.[144] He requires this monitoring to be added as a condition.

e) Mr Ellwood, CRC s42A report (conducting a technical engineering review) states that **a non-deficit regime means that soil moisture status is not considered in decisions to irrigate**,, **that this needs to be determined at the hearing, and the lack of detail on soil condition monitoring increases the risk of irrigation water running off and entering surface water**. He also notes that the soil is likely to be at or above field capacity for a significant period during the winter and therefore rainfall and surface applied irrigation could flow directly to the ephemeral streams linking via surface water and runoff without further treatment through the soil profile, and that this potential is greater on the steeper slopes.[145] One of the key concerns he expresses is "*The management of the irrigation system during wet weather events and following these events and how this is tied in with soil moisture monitoring, storage and rainfall recording".*[146] He therefore recommends an Irrigation Management Plan setting out Procedures to measure soil moisture and rainfall and irrigation scheduling rules based on storage availability, soil moisture and rainfall forecast.[147]

11.2.3 Mahaanui Kurataiao also gives attention to the effects of over-irrigation in their cultural assessment,

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[142] CRC S42A, Burns, Cl 37 p 6
[143] CRC S42A, Hayward Cl 31 p 5
[144] CRC S42A, Riddle, Cl 24 p 4
[145] CRC S42A, Ellwood, Cl 18,19,20,21,23, p4
[146] CRC S42A, Ellwood, Cl 31, p5
[147] CRC S42A, Ellwood, Cl 35, p6

with reference to policy WM6.11 requiring certain conditions for consented discharges to land, including application rates to avoid saturation and nutrient overloading. They indicate their expectation that the scrutiny of the consenting process will ensure that irrigation to land is undertaken within environmentally protective limits. [148] This is made more explicit in the Mahaanui Iwi Management Plan provisions, policy P9.1(b): *"avoid over-saturation and therefore the contamination of soil and/or run off and leaching"*[149]. We agree with this policy.

11.2.4 Mr Van Kekem providing evidence on air quality for the Applicant is under the impression that there are proposed consent conditions that prohibit surface ponding in the irrigation fields, and goes on to explain that an offensive rotten egg like odour can be emitted in the event of ponding.[150]

11.2.5 There appears to be agreement between experts that irrigation to the level where ponding and runoff are occurring will cause issues with fresh, coastal and groundwater, odour and slope stability. This is therefore a matter that requires close examination of how it is to be managed in practice.

11.3 When to cease and restart irrigation

11.3.1 At this stage there seems to be disagreement between experts on how to trigger the cessation of irrigation in practice when ponding and surface runoff are occurring.

11.3.2 Mr Ellwood suggests soil moisture meters be installed and that a more precautionary approach be decided upon at the hearing. "*The applicant should detail how soil condition monitoring that inhibits soakage and rainfall data will be integrated into the operational regime and the conditions to return to irrigation based on soil status and/or following a 50 mm rainfall day"*[151]*.* He recommends that the Irrigation Management Plan includes soil moisture monitors being installed, and Irrigation scheduling rules based on soil moisture and rainfall forecast.[152]

11.3.3 Mr McIndoe does not recommend this for daily irrigation management purposes. Instead, although he also proposes irrigation should not occur when the soil is saturated, he suggests this be achieved through a direction in the Irrigation Management Plan with some targeted soil moisture measurement to establish the conditions that cause saturation, so that irrigation can be avoided at these times, and along with criteria for when irrigation should be resumed. To deal with the variability over the different areas, he suggests that visual inspection is used. He does not think ponding and runoff will be caused by the irrigation but agrees that there needs to be a procedure to avoid irrigating when the soil has been saturated by rainfall.[153]

11.3.4 We consider visual inspection impractical given the large, steep and dis-contiguous areas involved, the dense plantings, and that runoff may occur without ponding on the steep slopes. The Applicant has not committed to have a manager or operator on site, so it is difficult to envisage how, without soil moisture monitors in place, the runoff could be observed. Heavy rainfall may occur at night or at weekends and take recently irrigated waster with it as it runs off the saturated ground, transporting

[148] AEE Appendix L cultural assessment p39
[149] AEE Appendix L cultural assessment p49
[150] Applicant's evidence, van Kekem, Cl 2.3, 5.5
[151] CRC s42A, Ellwood Cl 20, p4
[152] CRC s42A, Ellwood, Cl34-36 p 6
[153] Applicant's Evidence, McIndoe Cl6.10-7.11

nutrients and other pollutants to water bodies.

11.3.5 Ms Van Dijk makes the sensible recommendation that irrigation takes place up to field capacity to ensure there is headroom for rainfall and to avoid the risk of irrigation or subsequent rainfall saturating the soil and resulting in ponding and runoff. She states that a network of soil moisture meters are needed to determine this.

11.3.6 Condition 6 has **not** been modified to include the addition of a network of soil moisture monitors, nor to include the visual inspection[154]. The critical issue of how to avoid saturation, ponding and runoff is therefore left unresolved.

11.3.7 Finally we note that the maximum annual irrigation rate has been set at 220,800m^3 per year. No information has been given on how this rate is to be applied. The proposed condition is that it is applied annually per calendar year. We suggest that is is applied from July to June, with irrigation ceasing when the limit is reached, thus avoiding applying above the annual maximum during winter.

11.4 Monitoring and adaptation are not effective mitigation

11.4.1 Both the applicant and the CRC s42A report officers recommend mitigation through monitoring, backed up by a management plan. There are three problems with this approach.

11.4.2 First, problems may develop slowly over an extended period; by the time an issue has become apparent, it may be well advanced:

a) Slope instability may take some time to become apparent, particularly if caused by undetected tunnel erosion. The first sign of a problem may be after a mass movement or collapse.

b) Excess nutrients may build up slowly in the soil, meaning problems only arise after several years once the soil is unable to accommodate any more nitrogen (as we have described earlier for Whakarewarewa). Mr Riddle concurs that nitrogen uptake by the kānuka will likely reach equilibrium at some point[155]. Once this happens, soil nitrogen levels would be expected to rise, leading to increased leaching.

11.4.3 Second, because there is no extra suitable land available on the irrigation properties, if additional irrigation areas are required, it could potentially take years to secure and prepare more suitable land and mitigation will likely involve major investment and take considerable time to be implemented. Mr Dean notes that remediation measures responding to slope stability failure could be extensive.[156]

11.4.4 Third, as noted by Ms MacKenzie, undertaking to put a management plan in place does not of itself guarantee that the identified issues will be mitigated. She proposes that it is the *conditions* that need to avoid environmental risk by making explicit the outcomes required to mitigate the risk.[157] We strongly agree that the conditions must make clear how risks will be mitigated, including bottom lines for when action must be taken and the outcome that must be achieved.

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[154] Draft proposed conditions as circulated at the hearing in November
[155] CRC S42A, **Riddle cl37**
[156] Dean cl 25 p6
[157] Ngai Tahu evidence, Mackenzie p9

11.4.5 Before we proceed to discuss such conditions, we address the claim by Mr Pizzey that the system is not maximised and has flexibility and contingency built in.[158] In coming to this view, Mr Pizzey has relied on the 'less suitable 5ha', that irrigation can be increased in more suitable areas and the maximum irrigation rate is 7x less than field work has shown possible. We clarify that the 5ha is longer part of the application, that increasing irrigation rates in more suitable areas of the field risks increasing the nutrient intensity in that area, and that the maximum irrigation rate he refers to ignores the impacts on slope stability.

11.4.6 We also disagree with Mr McIndoe's assertion (repeated by Mr Pizzey) that the capacity of the irrigation areas is only at 71%, and that if problems develop in one area, irrigation could be increased in another. As we note in 9.5.3 above this figure is an average and while there is spare capacity in summer, this will not be the case during a wet winter when the problems of saturation, ponding and runoff are most likely to occur. Furthermore, without an assessment of the LTAR of the site where increased irrigation is to be located, it might exacerbate the long term risks in the new location.

11.4.7 We consider that if there was spare capacity in the proposal, the Applicant would have already planned this in to avoid exceedances and discharges.

11.5 Appropriate mitigation

11.5.1 Ms M Burns recommends the following conditions[159]

1. treated wastewater must not be irrigated to land that may result in surface ponding or runoff
2. treated wastewater must not be irrigated to land when rainfall exceeds 50mm in any 24 hour period
3. Irrigation must only recommence once conditions allow wastewater to be applied without ponding or runoff of treated wastewater.

11.5.2 It is difficult to see how such conditions would be monitored and enforced, let alone how the irrigation field operators would ensure this was the case. Visual monitoring will be extremely difficult, and regardless, if there is no headroom in terms of soil capacity then heavy rain during or following irrigation may well lead to runoff at times when the soils moisture levels are already above field capacity when the rain starts.

11.5.3 Instead, we agree with Ms Van Dijk. The Applicant should be required to take a precautionary approach and ensure that the environmental risks are avoided by conditions clearly stating that irrigation does not occur beyond field capacity.[160]

1. treated wastewater must not be irrigated to land such that soil moisture is raised beyond field capacity
2. treated wastewater must not be irrigated to land when rainfall is forecast to exceed 50mm in any 24 hour period

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[158] Applicants Evidence, Pizzey legal submissions, cl 3.7, p3 and cl 6.51, p25
[159] CRC S42A, Burns,p102-103
[160] Van Dijk p6 :

3. Irrigation must only recommence once soil moisture falls sufficiently that irrigation will not raise the soil moisture above field capacity.

11.5.4 These requirements are in line with the concerns noted, and conditions recommended by Mr Ellwood in his s42A evidence.[161] As per Ms Mackenzie, they should be part of the consent conditions (the "what"), backed up by the management plan (the "how").[162]

11.5.5 We support the evidence of Mr Ellwood that soil moisture meters be installed so that soil conditions in different irrigation areas can be closely monitored and the irrigation appropriately controlled.

11.5.6 We recognise that deficit irrigation will change the basis of the system design and will result in more storage exceedances. However, given the high risk of moisture build up in loess soils causing slope instability, the uncertainties around nutrient uptake and the risks over nutrients impacting the fresh and coastal water ecology if irrigation takes place to saturated soils, we consider the Applicant must take a precautionary approach and leave headroom in the soil to accommodate rainfall. Irrigation to field capacity provides this precautionary approach.

11.5.7 Given that storage exceedances will already occur even with the non-deficit irrigation proposed, and suitable discharge management will need to be provided, then adopting a deficit approach to the irrigation does not fundamentally change the overall design, but would de-risk the irrigation aspects.

[161] CRC S42A, Ellwood pp 200-201
[162] Ngai Tahu evidence, Mackenzie p9

Section 12. Treated wastewater storage exceedances

Based on information provided since the Application was lodged, first by FBPI and then by the Applicant, all parties are now in agreement that overflows (now called storage exceedances) will occur in many seasons and be of large volumes.

12.1 Frequency of exceedances

12.1.1 The predicted frequency and magnitude of overflows has changed many times as the modelling and key parameters, including irrigable area, irrigation rates and storage volumes, has been refined.

12.1.2 As stated in Section 4.6 the Application lodged set out that 12,000m^3 of storage would be sufficient to ensure that the system would be fully contained, and no provision for treated wastewater overflows was made.

12.1.3 Then in its response to CRC's RFI, the Applicant stated that there would have been exceedances above the 12,000m^3 storage capacity on five occasions in the 50 year period modelled, including 1986, 2017, 2019, 2022 and 2023. After obtaining the RFI response we wrote to CRC questioning the credibility of the modelling given that 4 of the 5 exceedances would have been in the past 5 years, with only one exceedance in the previous 43 years, in sharp contradiction with our own modelling.

12.1.4 The Beca Akaroa Design Update Report was subsequently sent to us in April 2024, with the revised modelling now confirming there would be overflows in 11-21 out of the 50 years modelled.[163] (It has since become clear that the lower value was included after CCC requested that a 10% reduction was applied.[164]. This has now been dropped[165]). This modelling was based on **20,000m^3** of storage plus the wetland, and including only the Akaroa flows.

12.1.5 As set out in Section 4.11.13 above, we now understand that the latest figure for the number of overflow seasons, using the combined flows for Akaroa and Duvauchelle, and the combined storage of 24,000m^3 at Robinsons Bay and the wetland is 21 in 52 years modelled, or 1 in every 2.5 years.

12.1.6 However, as set out in the evidence of Mr Coutinho, we believe the number of overflow seasons and volumes will be higher in practice once realistic and safe irrigation management has been adopted and a full geotechnical assessment of the site has been carried out. We now cover this in more detail.

12.2 Mismatch between storage modelling parameters and the irrigation management proposed

12.2.1 The Application states that a fundamental principle is that irrigation will be adjusted to avoid ponding and runoff[166]. This is purportedly achieved through avoiding soils reaching saturation or ceasing irrigation if ponding or runoff is apparent.

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[163] Beca Akaroa Design Flow Basis Update Report, April 2024, Table 6-2 p34
[164] Applicant's Evidence, Hills, cl 12.13 p 24
[165] Applicant's Evidence, Offer, cl 3.19 p 8
[166] AEE, p83

12.2.2 However, all storage modelling carried out by PDP assumes irrigation proceeds regardless of soil moisture, including beyond saturation, and ceases only when 50mm of rainfall has fallen over a 24 hour period.[167] Irrigation then recommences after 24 hours without rain regardless of soil moisture or ponding and runoff, a condition Mr Kerr acknowledges is a simplification for modelling purposes[168].

12.2.3 No justification is given for adopting this cutoff figure, but it has been used in the irrigation modelling since 2018.

12.2.4 In 2023, we examined the Sawmill Road site 8 days after the rainfall event had ceased (27 July), and found the ground saturated, including in areas earmarked for irrigation. We found water draining into one of the proposed irrigation areas via a culvert.

Figure 11 Robinsons Bay irrigation site 4 August 2024, the 8th day after rain had ceased

12.2.5 This provides an example of the mismatch between the storage modelling and the irrigation management proposed. Applying the storage modelling restart parameter, irrigation would have commenced 7 days prior on 28 July. If saturation is to be avoided irrigation would not have recommenced yet on 4 August. Using this period as an example, the storage model has included *at least* 7 days of irrigation for this event when, in practice, the wastewater would have been sent to storage.

12.2.6 The consequence of this is that the modelling will have understated the amount of storage required. These points are also picked up by Mr Ellwood.[169], who notes that the modelling does not consider cumulative rainfall when applying the cutoff.

12.3 Storage exceedances greater when realistic parameters applied

12.3.1 We concur with Mr Coutinho that the Applicant's irrigation modelling likely underestimates the

[167] AEE, Appendix F, PDP, p6
[168] Applicant's Evidence, Kerr, Cl3.21, p 8
[169] CRC S42A, Ellwood cl 18-20 p199

storage required and therefore the exceedances will be greater than stated[170].

12.3.2 Modelling based on the simplified cut-off parameter of ceasing irrigation when more than 50mm of rain has fallen in a single day and restarting on the next dry day does not take account of ground conditions. Once ground conditions are taken into account, irrigation will take place on fewer days.

12.3.3 Furthermore it is quite likely that after more thorough geotechnical investigations are carried out some areas of land currently considered as irrigable areas will be rejected. This already applies to the area around the tank platform which will now be irrigated only as required to maintain the vegetation.

12.3.4 As we have stated in 11.5.6 should a deficit rather than non-deficit irrigation approach be adopted, the storage requirement/exceedances will increase further.

12.4 How more realistic parameters affect the storage requirement or exceedances

12.4.1 To help assess the current level of underestimation, Dr Martin has modelled several scenarios to illustrate the likely impacts on storage and exceedances if irrigation takes place as defined by soil moisture conditions (rather than a 50mm of rainfall cutoff) , or if land is found to be unsuitable and has to be retired from the scheme.

- Scenario 1 assumes that irrigation does not resume on the first dry day after a heavy rain cutoff, but waits until ground conditions have returned to a more favourable state
- Scenario 2 gives an approximation of how irrigating to field capacity rather than to saturation might impact storage and exceedances
- Scenario 3 examines the impact of having less land available
- Scenario 4 presents a combination of waiting until favourable ground conditions have returned and having less land available.

12.4.2 We present the results of this modelling below, stressing that these results are not intended to provide absolute values, but to indicate the sensitivity of the storage modelling to relatively minor changes that may occur in practice:

12.4.3 The flows used are Akaroa only, the treated storage volume of 20,000m^3 is used (the 4,000m^3 needed to store Duvauchelle flows is not included because Duvauchelle flows and irrigation are not included in this modelling), and the wetland freeboard is 1,808m^3. This agrees with the most recent storage modelling parameters as used in the PDP *Akaroa and Duvauchelle Combined Storage Exceedance Discharges* document, when taking the Akaroa derived exceedances and storage alone.

12.4.4 For each Scenario we present the number of Exceedance Seasons followed by the Average Recurrence Interval this represents over the 52-year period modelled from 1972-2023. (ie the base case is 2.16 meaning the average recurrence interval is 1 in 2.16 years. Note this is slightly higher than the figure of 1 in 2.5 years that we have been using throughout this submission, as it represents

[170] Coutinho cl27 p8

the exceedances from Akaroa only, not the combined flows and storage).

12.4.5 We then present a more detailed breakdown for three example years. The years chosen are already identified as having storage exceedances - Table 6 from the PDP document shown previously in Section 4.11.13. The three years we have selected represent a range with 1978 as a worst case, 2022 as a mid-range case, and 2008 as a low exceedance case.

12.4.6 For each year we report the Required Storage to avoid exceedances in that year altogether, and the exceedance volume that would be generated with the current Akaroa storage of 20,000m^3 and the wetland.

12.4.7 In each table we present the base case using the current storage modelling parameters (cut off after 50mm rain, restart on the next dry day, 35.7ha of land available) and then compare this with the various scenarios.

12.4.8 **Scenario 1:** In the table below, we vary the number of days before irrigation can resume after a heavy rain event (> 50mm in 24 hours) from 1 day (as used in the current modelling) to up to 4 days.

Table 5 Scenario 1 Exceedances resulting from delaying irrigation restart for more than 1 day

Restart after	Exceedance seasons/ARI	1978		2008		2022	
		Required storage m^3	Exceedances m^3	Required storage m^3	Exceedances m^3	Required storage m^3	Exceedances m^3
1 day (base case)	24 (2.16)	60,900	39,100	22,100	300	32,600	10,800
2 days	27 (1.93)	67,400	45,600	22,700	900	38,000	16,200
3 days	28 (1.85)	73,500	51,700	23,300	1,500	39,800	18,000
4 days	29 (1.79)	79,000	57,200	23,900	2,100	41,000	19,200

12.4.9 The results illustrate how increasing the delay before irrigation can resume strongly affects the volume of exceedances, or alternatively the additional required storage to avoid exceedances.

12.4.10 This illustrates how the current storage modelling is likely to be significantly underestimating the exceedance frequency and volumes that will occur if irrigation does not always resume on the next dry day after a 50mm rainfall cut-off.

12.4.11 **Scenario 2:** In the table below we indicate the potential effects of taking soil moisture into account when determining whether to cease irrigation.

12.4.12 As we are not able to determine soil moisture levels in the irrigation fields without another complex set of data, we have used the Akaroa wastewater flow levels as a proxy indicator of the state of the Robinsons Bay fields. Again, the purpose is not to provide absolute values, but to indicate the sensitivity of the storage modelling.

12.4.13 The logic is that if the ground in Akaroa is still very wet and causing high levels of infiltration, the ground in Robinsons Bay will be similarly wet.

12.4.14 The chart below shows the Akaroa wastewater daily flows for the winter in example year 2022. As can be seen, during dry weather flow levels are below 500m^3 per day. The three cut-off levels we have chosen to model are marked with horizontal lines, and are 600 m^3, 700 m^3 and 800 m^3

respectively. At these levels flows are all part of large peaks, indicating high levels of I&I due to both rain and drainage from Akaroa soils.

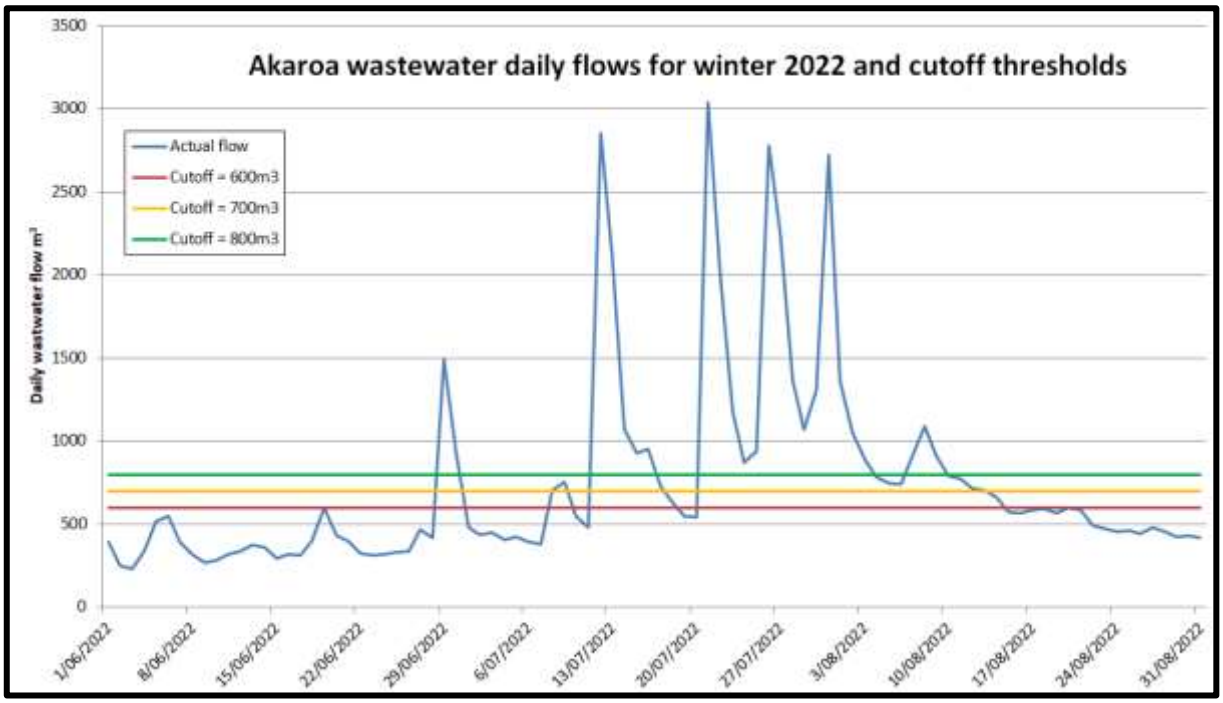

Figure 12 Example Akaroa Daily flows used as a proxy for soil moisture levels at Robinsons Bay

12.4.15 In the table below we have used 3 different inflow levels as the cut-off to stop and start irrigation, which are significantly above typical winter dry weather flows of around 450m^3.

Table 6 Scenario 2 Using soil moisture (proxy) to determine whether to irrigate

Restart after	Exceedance seasons/ARI	1978		2008		2022	
		Required storage m^3	Exceedances m^3	Required storage m^3	Exceedances m^3	Required storage m^3	Exceedances m^3
Base case (stop after 50mm rain restart next dry day)	24 (2.16)	60,900	39,100	22,100	300	32,600	10,800
Irrigate to soil moisture based on inflow<800m^3 per day	28 (1.85)	79,600	57,800	24,500	2,700	42,200	20,400
Irrigate to soil moisture based on inflow<700m^3 per day	31 (1.68)	101,400	79,500	26,900	5,100	46,400	24,600
Irrigate to soil moisture based on inflow<600m^3 per day	35 (1.49)	108,300	85,200	28,700	6,900	47,600	25,800

12.4.16 These results illustrate the impact of using soil moisture to determine when to irrigate on the storage requirements or exceedance number and volume).

12.4.17 **Scenario 3:** The table below progressively removes areas from the total 35.7ha irrigable area. The areas we removed are those identified in Figure 7 Upper and North-eastern irrigation areas. These are the areas that have not been geotechnically assessed, the original landowner identified them as unsuitable for irrigation, and they were saturated and ponding on our visual inspection in August

2023 8 days after the July storm.

Table 7 Scenario 3 Removing areas of land

Irrigation area ha	Exceedance seasons/ARI	1978		2008		2022	
		Required storage m^3	Exceedances m^3	Required storage m^3	Exceedances m^3	Required storage m^3	Exceedances m^3
35.7 total all areas included	24 (2.16)	61,000	39,100	22,100	300	32,600	10,800
32.2 total 3.5ha highest area removed	28 (1.85)	71,100	49,300	27,000	5,200	34,500	12,700
29.85 total 2.35ha wet eastern areas removed	33 (1.58)	128,500	57,000	30,400	8,600	36,200	14,400
28.82 total 1.03ha wet mid-eastern areas removed	35 (1.49)	166,800	60,400	31,900	10,100	37,400	16,000

12.4.18 As these results show, any reduction in irrigable area impacts the exceedance volumes. Note that in two cases for 1978 the storage appears significantly higher than expected; this is because the available land had been insufficient to irrigate all of 1977's stored wastewater under the scenario modelled, and hence the year commenced with tanks that were already full.

12.4.19 **Scenario 4:** The table below shows the combined effect of a small reduction in the irrigable area of land and delaying the restart of irrigation

Table 8 Scenario 4 Combined effects of removing land and including a soil moisture based cut-off

Irrigation area ha	Exceedance seasons/ARI	1978		2008		2022	
		Required storage m^3	Exceedances m^3	Required storage m^3	Exceedances m^3	Required storage m^3	Exceedances m^3
Base case (35.7ha and restart irrigation next dry day)	24 (2.16)	61,000	39,100	22,100	300	32,600	10,800
Scenario 4a 32.2 total 3.5ha highest area removed, 2 day stand down	28 (1.85)	77,300	54,500	27,500	5,700	39,400	17,600
Scenario 4b 28.82 total high and all wet areas removed 800m^3 cutoff	39 (1.33)	236,300	76,900	181,300	12,000	134,400	23,300

12.4.20 This is perhaps the most useful scenario, demonstrating how a combination of relatively minor changes affects the storage or exceedances. Again in Scenario 4b, the tanks were full at the start of each year, so the required storage is compounded.

12.5 Exceedances need to be properly considered

12.5.1 As we have shown, in practice storage exceedance discharges are likely to be much higher than currently assessed as they are very sensitive to minor changes in the area of land being irrigated or the irrigation cut offs applied.

12.5.2 Exceedance discharges must be properly and safely provided for. Currently, how exceedance discharges will be managed has not been specified.

12.5.3 Therefore we proceed on the basis that the Applicant has signalled the intent to apply for a discharge consent in the future, with the Duvauchelle application, and the information presented in the most recent report by PDP the *"Combined Akaroa & Duvauchelle Treated Wastewater Storage, Exceedance Discharges – Short-List Options Assessment"* dated November 2024.

12.5.4 This indicates that the Applicant's assessment of the matter of where to discharge the treated overflows is quite advanced; that it is at Children's Bay via an outlet in the sea wall in front of boat store area, and that this has the approval of Ōnuku Rūnanga who participated in a shortlisting exercise and rejected other solutions such as a harbour outfall. This information has not however been included in the Applicant's evidence, nor has CCC involved or informed the wider public.

12.5.5 In Appendix C we provide images of where the overflow is likely to be and an assessment of the environmental effects based on information about the quality of the Childrens Bay estuary given by the various experts, its flushing ability and the effects of treated wastewater on human health.

12.5.6 We note that the untreated overflows from the Terminal Pump Station will also flow from the Grehan Stream into this area.

12.5.7 We do not consider that discharge to Childrens Bay provides an safe or acceptable solution to deal with the of treated storage exceedance volumes likely from the ATWIS proposal, nor do we believe it will be seen as acceptable or sensible by the Akaroa community. For CCC to spend $107 million on a new wastewater system that will regularly discharge overflows at the town's recreational and boating area will be seen as absurd and offensive.

12.5.8 Furthermore, once an overflow discharge is consented, then even if consent limits are set, in practice and over the years, these limits are likely to be exceeded when the system is overloaded and under pressure. There will then be little that a consenting authority can do to control this. A town cannot simply stop producing sewage and a sewerage system cannot be turned off; even if the safety valve is a poor one, it is still the safety valve.

12.5.9 The concept that ATWIS is a 100% land based system, as put forward in the lodged Application, has now been shown to be incorrect. The Application must be judged on the effects of the system as a whole and not on the partial view put forward in the original Application. This means including the effects of the secondary discharge when considering the Application before the Panel. This information is needed to make an informed decision.

12.6 Dual discharge system

12.6.1 Mr Coutinho sets out in his evidence that the ATWIS has, as a result the storage exceedances, become a dual discharge system – with the primary discharge to land and a secondary discharge to the harbour.

12.6.2 This is the situation modelled in 2010 by Andrew Dakers when it was recognised that given the slip-prone nature of the Peninsula landscape and high flows in wet weather, a secondary discharge to the harbour would be necessary.

12.6.3 After a further 15 years of research the idea of a 100% land based irrigation system has been exhausted, and for both the Akaroa and Duvauchelle proposals, which are now proposed to be combined into a single system.

12.6.4 Hence, now is the time for the primary and secondary discharges are considered together, to ensure that the secondary harbour discharge appropriately mitigates the risks and effects of the primary land discharge.

12.6.5 There needs to be some certainty now that the secondary discharge does not itself lead to unacceptable effects.

12.6.6 Discharges to the sensitive coastal and high recreation environments at Robinsons Bay (as a result of run-off) or at Childrens Bay are likely to have significant adverse effects, along with creating negative public perceptions.

12.6.7 We therefore recommend that the secondary discharge is a long harbour outfall, taking the water out where it will quickly disperse, rather than a foreshore discharge where it will concentrate nutrients or other contaminants in the mudflats. We suggest that if it receives cultural treatment, for example the methods that Ōnuku rūnanga have considered acceptable through the Exceedance Discharge shortlisting workshop, then options for a harbour outfall could include:

a) Continued use of the existing Akaroa outfall

b) The 2015 outfall proposal

c) The 2020 consultation outfall – combining a purple pipe through Akaroa with a new pipe entering the sea at Glen Bay.

12.7 Summary of concerns on treated storage exceedances

12.7.1 The modelled level of treated exceedances given in the Applicant's evidence is once every 4.3 years but this is only for the short period before the Duvauchelle flows are added to the system. Once the Duvauchelle flows become part of the system exceedances are modelled by PDP as 1 in every 2.5 years. The number of years represent overflow seasons.Within each season there may be multiple overflow events and overflows may last for multiple days and be large volumes.

12.7.2 In practice, with irrigation managed to avoid ponding and runoff, the exceedances will be greater. Exceedances will further increase if any of the land on the irrigation sites needs to be retired. It will not be possible to provide for exceedances with additional storage. The sensitivity of the system to minor changes is such that this would be impracticable. Acquiring more land for irrigation is also not a practicable solution; the exceedances occur in wet weather when all land in the area is likely to be saturated and therefore unable to be irrigated.

12.7.3 The exceedances are most likely to occur when the treatment plant is running at a reduced treatment level due to high inflows and therefore rely on dilution to achieve the required per litre standards. This means the total volume of contaminants that will be discharged to the beach, and which may be retained in the mudflats of the proposed exceedance location, are likely to be higher.

12.7.4 The current intention to discharge treated wastewater to Childrens Bay, after a shortlisting exercise that only involved CCC and Ōnuku rūnanga, will not be acceptable to the Akaroa community and

may further harm Akaroa's reputation as a recreation destination (already tarnished by beach swimming closures (likely contributed to by leaking sewage pipes).

12.7.5 The exceedances need to be considered in conjunction with the irrigation system. There is a direct two way relationship between the effects as they are used to balance each other.

12.7.6 The Duvauchelle flows are also relevant, as they directly affect the total volume of treated exceedances

12.7.7 It is our view that the Panel must consider the treated exceedances when considering the ATWIS application. How they are dealt with is an intrinsic part of the proposal and cannot be deferred for future consideration.

Section 13. Untreated wastewater capacity issues

Earlier in this document we have drawn attention to LWRP Rule 5.84 and its applicability to the Terminal Pump Station and Wastewater Treatment Plant. We now consider the potential untreated wastewater overflows and the applicability of this rule to them.

13.1 Terminal Pump Station

13.1.1 Untreated overflows are predicted from the Terminal Pump Station at a 1 in 5 year ARI based on historical weather patterns. These are not emergency overflows, but a direct result of the capacity design of the TPS. Even with the increased pump capacity of 86l/s the TPS is expected to overflow twice as often as rest of the upgraded reticulation network which is being designed with a 1 in 10 ARI.[171]

13.1.2 The Applicant has stated that these overflows do not form part of the ATWIS application.

13.1.3 We take a different view and agree with Mr Ellwood's recommendation and that of Mr Coutinho that untreated wastewater overflows should be considered as part of the overall consent process.[172]

13.1.4 As set out in Mr Coutinho's evidence, the Terminal Pump Station is only to be constructed once the ATWIS has been granted consent, therefore it acts as the trigger for the 1 in 5 year untreated overflows.

13.1.5 These overflows are not currently covered by a discharge consent and the Applicant appears to rely on existing network overflows which are also unconsented (and therefore not a legally established activity) to justify them until such time as it elects to apply for a network discharge consent.

13.1.6 We consider that the effects of overflows from this location will be different from the effects of the existing network overflows, as these are distributed over several locations, rather than concentrated in a single location and are also likely to be smaller.

13.1.7 As stated in 4.3.6 , the CRC 42A report clarifies that the Terminal Pump Station requires a land use consent under LWRP Rule 5.84, and that this land use is a discretionary activity.

13.1.8 In our view, given that the ATWIS cannot operate without the Terminal Pump Station, the Panel needs to consider whether to grant this land use consent. The untreated wastewater overflows are the key matter to consider, including their environmental effects, and how they can be prevented or reduced to at least the 1 in 10 ARI matching the rest of the network.

13.2 Wastewater Treatment Plant

13.2.1 As we have set out in Section 4.5 we are concerned that the untreated buffer storage tank at the WWTP may be undersized. If so this will result in either additional raw overflows at the Terminal Pump Station or an unacceptably low standard of treatment.

13.2.2 Rule 5.84 of the LWRP also applies to the WWTP, and this gives the Panel the opportunity to

[171] Beca, Akaroa Wastewater Scheme Design Flow Basis Update Report, p 21 & p36
[172] CRC S42, Ellwood, p6, Coutinho Cl 57-69

consider the effects of the system as a whole. Further work along similar lines to that carried out by Mr Ellwood is needed to show how each stage of the treatment train handles peak flows and to identify any bottlenecks.

13.2.3 Furthermore the untreated and treated wastewater overflows need to be considered together as a cumulative effect if they are to occur in the same area, and this is a compelling reason why the ATWIS application should be declined in its current form, or placed on hold until the applications for both network and treated wastewater discharge applications are lodged.

Section 14. Natural Hazards and Climate change

In this section we discuss why the proposed system is more vulnerable to the effects of natural hazards and climate change than the existing system.

14.1 Natural Hazards

14.1.1 The AEE identifies the following risks: geological risk, seismic risk, flooding and erosion risks, fire and sea level rise. We agree with this.

14.1.2 We have already set out our concerns in Section 9 about the slope stability of the irrigation fields and their surrounding areas, the exacerbation of those risks if non-deficit irrigation is used, the risks to the irrigation areas below the tank farm should it fail, and the paucity of geotechnical investigation.

14.1.3 The Alpine Fault has a high probability of rupturing in the next 50 years and historically that produces an earthquake of magnitude 8.0.[173] This is therefore likely to occur during the lifetime of the ATWIS system should it go ahead.

14.1.4 We have noted that there is no information on the seismic rating of the tanks, or any analysis of the risk of failure and consequential flooding. In 2020 when the Applicant had proposed using storage dams rather than tanks, a dam break analysis was carried out to assess the flood risk to properties down the valley. We include an example from this in Appendix F. At that time the storage capacity of the dam was 19,500$m^{2.}$ With storage increased to 24,000m^3, we request that a similar assessment of the flooding risk to downstream properties and the irrigation fields below the tank platform is carried out.

14.1.5 Enquiries with tank manufacturers lead us to understand that normal practice for Councils storing wastewater in tanks is to require these tanks to have a seismic Importance level rating under the Building code of at least IL3.

14.2 Increased vulnerability to climate change

14.2.1 The effects of climate change are being increasingly felt around the world. Every day there are new reports of record storms, atmospheric rivers, floods, landslides, winds and wildfires on scales rarely seen in the past.

14.2.2 The Guardian reported on 18 November 2023 that *In total, studies calculating the role of the climate crisis in what are now unnatural disasters show 550 heat waves, floods, storms, droughts and wildfires have been made significantly more severe or more frequent by global heating. This roll-call of suffering is only a glimpse of the true damage, however. Most extreme weather events have not been analysed by scientists.*[174] *Three days later it reports: The world is on track for a "hellish" 3C of global heating, the UN has warned before the crucial Cop28 climate summit that begins next week in the United Arab Emirates…. Temperature records have already been obliterated in 2023 and*

[173] https://www.gns.cri.nz/our-science/land-and-marine-geoscience/our-plate-boundary/alpine-fault

[174] https://www.theguardian.com/environment/2024/nov/18/climate-crisis-to-blame-for-dozens-of-impossible-heatwaves-studies-reveal

intensifying heat waves, floods and droughts have taken lives and hit livelihoods across the globe, in response to a temperature rise of 1.4C to date.[175]

14.2.3 In its most recent report, the NZ Climate Commission is warning that average global temperatures are already close to 1.5°C above pre-industrial levels, are highly likely to reach that threshold within the next 10 years, and that the impacts of climate change are greater in both severity and scale than previously anticipated. It states: Aotearoa New Zealand is also affected. *The country has, in recent years, already experienced significant harm from cyclones, floods, landslips, droughts and wildfires. Climate change is increasing the frequency and impacts of these events, which cause damage and impose significant costs on Aotearoa New Zealand's communities.*[176]

14.2.4 The most recent information from the United Nations is that February 2023-January 2024 was the first 12 month period to exceed 1.5°C as an average, and that the *likelihood of the annual average global temperature exceeding 1.5°C above pre-industrial levels for at least one year over the coming five years has increased significantly since 2015, when it was close to zero.*[177]

14.2.5 Banks Peninsula is not immune from this trend. Its has recently experienced catastrophic slips in the Eastern Bays in December 2021, including in the well established native forest of Hinewai Reserve, and record rainfall in a single day in July 2023 causing CCC to completely change all its plans for the Duvauchelle wastewater treatment system.

14.2.6 Akaroa's current simple wastewater system is mainly gravity fed, with three relatively small pumps pushing the wastewater south through the flat part of the township and then to the WWTP and a short harbour outfall. This is to be replaced with a sprawling network of pumps, pipes, storage tanks, a wetland and irrigation fields on sloping slip-prone soil and two terminal pump stations located at the coast.

14.2.7 The ATWIS system is highly vulnerable to the effects of climate change because of its extensive and complex design with many exposed components, and because it will be time-consuming, demanding and expensive to manage.

14.2.8 This increased vulnerability is made much worse by the I&I levels experienced by the system. The failure of the Applicant to substantially reduce I&I levels, combined with a fixed capacity irrigation system, means that there is already a lack of headroom or spare capacity in the proposed system during times of wet weather, and no spare capacity to cope with future events.

14.2.9 Beca clearly warn in their Akaroa Design Flow Update report that although the modelling includes RCP 8.5 scenario in the modelling, "*an appropriate margin should be considered when sizing the infrastructure for this wastewater scheme*." And that "*The probabilistic approach cannot forecast extreme individual "black swan" rainfall and storm events that are a feature of climate change and that have been observed around New Zealand in recent times. Recent black swan events include Cyclone Gabrielle and the extreme rainfall event that occurred at Akaroa on 24th of July 2023. Such*

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[175] https://www.theguardian.com/environment/2023/nov/20/world-facing-hellish-3c-of-climate-heating-un-warns-before-cop28

[176] https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/review-of-the-2050-emissions-target/2024-review-of-the-2050-emissions-target/final-report/executive-summary-2050-target-and-isa/

[177] https://www.un.org/en/climatechange/science/climate-issues/degrees-matter

black swan events are expected to occur with increased frequency and can strike randomly in any location at any time. As the modelling cannot predict them, CCC should expect that the design basis settings for the Akaroa Wastewater Scheme will be exceeded on occasions in future."[178]

14.2.10 As Mr Offer has stated in his evidence, climate change adjustments factored into the modelling cannot forecast unpredictable "black swan" events that are a feature of climate change and have been observed around New Zealand in recent times.[179] We agree with this. What concerns us is that the RCP 8.5 emissions scenario climate adjustment factor used in the modelling in fact decreases the rainfall over winter by 4% and does not include any sort of factor for extreme storms. As evidenced in the quote in 14.2.9, the model underpinning the Akaroa Design Flow Update (released in April 2024) and the Combined Akaroa & Duvauchelle Storage Exceedance Report (released in November 2024 but using the same set of years for modelling) do not include any margin for the increased climate change storms anticipated.

14.2.11 The Applicant has not heeded the warning from Beca. Instead, as we have shown throughout this submission, the entire system is based around optimistic assumptions including irrigating slip-prone loess soils to saturation levels, irrigating marginal areas with slopes or downslopes steeper than 19^{o}, and loading the weight of 24,000m^3 of water storage on an extremely large cut and filled platform in the middle of the irrigation areas.

14.2.12 Additional capacity and headroom has not been provided in this system. Any spare capacity in the original design has since been eclipsed by the increased wastewater flows and the addition of Duvauchelle to the system. To summarise,

a) There is no buffer tank at the Terminal Pump Station. It is expected to overflow 1 in 5 years based on current rainfall patterns, not increased intensity extreme storms.

d) The untreated wastewater buffer tank has not increased in size despite additional flows being added. Any headroom it did have initially must therefore have been decreased.

e) The Application lodged stated that 12,000m3 would suffice for the treated storage but applied for 20,000m3, providing headroom of an additional 66%. That headroom is now gone, and no further headroom has been provided. Instead exceedance discharges are planned, but with no information or assessment, although all indications to date are that the Applicant plans to discharge to

f) There is no further suitable land on the irrigation properties to provide headroom should any problems arise with the current areas.

g) The I&I reduction program is nearing completion, and there are no plans set out for substantive work to further reduce flows. There is no method to assess the reduction achieved aside from waiting for a wet year to observe the response to rainfall and increased groundwater. There is no consideration of the potential for the sewer pipes to deteriorate further if not comprehensively repaired, thus in future I&I levels may further increase.

[178] Beca 2024 Akaroa Design Basis Update report, p36
[179] Applicants Evidence, Offer, Cl3.24 p10

14.2.13 This lack of headroom means that if a large storm event were to destroy parts of the irrigation field, the result is likely to be further exceedances. It will also make recovery from such an event more difficult because there is no surplus land to use instead.

14.2.14 Should a future storm take out the electricity network for an extended period, or cause land slips, this proposed system is vulnerable in many ways. If parts of the field are lost in a storm, there is nowhere else for the water to go except to overflow.

14.2.15 We are also concerned about the tank platform, and the risk of catastrophic failure in a major storm event.

14.2.16 Another weak point is the Terminal Pump Station (TPS), situated on a capped landfill right beside the coast. This area already suffered major issues in 2014 when part of the sea wall collapsed below the boat store area. The TPS is in the tsunami zone and will be vulnerable to storm surges in a major storm.

Figure 13 Collapse of area under the boat store 6 March 2014 storm

14.3 Re-use to address water shortages

14.3.1 Akaroa experiences chronic water shortages almost every summer. As well as more ferocious storms, climate change is also expected to result in increased droughts in Canterbury. Akaroa residents have repeatedly expressed their wish for wastewater to be used to alleviate water shortage.

14.3.2 The only proposed re-use is the sub-surface irrigation to Jubilee Park (the Akaroa Recreation ground). It is unclear whether the Applicant intends to construct this, or whether it is just included as a concept, as it is labelled on the main diagram setting out the system in the AEE as a “future purple pipe scheme” [180]

14.3.3 We note the concerns from various experts that this irrigation will be above the capped landfill, and

[180] AEE, Figure 3-1,p8

could therefore cause leaching issues, and the concerns of submitter McFadden that the public could be exposed to the irrigated water during flooding.

14.3.4 Irrigating the recreation ground will not help alleviate Akaroa's water shortages. The public had aspirations for something that would do this, such as using the treated wastewater to flush public toilets and, in the process, constructing a trunk line purple pipe through Akaroa to provide for future opportunities.

14.3.5 It also raises the question that if the treated wastewater is not safe enough for flushing toilets and must be drip irrigated underground in a public place, how is it safe to release it onto the public beach at Childrens Bay or to promote public recreation at the irrigation fields at Robinsons Bay and Hammond Point? How can it form the basis of a future purple pipe system?

14.3.6 We express our frustration that after years of discussions about beneficial re-use, and the overwhelming community support for this, no meaningful reuse has been included. The lack of provision for re-use is a major omission in this proposal.

14.4 Resilience should be the primary driver

14.4.1 Resilience should be a primary driver of a new sewage system being developed and installed in the face of serious climate change effects, especially one with such a large budget per connection as this one.

14.4.2 A sewage system must keep working as much as possible, or be able to be quickly reinstated, during catastrophic events.

14.4.3 A recent report on the impacts of Cyclone Gabrielle warns that water infrastructure failures show low resilience.[181] Water tanks were carried away in that storm when hills covered in established vegetation collapsed. We should be learning from what happened in that event and not repeating infrastructure fvulnerabilities in new designs.

14.4.4 Given the probability and significance of seismic and damaging climate change events, we suggest that natural hazards are a clear and apparent risk with potential effects of very high impact.

14.4.5 One of our biggest concerns about the proposal is that there is no Plan B. There is no safe outlet for the untreated sewage if the Terminal Pump Station fails, or for the treated wastewater if there are major losses to the irrigation field or storage tanks.

14.4.6 The most high impact effects of this would be that Akaroa community would be left without a functioning wastewater treatment system and the mixing of raw sewage or large volumes of treated sewage into areas where people live and recreate, creating a grave health hazard.

14.4.7 One of the great scientific achievements of modern society is to remove raw sewage from the environment and safely treat it, resulting in a huge reduction in contagious disease.

14.4.8 This Scheme, with its good intentions to achieve Ngāi Tahu cultural values, must also ensure that protecting public health remains a top priority. We refer to the submission of Health New Zealand, Te

[181] https://www.phcc.org.nz/briefing/water-infrastructure-failures-cyclone-gabrielle-show-low-resilience-climate-change

Whatu Ora in this regard, and in particular to the public health measures requested in clause 8.

14.4.9 If the system has a secondary discharge path for treated wastewater designed to minimise environmental and health effects (such as a long harbour outfall), then this would provide not only for the safe discharge of planned exceedances, but also a backup for failure in the storage or irrigation system. We suggest that this could also be used in the case of emergency discharge of untreated sewage as this would be much safer than discharging into the Grehan stream at the Akaroa foreshore.

14.4.10 We do not believe that it is misguided, unreasonable, or unfeasible to have a backup discharge mechanism for use in case of catastrophic events as Mr Pizzey has suggested.[182] We consider it an essential duty of both the Applicant and the CRC to consider and plan for natural hazards and climate change. In this case a safe backup harbour outfall would not be technically difficult or very expensive.

[182] Applicants Legal Submission, Cl6.49

Section 15. Operational feasibility

In this section we present our concern about the lack of analysis and information on feasibility and costs of operating the proposed ATWIS system.

15.1 Operability

15.1.1 The AEE and the Applicant's evidence are devoid of any information on the costs and practical management of this large, complex system. FBPI has requested operating cost information via LGOIMA but has not been provided with any meaningful costings or management details.

15.1.2 As we stated in 4.9.5, there will be 700kms of irrigation line and between 1.43 million to 2.38 million drippers depending on the final spacing. These lines will be spread over sloping ground, necessitating complex hydraulic balancing to ensure that the water is dripping out evenly along the lines.

15.1.3 Aqualinc have recommended monthly visual inspection[183]. Walking 700kms of line looking at millions of drippers will be a highly labour-intensive activity. At a walking pace of 2.5km per hour (a rapid pace under dense bush while examining drip lines) this would take 280 hours, or 7 working weeks. In other words 2 people would be occupied for almost a month just to inspect the lines once.

15.1.4 In addition, the lines will be planted with kānuka, with the intention that *the species diversity will increase over time with emergent canopy, understory, ground cover and vine species.*[184] In our view, as the understorey increases it will become increasingly difficult to access or inspect the irrigation lines. We suggest that the concept of a biodiverse forest is incompatible with good irrigation management, and that in practice the Applicant will need to ensure the forest floor under the kānuka is relatively clear of undergrowth and to prune the lower branches of the kānuku trees for several years until canopy closure is achieved to create space for access underneath.

15.1.5 If the maintenance is not carried out properly, it will increase all the risks associated with the irrigation field failing to perform.

15.1.6 There is as yet no clear information on how the irrigation cut-off and restart itself will be managed. As already discussed, the visual inspection proposed by some of the experts seems infeasible given the size of the irrigation areas, the steepness, and the distance between different irrigation areas separated by steep gullies, as well as the practicalities of inspecting irrigation lines through increasingly dense vegetation. An alternative is to use soil moisture probes, but the number, locations and what is involved in their physical management is not explained.

15.1.7 CCC, CRC and Ngāi Tahu and Ōnuku rūnunga experts have recommended a wide range of monitoring to be in place along with adaptive management and this will further add to the operational costs.

15.1.8 Even in the absence of any detail on how this system is to be operated and managed, it is obvious

[183] AEE, Appendix A, Aqualinc, P51
[184] Applicant's Evidence, Evidence Summary, Meurk, Cl 1.8 p 3

that the effort and therefore operating costs will be significant..

15.1.9 It would be fair to say that CCC has struggled to manage the existing simple system well. This is evidenced by the repeated failure to check and calibrate the flow meters in the current system, the lack of awareness of the levels of I&I in the system, the lack of awareness of the level of drinking water retentate entering the system, non-compliance with consent conditions over the years and repeated failure to publicly report monitoring information in a timely manner.

15.1.10 The effectiveness of CRC in overseeing consents is little better. It has not taken any action over the failure of CCC to reduce I&I in line with its Akaroa outfall consent requirements, or to check that flow information reported to it came from accurately calibrated meters.

15.1.11 FBPI is therefore justifiably concerned about whether CCC has the resources and capabilities to operate the new expansive and highly complex wastewater system effectively, to carry out all the required monitoring, to ensure that the irrigation fields are not irrigated above prescribed levels, or to effective identify and deal with problems as they arise.

15.1.12 Should this system proceed, it will be essential that monitoring and management information is made publicly available in a timely manner so that the public can also check and be assured that it is operating in accordance with consents.

15.2 Financial pressures

15.2.1 In addition to facing the physical threats of climate change, there needs to be realism about the costs in the face of the increased intensity of rainfall, ferocity of storms and storm surges, heat, wildfire risk, sea level rise and increased world political instability. All these will add to the financial stresses and difficulties of the future, for both the CCC and its ratepayers.

15.2.2 We already know that the ATWIS system proposed will burden the future Christchurch City Council with debt repayment for its, at least, $107 million capital budget as set out by Mr Hills in his evidence.[185] This figure does not include the costs of adding Duvauchelle.

15.2.3 In addition to that debt repayment, operating ATWIS is likely to become an increasing strain on CCC finances. Under the current rating system, these costs are currently amortised across all ratepayers with reticulated sewage across the city.

[185] Applicant's Evidence, Hills Cl 20.1 p43

Section 16. Piecemeal approach to obtaining consents

We restate our position that consent processing should be suspended under s91 of the RMA so that all additional consents are lodged and assessed alongside this Application. We have listed the outstanding consents in Section 4.13.

16.1 Deferral decision

16.1.1 We note that in Minute 9, the Panel has stated that while it is proceeding with the hearing, it remains vigilant to reconsidering deferral if further matters are raised.

16.1.2 In this section we present new information relevant to this consideration, including:

a) further evidence that the Applicant intends a single combined community wastewater treatment system, for Akaroa and Duvauchelle

b) that the Duvauchelle irrigation component may have run into difficulty,

c) address matters raised at the deferral hearing day regarding the treated overflows

d) and additional consent considerations regarding the untreated overflows.

16.2 Akaroa and Duvauchelle combined system

16.2.1 Since the Applicant decided to not proceed with a separate Duvauchelle system in April 2024, Duvauchelle has become an intrinsic part of the ATWIS system. While the Applicant has restated its position at the hearing that the ATWIS application stands separately from Duvauchelle, the documents they have supplied in response to LGOIMA requests suggest that in reality CCC now intends for the ATWIS to be a combined Akaroa & Duvauchelle scheme. These reports are:

- Beca Ltd, *Akaroa & Duvauchelle Combined Wastewater Schemes Feasibility MCA Assessment Report*,13 February 2024
- PDP *Combined Akaroa & Duvauchelle Treated Wastewater Storage Exceedance Discharges Short List Options Assessment,* November 2024

16.2.2 The Duvauchelle component of this scheme cannot stand on its own. It relies wholly on the Akaroa WWTP, and the raw buffer tank, piping to Robinsons Bay, treated storage facility in Robinsons Bay and a treated overflow mechanism, all of which are intrinsic to the ATWIS.

16.2.3 The exceedances from the ATWIS will be affected by any storage usage by the Duvauchelle scheme. The Applicant has presented to the Hearing exceedance frequency and volume based on the full amount of storage provided for the Akaroa flows alone. As the PDP *Combined Akaroa & Duvauchelle Treated Wastewater Storage Exceedance Discharges Short List Options Assessment* document sets out, these exceedances will be much greater once the Duvauchelle flows are added to the system. Therefore an assessment of the volume of overflows cannot be made without the information from Duvauchelle as we have set out in this submission.

16.2.4 The Applicant has stated that the Robinsons Bay irrigation fields will only be used to irrigate the Akaroa wastewater equivalent volume, but provided no information on how this can be physically

achieved, or over what time period it would apply. This opens the risk that more water is applied to Robinsons Bay than would have been the case with the Akaroa flows alone, particularly as the irrigation rates and rainfall cut-off for Duvauchelle are lower, so it will not be available for irrigation at times when Robinsons Bay may be.

16.3 State of the Duvauchelle irrigation application

16.3.1 On the first day of the Hearing it was clarified that CRC had agreed to proceed with the ATWIS application on the understanding that the Duvauchelle application bundled with the treated overflow application would be lodged in October 2024, enabling the ATWIS hearing to take it into account, but that did not eventuate. However, the Applicants evidence stated the application was not expected until mid 2025.

16.3.2 On 12 December 2024, a Project Update[186] on the Duvauchelle scheme was emailed to the community by CCC. This update only refers to the plan to use treated wastewater to drip irrigate trees at the Akaroa Golf Club. It does not mention that Duvauchelle wastewater will be sent to Akaroa or that there would be overflows. It states "*We plan to submit the resource consent application to Environment Canterbury in February 2025."* Mr Ure, project manager for ATWIS, was listed as the contact for further information.

16.3.3 In response to an enquiry from Dr Martin Mr Ure replied on 17 December that the consent application is not likely to be lodged until mid-year. There is no clarification regarding what is causing the delay or why the Community Project Update was misleading regarding the planned date.

16.3.4 Dr Martin subsequently received a draft AEE for the Duvauchelle Treated Wastewater Irrigation Scheme prepared by PDP and dated November 2024. The *Duvauchelle Treated Wastewater Irrigation Scheme - Assessment of Environmental Effects* is watermarked as a "Staff working draft". The information it lists is consistent with that in the other PDP and Beca reports, including flagging that storage exceedances will be discharged to Childrens Bay.

16.3.5 The draft AEE makes clear this is a combined scheme: "*Although the ATWIS project and resources consents are separate to this application for the DTWIS, the decision to combine treatment at the new Akaroa WWTP means that the two projects and irrigation schemes are connected.*[187]" And "*The irrigation SMB model links the irrigations sites at the Duvauchelle scheme and the Akaroa scheme (ie Robinsons Bay and Hammond Point) to optimise the irrigation capabilities based on rainfall trigger levels adopted for the model (i..e. stop irrigating when 30 mm/day of rain is reached at Duvauchelle and 50 mm/day of rain at Robinsons Bay/Hammond Point).*"[188]

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[186] Tim Ure, Project Update to the Community, *Duvauchelle Treated Wastewater Irrigation Scheme,* December 2024

[187] PDP, Duvauchelle Treated Wastewater Irrigation Scheme – Assessment of Environmental Effects, Prepared for Christchurch City Council, November 2024, p7

[188] PDP, Duvauchelle Treated Wastewater Irrigation Scheme – Assessment of Environmental Effects, Prepared for Christchurch City Council, November 2024, p9

16.3.6 It further demonstrates the Applicant's piecemeal approach, as there is no description of the pump station planned for Duvauchelle, the pipework to send the untreated wastewater to the WWTP, the pipework and pumps to return it from the Robinsons Bay storage to the Duvauchelle irrigation area, or the methodology that will be used to ensure the amount returned equates to the flows derived from Duvauchelle. Nor does it include any assessment for a discharge consent application.

16.3.7 There is currently no way of knowing whether what is proposed for Duvauchelle is consentable. We understand that there are challenges relating to groundwater mounding and nutrient levels. If the irrigation system at Duvauchelle is not consented, but the wastewater is treated at Akaroa and stored at Robinsons Bay, the result could be an increase in the irrigation at Robinsons Bay increasing the nutrient loading and storage exceedances.

16.3.8 A clear understanding of the Duvauchelle application is therefore needed now to determine its exact configuration, how the apportionment of the wastewater between irrigations fields is to be managed, and the total storage capacity and exceedances.

16.4 Treated discharge consent needed

16.4.1 A treated wastewater discharge consent application for the combined Akaroa & Duvauchelle system is essential to assess the environmental effects of the combined system.

16.4.2 For example, much reliance was placed by the Applicant on the 1 in 4.3 year storage exceedances now predicted by Mr Offer, and this figure was used in the preliminary coastal assessment of Childrens Bay carried out by Ms J Burns. We think this is at best an optimistic and temporary situation. The real volume of storage exceedances result from the combined flows.

16.4.3 Furthermore, as we have demonstrated, storage exceedances in practice are likely to be greater than the current modelling predicts.

16.4.4 Consenting ATWIS without knowing the volume or location of the storage exceedance discharges, and without giving consideration to an appropriately structured dual discharge approach risks creating greater overall environmental effects.

16.4.5 Legal counsel for the Applicant and for CRC were of the view that the discharge of storage exceedances to the coastal environment had no effect on the land discharge.

16.4.6 This demonstrated their lack of understanding of how a dual discharge system works. As explained in Mr Coutinho's evidence and above, once a secondary discharge path is designed as part of the system, rational decisions can be made about how the primary land discharge and secondary water discharge function together to ensure good environmental outcomes and to minimise adverse effects of both discharges.

16.5 Whether existing harbour outfall consents create a hard deadline

16.5.1 The Akaroa Outfall consent CRC204086 expires on 24 May 2030, and the Duvauchelle Outfall consent CRC23058 expires on 25 July 2031.

16.5.2 In both consents, the milestones set out for replacing the existing systems are dependent only on CCC *lodging* consents for its new systems within 18 months on from the commencement of the

consent.

16.5.3 All dates following that are dependent on the commencement of the consent for each new system. The ATWIS application was lodged in June 2023, so met the 18 month requirement. The Duvauchelle application would have met its equivalent deadline (January 2025) had it been lodged in October as previously indicated by CCC. Now it is delayed and clearly will not. There seems to be no consequences as a result, which suggests that the deadlines are not a major issue.

16.6 The risk in proceeding without a discharge consent

16.6.1 The Applicant's legal counsel has stated that CCC is prepared to take the risk of proceeding with the ATWIS proposal in the absence of a harbour discharge consent, and that should consent be declined in the future, it would find a way forward, such as returning to other options presented in the 2020 consultation.

16.6.2 We consider that such a course of action would represent reckless spending of public funds and risks to the environment. CCC has already been carrying out extensive works on the ATWIS irrigation fields without having obtained consent. Continuing with even more expensive aspects of the project such as the storage platform would be irresponsible.

16.6.3 The other land based options presented in 2020 are unlikely to be available as both rely on willing sellers, which neither had in 2020. That would only leave the harbour outfall option.

16.6.4 We note that CCC has had consent to build the treatment plant and terminal pump station since 2015 but has not done so in the absence of a discharge consent.

16.7 Untreated discharge consent needed

16.7.1 The Applicant has also acknowledged that consent will be needed for the untreated wastewater overflows from the Terminal Pump Station, but has not lodged an application for this.

16.7.2 The CRC Planning Officer has stated that the Terminal Pump Station still requires consent under the LWRP Rule 5.84.

16.7.3 In her legal submission in relation to deferral. Jessica Ottowa stated in Clause 11: "*FBPI anticipates that the decision/ conditions of the TPS consent will be reviewed to ensure the implications of the updated modelling is duly considered, as it relates to expected discharges of untreated wastewater to the coastal marine area*."

16.7.4 We now understand that consent for the TPS is required under LWRP rule 5.84. .Rule 5.84 specifically covers discharges from community wastewater systems, and rule 5.87 states that the untreated sewage into surface water as a result of overflows is a non-complying activity.

16.7.5 As we stated in our earlier submission ATWIS cannot operated without the Terminal Pump Station, and it is therefore intrinsically linked to it.

16.8 The concept of staged transition

16.8.1 A new concept mentioned during the deferral hearing was the staging in of the new treatment plant and that some flows could continue to go to the existing treatment plant and outfall for a period of time. This idea has not been mentioned before, and was not presented in the AEE.

16.8.2 FBPI strongly supports the idea of a staged transition should the ATWIS proceed.

16.9 The Big Picture

16.9.1 Legal Counsel for both CCC and CRC both stated that it was not the Panel's job to look at the big picture, but neither suggested that it was their Council's job to do so.

16.9.2 We are extremely concerned that the piecemeal approach to consenting will lower the bar because the total effects of the system are not being looked at in the round, and that this approach might also be applied to the other consents required, and are further concerned that these may not be subject to the scrutiny of public notification.

16.9.3 We are also extremely concerned that if the ATWIS system is consented without consideration of the Duvauchelle system and the exceedance discharges, this would put CRC into a position where it could be obliged to subsequently approve the discharges (likely to be at Childrens Bay), on the basis that the Panel was aware of the Applicant's intentions when it approved the ATWIS system, and that without the discharge consent the ATWIS cannot operate.

16.9.4 We submit that the big picture is extremely important for Akaroa and Duvauchelle ratepayers, who expect a safe and sustainable wastewater system, and for the communities that are being expected to receive their wastewater.

16.9.5 Effects on the receiving environment and human health must be minimal. To achieve this the Big Picture must be taken into account. We therefore expect that the Panel will want to consider the entire wastewater proposal for the Akaroa Harbour area in the round.

16.9.6 The ATWIS and DTWIS combined scheme is a single community wastewater treatment system and therefore it, and all its discharges, should be assessed as such under LWRP Rule 5.84. As we stated earlier, we submit that the intent of LWRP Rule 5.84 is that a community wastewater treatment system including its discharges is assessed as a discretionary activity and therefore the effects of the scheme, including its discharges, must be considered as a whole. This includes all components and all discharges, including those that are currently partially consented.

16.9.7

Section 17. Revisiting the Assessment of Environmental Effects

We now revisit the Assessment of Environmental Effects as presented in Clauses 323 – 528 of the CRC s42A report.

We reference the changes to the application since the AEE was submitted, the more recent information provided by various CRC experts and our own experts, and our review above of the assumptions on which the application is based. We take into account new information provided in the Applicants Evidence and Evidence summaries presented at the hearing. We also consider where the piecemeal approach is hampering the assessment.

17.1 CRC S42A report does not address key risks, uncertainties and effects

17.1.1 The CRC s42A report concludes that the adverse effects of the ATWIS system will not be more than minor.

17.1.2 Given the matters we have set out in this submission including the novelty of large scale irrigation to planted native trees, the steep, slip-prone loess slopes, the essential nature of a municipal wastewater system, the substantive changes made since the application was lodged, the number of years it will operate, and the fact that the proposed Scheme is already undersized, we are surprised that the CRC s42A report did not take a more holistic look at the key assumptions underlying the whole proposal and consider matters in the round.

17.1.3 Instead it has reached the conclusion that adverse effects will be minor despite the many concerns and uncertainties raised by the experts providing advice to CRC.

17.1.4 The s42A report does not draw the threads together nor examine the extent to which the Application can meet the recommended conditions of the various experts and the certainty around those conditions.

17.1.5 The report fails to address the critical issue that the system proposed does not have sufficient capacity and will result in substantial overflow discharges to an unknown location.

17.1.6 Although the Application is made to CRC for a community wastewater treatment system[189], the s42A report fails to consider it and its associated discharges as such under LWRP Rule 5.84. It considers that the "*proposed discharge of contaminants to air, the use of land for community wastewater treatment, and the discharge of treated wastewater to land are interrelated and should therefore be bundled together*"[190], but not the discharges of treated wastewater to water. This seems inconsistent.

17.1.7 We now examine in more detail key sections of the CRC s42A report and give our view where it differs.

17.2 Effects of the Wastewater Treatment System Design

17.2.1 The Applicant and the CRC experts have placed a heavy reliance on monitoring and adaptive

[189] CRC s42A. Mitten, Cl 9, p2
[190] CRC s42A. Mitten, Cl 309, p2

management to deal with the many risks and uncertainties that have been identified. As we have already discussed, this is not a realistic solution because:

a) There is no spare land or capacity in the system. All irrigable land is being used and the system will experience overflows when it is under pressure in wet weather. Therefore there is no space to adapt.

b) Monitoring will not necessarily pick up issues such as a build up of nitrogen until it is too late to make changes. For example, detecting contaminants in the surface water may well mean that they have built up to a saturation point in the soils.

17.2.2 We agree with all of the points made by Mr Ellwood regarding the system design and summarised in the CRC s42A report in clauses 339-348. These concerns include:

a) Management of different zones based on steepness and soil type

b) Management of the irrigation system during wet weather and following these events and how this is tied in with soil moisture monitoring, storage and rainfall recording

c) How the overflows of treated wastewater are to be managed, noting that recent modelling shows these are likely to occur every second year, but with no indication of how many events in those exceeded years

d) The need for a much more detailed irrigation management plan as part of the consent

e) Consideration of the untreated overflows from the Terminal Pump Station as part of this consent

f) The capacity of the system to cope with increased flows given the Terminal Pump station has been increased to deliver 86L/s, significantly more than set out in the AEE, and the need for more information about the flow rates, daily volumes and storage capacity at each point

g) The impact the addition of the Duvauchelle flows, and the need for further information to be presented at the Hearing as to the rates and volumes applied for.

17.2.3 Further work along similar lines to that carried out by Mr Ellwood is needed to show how each stage of the treatment train handles peak flows.

17.2.4 We fail to see how the CRC s42A report can have included all of these issues raised by Mr Ellwood, and yet concluded that the effects are minor.

17.2.5 We have raised these concerns earlier and consider they will have the following effects, which are likely to be significantly more than minor:

a) Reducing the irrigation rates in some zones will mean increasing them in others. Increasing the irrigation above that stipulated in some zones is likely have a knock on effect of reduced nitrogen removal, as this removal is worked out based on hectarage. If less nitrogen is removed this will increase the negative effects on the fresh water and coastal ecology.

e) Proper management of the irrigation to take account of weather, soil moisture and rainfall will increase the volume of storage exceedances compared to that calculated based on the simplified modelling because it will likely increase the number of days when irrigation does not take place.

f) The addition of Duvauchelle flows will also increase the volume of exceedances. As shown in Appendix C, the Akaroa and Duvauchelle catchments frequently experience high flows due to I&I at the same time. Therefore the total volume of overflows will be greater from the combined system than from just Akaroa alone.

17.2.6 The storage exceedances are a major effect arising from the system proposed despite the Applicant failing to provide an assessment of effects or discharge consent with the application. The piecemeal approach to consenting means that the effects of the entire proposal cannot be assessed.

a) We have provided additional information in the form of the November 2024 PDP *Akaroa and Duvauchelle Combined Storage Exceedance Discharges* report which sets out both the expected frequency and volume of treated storage overflows and that the discharge location after consultation with the runanga is through the sea wall at Childrens Bay.

b) The cumulative effects of both untreated and treated overflows into this ecologically sensitive and high recreation area need to be considered together.

c) The Applicant presented evidence from Ms J Burns who provided some initial opinions on treated overflows and that they would be unlikely to have significant adverse effects on the marine ecology of Childrens Bay. We note that she had based her work on the overflow volumes provided by Mr Hills (1 in 4.3 years), which are not correct as we have explained in Section 4.11 above, and also did not consider the cumulative effects of the untreated overflows.

17.2.7 Failure to consider the effects of these overflows undermines the entire consenting process. In our view the Application should not proceed further until a full assessment of the effects of both untreated and treated wastewater overflows has been provided by the Applicant and reviewed by CRC.

17.3 Effects on Groundwater

17.3.1 The CRC s42A states that the treated wastewater contains potential contaminants that may seep through the soil and into groundwater impacting stock and human water supplies, and that managing the concentration of contaminants and the volume of water that is applied to the irrigation area is crucial to ensure that any adverse effects on the groundwater are mitigated.

17.3.2 The effects on groundwater quality are considered likely to be minor provided that the wastewater is treated to a very high quality. There is also a reliance on the “conservative” approach taken to the level of dissolved organic nitrogen, and the application at low rates to unsaturated soils. As we have previously set out,

a) the wastewater treatment standard will not always be to a very high quality, as the standard will be lowered during times when the incoming volume is beyond the capacity of the plant to process fully.

b) the approach taken to DIN has not been conservative. That would have assumed that all nitrogen irrigated flowed through the ground to surface water. Instead the approach taken is that there will be denitrification and tree uptake amounting to 13.5kg/ha/yr across the both the irrigated and planted areas, which is not supported by the evidence.

c) The Applicant does plan to water up to saturation levels, only ceasing when ponding and runoff are evident, which implies that irrigation may occur beyond saturation. Irrigation beyond field capacity substantially increases drainage to groundwater, creating a pathway for contaminants to enter groundwater.

17.3.3 Given that the matters that Dr Scott has set out to ensure effects on groundwater are minor are not likely to be met, the effects are therefore likely to be more than minor.

17.4 Effects on Surface Water Quality and Ecology

17.4.1 CRC experts raised a number of concerns with regard to surface water quality and ecology in the Robinsons Bay Stream. These are not adequately summarised in the s42A report.

17.4.2 Ms Hayward concludes that Robinsons Bay Stream is potentially impacted through increased nutrient inputs, particularly increased nitrogen inputs to the stream.[191]…and that "*The Freshwater Ecology Report assessment of potential effects of the wastewater discharge focussed on modelled increased nitrogen concentrations in Robinsons Bay Stream. I consider this could potentially affect the amount and type of periphyton growing in the stream, including potential for toxic benthic cyanobacterial growths. I do not consider the nitrogen concentrations in the stream will likely reach levels that pose toxicity risks to aquatic organisms.*" She is also raises the point that "*using a lower base flow than the mean flow would have resulted in modelled higher increase in nitrogen concentrations. Inevitably, seasonal variations in nitrogen loading and leaching will result in a wider range of nitrate concentrations occurring in the stream."*[192]

17.4.3 All of these assessments rely on the Applicants assumptions regarding of the nitrogen removal of 13.5kg/ha/yr. Even with this assumption, nitrogen levels in the stream are expected to increase 190%, and push very close to the 0.09mg/l set out in the LWRP as the standard for Banks Peninsula streams. If the Conservative approach (as we recommend in Section 10) is taken then this limit is exceeded.

17.4.4 Furthermore, Ms Hayward states: *"Inputs of other contaminants such as phosphorous, pathogens or metals to Robinsons Bay Stream do not appear to have been assessed in detail. The AEE considers these low risk because of the high level of treatment of wastewater and appropriate irrigation management. I agree that risks are generally low, but I consider the risk of runoff may occur if heavy rainfall coincides with recent irrigation."* She considers that maintaining the 20m setback distances

[191] CRC s42A, Hayward, Cl 28 p 5
[192] CRC s42A, Hayward, Cl 13, p3

and appropriate vegetation in riparian zone will contribute to reducing the risks of contaminates entering waterways[193].

17.4.5 Ms Hayward goes on to say *"However, if overflows of treated or untreated wastewater does occur at any sites ... then short-term impacts on receiving surface waterways will likely be more acute that that anticipated in the routine discharge to land"*[194]

17.4.6 Ms Hayward concludes, in clause 31, that these risks can be mitigated by careful monitoring and adjustment.

17.4.7 Ms Mitten concludes that effects on surface water quality and ecology are **mostly** minor and that effects of nitrogen on plant growth (we assume she is referring to 'instream' plant growth referred to by Ms Hayward) is **moderate**, but is of the view that effect can be mitigated through appropriate conditions, monitoring and management actions[195]. (emphases added)

1.1.1 Again, we express our concerns that the impacts are likely to be more than minor as the nitrogen uptake may be less than assumed, the risk of run-off occurring due to heavy rainfall is more likely because irrigation is to take place to saturation rather than field capacity, and that during times when saturation is most likely, the treatment standard is may also be lower due to high inflows.

17.4.8 For all these reasons, we consider that the impacts on the Robinsons Bay stream are likely to be more than minor.

17.4.9 We also strongly support both upstream and downstream site monitoring of nutrient levels in the Robinsons Bay stream.

17.5 Effects on Soil Quality and Stability

17.5.1 Mr Riddle shares the concern of Mr Deans that there has been a lack of geotechnical assessment of the areas proposed to receive wastewater and that most of the steeper areas with erosion scars have not been investigated to determine whether there is adequate infiltration capacity in the soil, noting also that the testing that has been done has suggested variability between sites and the depths tested. We disagree with Mr Pizzey that geotechnical assessment of the irrigation sites can be left to the design stage. If further geotechnical issues result in insufficient irrigation capacity across the area, then the system becomes unviable in its current form. Hence further information is needed to reach the level of assurance required that the system is in fact consentable.

17.5.2 Mr Riddle also notes that sometimes during summer the soils will be at field capacity or higher as the combination of rainfall and irrigation will be greater than the evapotranspiration rate (PET). In winter the rainfall is greater PET meaning the soils will be at or above field capacity for most of the May to August period and that this will contribute to drainage losses. However, he then relies on the limited testing done to date to reach the view that the winter irrigation rate should not contribute to direct nutrient losses.[196]

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[193] CRC s42A, Hayward, Cl 18
[194] CRC s42A,. Hayward. Cl 19
[195] CRC. S42A, Mitten, Cl 412
[196] CRC s42A, Riddle, Cl 20, p3

17.5.3 He states that rainfall induced surface runoff may also occur during this time – which supports the concern expressed by Ms Hayward that if irrigation has recently occurred then this runoff will transfer nutrients and contaminants to the stream.

17.5.4 What Mr Riddle is concerned about is tunnel gully erosion when wastewater is applied to loess soils that are already at field capacity.[197] He recommends the use of soil moisture monitors to ensure avoidance of irrigation during saturated conditions, but is also concerned that the irrigation modelling used to calculate the storage is based on irrigation occurring regardless of soil moisture conditions.[198]

17.5.5 He is also concerned about the level of phosphorous absorption over long periods of time, as any bypassing of the soil matrix caused by preferential flow of wastewater from irrigating saturated soils or infiltration barriers preventing deeper wastewater penetration. The enrichment of the soil with P is likely to then increase the dissolved reactive phosphorus (DRP) concentration in any runoff water from the wastewater irrigation area, irrespective of whether the runoff is initiated by wastewater or rainfall, as will any erosion resulting in sediment loss to waterways.

17.5.6 Ms Mitten, in 454 and 455 of her report, outlines proposed mitigations to address effects on soil quality and stability, and agrees that effects are minor to less that minor with the proposed mitigations in place and noting that greater understanding of storage capacity is required to ensure that irrigation does not have to occur when soils are saturated.

17.5.7 It is hard to see how the CRC s42A report could reach the view that the effects on soil quality and stability are minor or less than minor given that:

a) Further testing is needed to determine the infiltration rates of irrigation areas not yet evaluated

b) Soil moisture monitoring is required to prevent irrigation above saturation levels, when the Applicant has not agreed to include soil moisture monitoring in the conditions

c) Irrigation above field capacity means that tunnel gullies and preferential flow paths are likely to form reducing soil stability and increasing runoff of phosphorous

d) Nitrogen levels are likely to reach equilibrium over the long term, and equate to levels found in high productivity land uses elsewhere in Canterbury therefore far exceeding the 0.09mg/l prescribed in the LWRP as the limit for the receiving water body of Banks Peninsula streams.

17.5.8 Our view is that the effects on soil quality and stability are likely to be more than minor.

17.6 Effects on Wetlands

17.6.1 In the CRC s42a report Ms Mitten states that "None of the wetlands or seepages observed will be within the irrigated land."[199]. However Ms Greenup states in her contributing report that *"Some*

[197] CRC s42A, Riddle, Cl 21, p3
[198] CRC s42A, Riddle, Cl 24, p4
[199] CRC S42a, Cl 208, p30

wetlands are situated within the area to be irrigated with treated wastewater"[200].

17.6.2 Dr. Greenep also states that there is no information on whether irrigation lines will avoid wetlands or whether they will be fully incorporated into the irrigation area[201]. We agree that this is the case.

17.6.3 The maps provided by Dr Meurk in response CRCs RFI show where wetlands fall within the irrigation areas.

17.6.4 What is not clear from these maps is how and where wetland areas and their recommended setbacks are being excluded from the irrigation areas. Of particular relevance is whether or not the area of the excluded wetlands has been taken into account in the calculation of irrigable area. The LWRP Rule 5.86 states *"The discharge of treated wastewater to wetlands is a non-complying activity."* Ms Mitten has classified the activity status for the ATWIS as discretionary.

17.6.5 Clarification is needed as to whether wetlands are situated within irrigation areas, and will receive wastewater discharges, and whether the non-complying status in Rule 5.86 should be applied.

17.7 Effects on Marine Water Quality and Ecosystems

17.7.1 The CRC s42A report acknowledges that drainage through the soil and into the Robinsons Bay stream and directly to the Bay from Hammond Point could adversely affect coastal water quality and estuarine habitat quality within the Robinsons Bay, and that this is most likely to occur during rainfall when contaminants that have accumulated in the site's soils are most likely to mobilise in groundwater and into Robinsons Bay Stream and be carried to the harbour.

17.7.2 It then puts forward an argument from the Applicant that this will be offset by the cessation of the current harbour outfall, without considering the different effects of drainage to a shallow and poorly flushing coastal estuary compared to dispersal in the harbour currents of the existing outfall.

17.7.3 As already stated, Ms M Burns considers the Robinsons Bay estuary to have high to very high ecological values.

17.7.4 She is concerned about the uncertainties raised by the changes to the application since the AEE was developed including discharging to land in saturated conditions, irrigation management on the steeper areas, with different soil types and depths, the uncertainty of the modelled effects of nitrogen on the freshwater, mobilisation of existing contaminants and direct discharges.

17.7.5 She states that these uncertainties could increase the potential magnitude of effect of nitrate-nitrite nitrogen, pathogens, heavy metals, and other contaminants entering groundwater and surface water and coastal marine area, and notes that direct discharge of untreated and treated wastewater to the coastal marine area has not been assessed and will likely have a more acute short term impact.

17.7.6 She concludes that in Robinsons Bay there is the potential for localised increased in nutrients which could stimulate the growth of nuisance macroalgae that could affect intertidal ecology, impacting the very high ecological values of its seagrass bed, and that in Childrens Bay there is also potential for contaminant losses from the land fill that could affect the seagrass beds.

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[200] CRC s42A, Greenep Cl19,p3
[201] CRC s42A, Greenep, Cl22, p3

17.7.7 She does not consider that the risk of adverse effects on the coastal environment are minor or less than minor, only that they are low *provided* the wastewater is treated to a high standard, there is no discharge of treated or untreated wastewater to coastal water and wastewater is applied at low rates to unsaturated soils.

17.7.8 The CRC s42A report has reached the conclusion that the effects will be minor to less than minor, despite the fact that there will be discharges of both treated and untreated wastewater to coastal water and that irrigation is to take place to saturation.

17.7.9 Our view is that the effects on the coastal ecology at Robinsons Bay are likely to be more than minor because of the likely increased levels of nitrogen and phosphorous in the stream, stimulating the growth of nuisance algae.

17.7.10 We also suggest that the effects on Childrens Bay are likely to be more than minor if it receives direct discharges of treated and untreated wastewater. Ms M Burns has stated that direct discharge of untreated and treated wastewater to the coastal marine area has not been assessed and will likely have a more acute short term impact than drainage through land.[202]

17.8 Effects on Air Quality

17.8.1 The CRC report considers that effects on air quality at the irrigation fields will be minor because an appropriate irrigation rate will be used.

17.8.2 Mr van Kekem, in his Applicant's evidence states: Odours of a more offensive character (a rotten egg like odour) can be emitted when anaerobic microbial decomposition of organic nutrients occurs. This would only occur in the event of ponding or if the wastewater is not treated sufficiently.[203]

17.8.3 As we have discussed, unless deficit irrigation is used, there is likelihood of ponding on the irrigation site. The prevailing easterly wind in Robinsons Bay or downdrafts in the evening may convey this to residences in the valley below, adversely affecting the environment which currently does not experience odours.

17.8.4 Odour is also a concern is if there is growth of algae and periphyton in the Robinsons Bay stream or coastal estuary. At present this estuary very rarely emits unpleasant odours, unlike Duvauchelle or Barrys Bay.

17.9 Effects on Landscape and Amenity values

17.9.1 The CRC s42A report states it has not sought any advice on landscape and amenity but agrees with the Applicant that effects will be minor through the construction phase and ultimately the planting will be positive. Ms Mitten does not appear to have considered the other permanent impacts of the scheme.

17.9.2 We have already discussed the extensive footprint of the system, how it will affect communities from Akaroa through to Duvauchelle during construction.

17.9.3 There will large and obtrusive structures including the Terminal Pump Station at Akaroa's main car

[202] CRC s42A, Burns, Cl 28 p 4
[203] Applicants Evidence, van Kekem, Cl 5.5 p10

park right beside Akaroa's freedom camping area and children's skate park and boating areas.

17.9.4 The structures on the Hay Paddock site will be very visible from Long Bay Road and the upper areas of Akaroa.

17.9.5 The storage tanks in Robinsons Bay substantially breach important built form standards in the Christchurch District Plan and will be visible from dwellings and public roads. They are of a much greater scale and density than any existing buildings in the rural amenity zone of Akaroa Harbour.

17.9.6 Added together, the cumulative effects of this system on landscape and amenity will be much more than minor.

17.10 Public Health and Recreation Effects

17.10.1 The CRC s42A report has not sought any expert advice regarding the public health and recreation effects, but agrees with the Applicants assessment that the effects of the proposal on public health and recreation will be less than minor and will likely result in positive effects.

17.10.2 In reaching this conclusion, the s42A report has ignored the issue of the overflows, and the location where these will be released.

17.10.3 The Applicant has decided not to present the overflows as part of the application, and therefore has not presented an assessment of their effects, but this does not mean that there are no effects. We are surprised that CRC has failed to address this critical issue and instead supports the Applicants assessment in its AEE, when this was drafted on the basis that the system would be 100% land based, which is no longer the case.

17.10.4 In our view the impacts on public health and recreation from overflows at Childrens Bay will be more than minor, particularly in view of its high recreational use, shallow and poorly flushing nature, and that overflows are most likely to occur during times when there are storm conditions which often result in flooding in adjacent land areas..

17.11 Heritage and Archaeology Values

17.11.1 Again, the CRC s42A report agrees with the Applicant that the effects of the proposal on the heritage and archaeology values will be less than minor without having sough any expert advice, and clearly without understanding what those values are, as it fails to mention the principle archaeological value of the site is the early sawmill.

17.11.2 While we are leaving it to other submitters to address the detail of heritage and archaeology impacts, we are aware that impacts on the Sawmill site in Robinsons Bay are significant, with a road already having been constructed right over the archaeological site, and that this important area requires protection.

17.12 Natural Hazards

17.12.1 With regard to natural hazards, including soil erosion, site seismicity, flooding and fire potential – matters which should be of primary concern to the regional council. CRC has not sought advice and the s42A report simply agrees with the Applicant that the effects are likely to be minor.

17.12.2 Ms Mitten considers a consent duration until 2054 for the discharge and land use consents is

appropriate. Given that the existing system has been in place since the 1960s, and due to the great difficulty in developing a replacement system has operated on a series of temporary consents since the 1990s, it is likely that the new Scheme could be in place for much longer than its initial 30 year consent (even if it doesn't perform well).

17.12.3 Given the probability and significance of both earthquakes and extreme climate change storms within the consent timeframe, we suggest that the potential effects of natural hazards are now a matter of both a high probability and high impact. Effects from any significant damage to the irrigation fields or tanks are very likely to be more than minor and potentially severe given that a wastewater system is critical infrastructure. The impacts of natural hazards and climate change should be an absolutely fundamental and critical matter for consideration at the resource consent, not the building consent stage

17.13 Climate Change Effects

17.13.1 The CRC s42A section on climate change completely lacks any analysis of the risks presented, and simply agrees with the Applicant that the effects of climate change are likely less than minor to minor.

17.13.2 While acknowledging that there will be more frequent and extreme rainfall events, and that higher intensity rainfall could lead to instability of the loess soil on steep slopes Ms Mitten has accepted the argument that planting trees will reduce the potential for instability.

17.14 This does not take account of the catastrophic impacts of the December 2021 rain event in the Eastern Bays, only a few kilometres away from Robinsons Bay, where hundreds of slips destroyed land, vegetation and infrastructure. Some of the worst effects were at Hinewai Reserve where, along the mid-slopes, land covered with 30 year old regenerated vegetation slipped, resulting in enormous avalanches of trees that descended all the way to the valley floor. The vegetation did not stabilise the land and exacerbated the widespread devastation of land, stream beds and infrastructure, with the worst effects at the valley floor at Otanerito Bay. This demonstrates that the irrigation field could not only be damaged by slips within the fields, but also by slips originating from the slopes above.

Figure 14 Otanerito Valley Hinewai Reserve showing debris deposited by slips on treed slopes in December 2021

17.14.1 Ms Mitten states that "*The applicant states that with adequate storage capacity, the scheme will be able to accommodate the anticipated high rainfall events and avoid the need for secondary discharge pathways from the scheme (e.g. to the harbour).*"[204] And then*: "It is my view that the effects of climate change and increased rainfall are one of several reasons as to why the appropriate capacity is provided so as to eliminate regular overflow events"*[205]. She then says "*it is vital that the appropriate storage capacity is provided for to minimise any adverse effects of future climate change."*[206] In her amendments to the conditions she suggests that the storage capacity needs to be discussed by experts.

[204] CRC s42A, Mitten, Cl 523, p72
[205] CRC s42A, Mitten, Cl 524, p72
[206] CRC s42A, Mitten, Cl 525, p72

17.14.2 Despite the lack of certainty, and the predicted exceedances Ms Mitten somehow concludes that the effects of climate change on the system will be minor to less than minor.

17.14.3 We strongly disagree with this. Given the high probability of increased storms that have not been taken into account in the system design, and their potential to damage the system and the risks to human health and the environment of a broken wastewater system, we consider that the effects of climate change are potentially severe.

Section 18. Consideration of positive benefits

18.1 Cultural and spiritual values.

18.1.1 The cultural and spiritual benefits to tangata whenua, and to Onuku Rununga in particular, of ending wastewater discharges to Akaroa Harbour are well understood and accepted.

18.1.2 We support moving the treatment plant from Takapūneke.

18.2 Harbour water quality.

18.2.1 The AEE has assumed that the removal of all treated wastewater from the harbour will be a positive benefit. This conclusion was reached when it was assumed that ATWIS would be a 100% land-based scheme and discharges to the Harbour would completely cease. All parties now acknowledge that the ATWIS, as proposed, will not fully achieve the aspiration to eliminate wastewater discharges to Akaroa Harbour.

18.2.2 With regard to the existing Harbour Outfall, the AEE states that::

a) that sampling of the current outfall required under the interim discharge permit CRC204086.[207] has concluded that the "*effect on receiving water quality and biophysical attributes is minor overall. Monitoring demonstrates that water quality in the vicinity of the outfall is consistently within the receiving water quality standards for all parameters except for faecal coliforms, in Class Coastal SG, AE and CR waters as defined in the Canterbury Regional Coastal Environment Plan.",*[208] and i

b) "The results of shellfish monitoring undertaken near the existing outfall since 2014 have consistently complied with guidelines for shellfish consumption, indicating a low public health risk if eaten. Similarly, monitoring shows that health risks for swimmers enjoying immersive contact recreation at Glen Bay, the closest monitored beach, are also consistently minimal."[209]

18.2.3 It then assumes a positive benefit to public health stating: *"Enabling the existing discharge to be decommissioned and removed from the harbour by replacing it with the ATWIS will result in a positive effect on public health as relates to existing harbour water quality."*

18.2.4 The current harbour outfall discharge is to an area of strong tidal currents. Replacing this with land discharge that could include discharge to the poorly flushing coastal estuary at Robinsons Bay (as run-off) and a direct discharge to Childrens Bay could lead to greater, not lesser, adverse effects on Harbour water quality, public health, swimming and shellfish gathering than the current discharge.

18.2.5 We suggest that this puts the claim of a positive environmental and public health benefit from the removal of wastewater to the harbour in doubt.

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[207] CRC204086 for ongoing discharge for the Akaroa WWTP, issued May 2022
[208] AEE, 10.1.1, p57
[209] AEE, 10.1.7, p59

18.2.6 FBPI supports the upgrade of the treatment plant to obtain the very highest quality of wastewater treatment, regardless of the method and location of discharges. The extent to which the proposed treatment will be an improvement on the current treatment will remove contaminants such as micro-plastics, PFAS and POPs or is not clear.

18.3 Effects on Climate Change

18.3.1 The AEE states that ATWIS will act as a carbon sink, due to the plantings. This we agree with

18.3.2 However, it also states that *"A comprehensive assessment would be required to confirm the extent of any emissions and sequestration and the extent of any positive effect on climate change."*

18.3.3 We agree that claims of carbon neutrality or positivity cannot be made in the absence of such an assessment.

18.4 Terrestrial ecology

18.4.1 We acknowledge that there will be some ecological benefit from planting of the unirrigated areas on the sites. The planting of irrigated areas is likely to be less beneficial because planted trees and emerging understorey will need to be managed for access.

18.4.2 While we do support and embrace increasing the native forest cover and biodiversity on Banks Peninsula, we do not generally see the retirement of productive farmland as an efficient way to go about this.The most effective ways to achieve good biodiversity and ecological outcomes are, firstly, the protection of existing indigenous vegetation and sites of special interest, and, secondly, the retirement and protection of marginal land – eg. steep, low fertility areas of gorse and scrub. On Banks Peninsula such areas regenerate readily and naturally once stock and pests are excluded. Planting of vegetation has a place, for example the rehabilitation of riparian areas or habitat for at-risk species, but generally the most efficient and effective outcomes are achieved by natural regeneration.

18.5 Landscape character and visual amenity

18.5.1 In his evidence for CCC, Mr Greenshields' conclusions in relation to all of the irrigation and storage sites is that the transition from open pastoral farmland to a landscape planted with indigenous vegetation is a positive effect.

18.5.2 As we describe in Section 7, the Christchurch District Plan was developed following considerable community input and culminating in a decision of the Environment Court. Pastoral farming activities and agricultural productive land are a recognised and valued part of the Akaroa Harbour landscape and amenity and provide substantial benefits by producing food and other commodities.

18.5.3 FBPI considers that vegetation which will be planted and managed for the irrigation of wastewater will have, at best, a neutral effect on landscape and visual amenity, and may well be offset by the negative visual impacts of the tank farm, terminal pump station and other infrastructure.

18.6 Public recreation benefits.

18.6.1 Mr Greenshields' conclusion in relation to all of the irrigation and storage sites is that "the future walking tracks for recreational use, as well as opportunities for educational and cultural awareness

through interpretation signage, will enhance user experience, in turn providing a positive connection with the landscape."

18.6.2 In our experience, such 'nice to haves', even when required by consent conditions, can take a very long time to eventuate, if ever. In any case, there are many options for public tracks and visiting public natural areas in the vicinity and in our view the attractions of a wastewater disposal area and planted vegetation are somewhat dubious. It is also possible that public access to sites may be found to be in inadvisable on public health grounds. However we would support the creation walking tracks and public access to the irrigation areas to assist with transparency, public monitoring and connectivity with longer routes.

18.6.3 A public walking connection between Robinsons Bay and Takamatua via Hammond Point is a benefit we support which we hope can be achieved now that the Council has purchased the land.

18.6.4 The opportunity to create a meaningful heritage reserve in Robinsons Bay does not seem to have been embraced by the Applicant. This is a benefit that we also support and hope can be achieved with the land in public ownership.

18.7 Re-use and future purple pipe

18.7.1 Re-use of treated wastewater to alleviate chronic water shortages has been a long-standing desire of the community.

18.7.2 The Application presents the irrigation of Jubilee Park as a first step towards providing a purple pipe system for Akaroa.

18.7.3 We note that Jubilee Park is to be irrigated with 80,000 sub-surface drippers, and question whether this represents either good value for money or good sense, given that the area is a contaminated capped landfill. Our preference was for something much simpler and directed towards an essential water need, such as the use of treated wastewater to flush public toilets.

18.7.4 We are also concerned about the treatment standard to be achieved by the IDAL process. Our understanding is that this will not achieve the same level of pathogen removal as the Ultra-filtration previously proposed. The IDAL process was introduced after the Application has been lodged, and we are not aware of any assessment of whether purple pipe would still be possible with IDAL or whether additional tertiary treatment would be needed, and if so, whether it could be accommodated on the current treatment plant site.

18.7.5 We are therefore doubtful that the system as currently presented is a meaningful first step towards re-use.

Section 19. Consideration of Alternatives

19.1.1 We now expand on Clause 73 of our initial written submission - that FBPI consider that the Application's consideration of alternatives is inadequate and that some options (or a combination of options) were discounted at an early stage despite them presenting as viable alternatives to the AWTIS proposal chosen by CCC. We have referred to Policy 23 of the NCPS which requires CCC to not allow discharges of untreated wastewater to the coastal environment unless there has been an adequate consideration of alternative methods. The Applicant's Legal Counsel has acknowledged that alternatives to the discharge to land at Robinsons Bay are relevant under s105 of the RMA

19.1.2 Mr. Pizzey argues that the Applicant's consideration of alternatives has been adequate, and that is sufficient. He also quotes Mr Dunning as stating that ATWIS as set out is the best practical option. We disagree.

19.1.3 When the previous application was lodged in 2014, the view of CCC and its experts was that it was not possible to irrigate 100% of Akaroa wastewater flows to land. Dry weather flow irrigation was possible, but a harbour discharge would still be required for times when the land was too wet to irrigate, even with substantial storage.

19.1.4 In its 2015 decision, the Hearing Panel stated CCC had misunderstood the cultural issue under investigation. It was not a question of reducing discharges to the harbour with proportionate appeasement of cultural concern. *Any discharge of human effluent into the harbour is offensive*.[210] At the time it was perhaps not unreasonable of the Panel to ask CCC to take a harder look at land irrigation for 100% of the water, including finding a much larger area.

19.1.5 In our view very little consideration has been given to options other than land based irrigation. The post 2015 process of shortlisting was carried out exclusively with Ngāi Tahu and the focus has always been on land irrigation. Similar effort was not put into exploring cultural treatment that could enable harbour disposal or an ocean outfall, or solutions leading to potable or non-potable re-use.

19.1.6 Despite the focus on land based irrigation after 10 more years of searching, CCC has still not found a solution for 100% land based disposal, even though it is now willing to spend $107 million (equivalent to $100,000 per connected property) and to accept substantive risks.

19.1.7 Instead it has a produced and is seeking consent for a partial solution, irrigation to land with most of the water, but no satisfactory solution for the wet weather storage exceedances, leaving the very real likelihood of adverse effects on the environment and human health, and a lack of capacity for future growth – either of the human population or the infiltration levels with the increased intensity of storms forecast.

19.1.8 New information has emerged since the Application was lodged, including:

a) much higher wastewater flows during wet weather meaning the system is not 100% land based as in the lodged application

[210] 2015 Decision, Cl 236, p52

b) as a result the scheme will experience predictable and substantial treated storage exceedances as well as untreated overflows,

c) the need to combine the Akaroa and Duvauchelle systems which will further increase the ATWIS overflows, as sufficient suitable land cannot be found to cope with the Duvauchelle flows either, and,

d) the failure of the Applicant to reduce I&I either to 20% as recommended in its resolution to proceed with the Inner Bays solution

19.1.9 We do not consider that the current high cost proposal at nearly $100,000 per connection makes efficient use of resources. The cost of the proposed scheme has nearly doubled since the Council resolution to proceed with this land based irrigation scheme in 2020.

19.1.10 For these reasons we believe that ATWIS is not the best practicable option, and that once these new issues and much greater costs had emerged, rather than relying solely on the pre 2020 considerations, greater consideration should have been given to alternatives that would avoid the environmental effects and would make more efficient use of resources.

19.2 I&I reduction alternatives

19.2.1 The high levels of I&I which minimally impact the current harbour outfall system are fundamentally incompatible with a fixed capacity irrigation system. The most wastewater is generated at the time when it is least possible to dispose of it to land.

19.2.2 Due to the faulty flow meter which was not discovered until 2017, CCC has had a poor understanding of the wastewater flows it has been dealing with. Wastewater flows are now known to be more than double those assumed in 2014/15.

19.2.3 The figures given by Mr Hills for the peak flows in the wet months of July 2022 and 2023[211] show that I&I is still very high in wet weather and, as Mr Hills comments, *Wet weather I&I has not improved as significantly.* The method used to calculate I&I also appears to contain substantial inaccuracies that underestimate its magnitude.

19.2.4 Had CCC undertaken the work to reduce I&I down to 20%, as set out in the Council's 2020 resolution, it might now have a viable land based system. Mr Hills has set out in his evidence that this level of reduction was discounted on the grounds of cost.[212] We note that only a pressure system appears to have been considered.

19.2.5 However there has been no cost/benefit analysis done to compare the cost of fully repairing or renewing the sewer pipes with the capital and operational costs of the proposed ATWIS, which must be designed to pump, treat, irrigate and overflow large volumes of predominately stormwater.

19.2.6 The Applicant has therefore failed to properly consider the benefits of substantially reducing I&I and then constructing and operating a much smaller system with fewer or no exceedances.

19.2.7 In particular, renewal of the sewer pipes could potentially eliminate all untreated sewage overflows.

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[211] Applicant's Evidence, Hills, Cl 14.6
[212] Applicant's Evidence, Hills, Cl 8.19

19.3 Alternative land sites

19.3.1 The steep slopes of the Peninsula with their slip-prone loess soils mean it is very hard to find large areas of land suitable for year round irrigation. An earlier proposal that involved the Takamatua headland was eliminated on geotechnical grounds.

19.3.2 The gentler slopes suitable for irrigation are either on inhabited valley floors of the Inner Harbour, or headlands on the outer coast. The former are broken into many small properties, while the latter involves pumping wastewater over 500m in height; it was made clear during the development of the 2020 options that CCC considered pumping over this height too risky and expensive.

19.3.3 CCC has had great difficulty finding willing sellers, or negotiating with farming landowners, hence it has focussed on the one large property where it did find a willing seller, the Thacker property in Robinsons Bay. However, even this property mainly consists of land that is too steep or otherwise unsuitable for irrigation.

19.3.4 It would therefore seem that land irrigation has been thoroughly investigated and a 100% land based solution is not feasible on the Peninsula terrain. We note that this was the end conclusion of a similar search in the Lyttelton harbour basin and the sewage from all reticulated communities in the basin is now piped to the Christchurch Bromley plant for treatment and ocean disposal.

19.4 Harbour outfall

19.4.1 Options for a harbour outfall combined with re-use or some land irrigation have not been properly considered due to cultural concerns and wetland retention times.

19.4.2 In the past, a system based on wetland cultural treatment followed by harbour disposal was discounted because of the retention time required by the rūnanga. Mr Hills describes this in his evidence: "*For a permanent discharge to harbour a median or average residence time of two weeks was considered desirable based in part on the Christchurch pond system residence time and advice from mana whenua. This would require 7ha of relatively flat land and a suitable site could not be found.*"[213]

19.4.3 However, the most recent shortlisting exercise described in the PDP *Combined Akaroa and Duvauchelle Storage Exceedance Discharges* report indicates this constraint has been relaxed. This report states that after a retention time of two days[214], sufficient cultural transformation will have occurred for it to be acceptable to mana whenua for the treated wastewater to be discharged into the marine environment, on the Childrens Bay foreshore, preferably also passing through a rock channel en route.

19.4.4 We therefore submit that given the costs have risen so high, and the proposed system does not remove 100% of wastewater from the harbour, it is time to have another look at alternatives that would meet cultural requirements and provide a safer, more resilient, future-focussed and cost-effective solution.

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[213] Applicant's Evidence, Hills, Cl 8.14 p17

[214] PDP, Combined Akaroa & Duvauchelle Treated Wastewater Storage Exceedance Discharges – Short List Options Assessment, November 2024, pp16,42

19.4.5 We suggest that an option involving a wetland with the 2 day retention time, potentially the rock overland flow down the Hay Paddock site, and a mid-harbour outfall via a purple pipe exiting Akaroa at Glen Bay needs to now be seriously investigated.

19.4.6 Such an approach would provide a system that presented a much lower risk to the environment, offered greater resilience, would facilitate reuse and would be much cheaper and easier to operate.

19.5 Ocean outfall

19.5.1 The option of an ocean outfall appears not to have been revisited since 2008.

19.5.2 It has been consistently ruled out at all stages on the grounds of the preliminary costings done by MWH 17 years ago.

19.5.3 Submitter Bruce McLean has researched this option, in conjunction with engineers experienced in ocean outfalls, and it appears to be feasible and have significant advantages over the current proposal, including avoiding all harbour discharges (both treated and untreated), greater resilience and lower capital and operational costs.

19.5.4 Should cultural treatment be required, this could be done in the manner considered acceptable for the discharges to the foreshore currently intended.

19.5.5 We consider that the ocean outfall option should now be revisited, and to see whether it could be done in conjunction with a partial re-use system.

19.6 Re-use

19.6.1 A consistent message from the Akaroa community has been that the wastewater should be treated to the highest possible (preferably potable) standard, and then re-used to address chronic summer water shortages.

19.6.2 Adopting an alternative that reduces the cost may open the opportunity to once again explore these options that would help make the community much more resilient.

19.6.3 Unlike the Applicants Legal Counsel, we do not think it is unreasonable for a community to seek the best possible outcome and for its territorial authorities to aim for that goal, particularly when a budget of $107 million has been committed.

19.6.4 It is important for the new Akaroa wastewater system to provide more resilience to climate change, of which re-use forms part.

19.6.5 We are concerned that if the land based system proposed is constructed, the sunk and operational costs will preclude any further development of re-use for this small and remote community.

Section 20. Conclusion

20.1 The Applicant has been searching for 17 years for an Akaroa Wastewater system to meet Ngāi Tahu cultural requirements; moving the treatment plant from the Takapūneke site and ceasing harbour discharge.

20.2 Land based disposal has proved extremely difficult because the loess soils of Banks Peninsula are unstable and susceptible to changes in moisture content. Irrigation should not be too intensive and needs to avoid steeper land, but there is very little such land available. The difficulty is greatly exacerbated by the high levels of I&I in the Akaroa network, meaning peak loadings at the very times when the ground is too wet to irrigate.

20.3 Hence in 2014, the Applicant abandoned the idea of a land based solution and applied for a scheme that provided a high level of wastewater treatment and a long Harbour outfall to discharge the wastewater into the centre of the harbour where it could rapidly disperse in strong tidal currents. Since the harbour outfall component of that application was declined in 2015, the Applicant has been under even greater pressure to find a land based solution. The search has been hampered and complicated by the realisation in 2017 that, due to a longstanding faulty meter, there was no accurate or reliable wastewater flow data. Once some accurate data became available, the extent of the I&I problem became better understood.

20.4 The role of the community, and in particular Friends of Banks Peninsula has proved pivotal. Our data analysis in 2017 lead to the discovery of the faulty meter. In 2020 we explained to the elected representatives the fundamental difficulty in constructing a fixed capacity land based system, sized to deal with predominantly storm water infiltration. Hence, when Councillors approved proceeding with the Inner Bays Scheme in 2020, this came with the recommendation that I&I levels were reduced to 20%.

20.5 However, the subsequent application lodged in 2023, was predicated on reducing I&I only by 20%, not to 20%. The Application claimed to be a fully contained 100% land based solution, despite providing less land and less storage than the 2020 proposal. Suspicious of this claim, Dr. Martin, on behalf of FBPI, replicated the wastewater flow modelling and was first to raise the alarm that the system would not be self contained, but instead would experience frequent overflows in wet weather. The error arose because the flow modelling underpinning the Application had been based on a limited set of data from dry years and did not perform correctly in wet years. The overflow levels and modelling error were subsequently confirmed by Beca in their Akaroa Design Flow Basis Update report released in April 2024. Their remodelled flows also revealed that the proposed Terminal Pump Station would experience frequent raw overflows and needed upgrading to meet a 1 in 5 design ARI (still a lower threshold than the rest of the network which was to have a 1 in 10 ARI).

20.6 At the same time the Applicant came to the conclusion it could not continue with a separate proposal for Duvauchelle identifying significant land instability above its existing treatment plant. It would need to combine Duvauchelle into the Akaroa Scheme.

20.7 Faced with two such major issues, in our view a responsible Applicant would have withdrawn its application and amended it to fully describe and assess the effects of the addition of Duvauchelle's sewage and of the discharge of overflows. Instead, the Applicant has proceeded without changing its application beyond increasing the storage capacity to provide for treated wastewater from Duvauchelle after treatment at the proposed Akaroa WWTP.

20.8 The result is the current deficient application; insufficient in capacity, and requiring:

a) assessment of effects and discharge consents for both untreated and treated wastewater overflows that result from this insufficient capacity,

b) assessment of the impacts of the addition of Duvauchelle wastewater flows on the treatment, storage and piping capacity, and

c) land use applications and associated assessments for the Terminal Pump Station and WWTP under the LWRP.

20.8.1 The Applicant in taking a piecemeal, staged approach to consenting, is avoiding the consideration of the system in the round, and therefore a complete assessment of the effects

20.9 The Applicant has stated they are willing to take the risks inherent in this piecemeal approach. Friends of Banks Peninsula does not support this. It is the community and our environment that will experience the effects if the system proves inadequate, and in this submission we have identified many reasons why this is likely to be the case. This includes the level of uncertainty underlying key assumptions that have then been relied on by experts assessing the potential effects.

20.10 We have identified that:

a) The system will have an extensive footprint stretching from the Terminal Pump Station near the Akaroa town entrance all the way to Duvauchelle, affecting amenity in many places both during construction and operation. The tank farm at Robinsons Bay will be particularly instrusive, and will be considerably larger than any other structure in the Akaroa Harbour basin.

b) The receiving environments where wastewater is to be irrigated, the waterways and coastal bays where it will drain and overflow to are sensitive high quality environments currently in good health. These areas are used extensively for recreation and provide habitat for nationally threatened seagrass important to the overall harbour ecosystem.

c) The treatment method now proposed is so recently introduced that it has not been assessed by external reviewers. There is no explanation of how it, and its associated raw buffer tank, will cope with the additional loading from Duvauchelle, which also experiences I&I driven peak flows at the much the same time as Akaroa. Information given indicates that during times of high flow volume, wastewater will receive a poorer quality of treatment.

d) Experts assessing impacts on streams and coastal bays have stressed that an excess of nitrogen will mean increases in toxic cyanobacteria and periphyton algal growth leading to odours and impacts on the current high ecological health. In reaching their conclusions that effects will be minor, they have then relied on assumptions that the 35.7ha of irrigated areas and 23ha of surrounding plantings will remove 13.5kg of nitrogen per hectare per year and that irrigation will be closely managed to avoid saturated ground and runoff. We have shown that neither of these assumptions is well grounded.

e) The 13.5kg/ha/yr nitrogen removal rate for the irrigated areas is not supported by the studies referenced in the literature reviewed, and there is no basis for assuming the surrounding un-irrigated areas will remove nitrogen at a comparable level. Even with this assumption, the increased nitrogen in the main affected stream rises very close (based on an annual rather than monthly average) to the 0.09mg/l maximum prescribed in the LWRP for Banks Peninsula. If assumptions do not hold this limit will be significantly exceeded.

f) Geotechnical assessment has not been undertaken for much of the area proposed for irrigation, despite the risks identified from increasing moisture levels in loess soils. Areas relied on for irrigation include slopes of greater than 19^{o} and downslopes of greater than 19^{o}, and areas which had earlier been discounted due to their history of saturation in winter. Only the lower areas of the Robinsons Bay valley of site have had any form of geotechnical assessment. The upper areas have been included on the basis of a walkover by irrigation, not geotechnical, experts. Mr Deans notes that only a desk study and walkover survey was carried out at the Hammond Point site.

g) A very large platform, for 10 storage tanks, is to be excavated in the middle of the irrigation field at an elevation of 150m. The tanks have been increased in size and therefore proximity to each other to hold the additional Duvauchelle water. There is no seismic rating given for the tanks proposed, the platform does not meet seismic criteria in the view of Mr Dean and there has been no assessment of the flood risk should there be a tank or platform failure.

h) Despite the geotechnical risks and ecological requirement to avoid irrigation to saturation, the Applicant is proposing non-deficit rather than deficit irrigation, meaning irrigation will take place up to the point where the soils are fully saturated, leaving no capacity for any subsequent rain. There is no clear method proposed for assessing when saturation is occurring or likely to occur.

i) Irrigating to saturation increases the risks of nutrient runoff into waterways and increases the risk of moisture building up in the lower levels of the loess soil, leading to land instability. If slips occur in the irrigation fields themselves or in areas affecting irrigation fields below, or at the tank platform, the already limited system capacity will be further reduced.

j) There is a gross mismatch between the irrigation cut-offs proposed for the storage calculations (ceasing when 50mm of rain has fallen and restarting the next dry day) and the statements that irrigation will be avoided when ponding and run-off is observed.

k) Treated storage exceedances are expected every 2 to 3 years once the Applicants intended combined Akaroa & Duvauchelle system is fully operational based on the Applicant's storage

calculation cut-offs. As we have modelled, if realistic, safer cut-off and restart parameters are used, or if any of the field is lost due to geotechnical or other issues, then these exceedances will be more frequent and of greater volume

20.11 The Applicant claims that the irrigation fields have spare capacity, because irrigation is only taking place to 71% of the theoretical capacity based on watering every day at the proposed irrigation rates. This claim ignores the seasonal loadings on the system, and the need for it to cope throughout the year. Patently, the system does not have spare capacity – if it did it would not experience regular storage exceedances. Nor is it valid to suggest that if irrigation had to be reduced in some areas , other areas could receive more irrigation. This ignores that the role of the land in taking up nutrients has been calculated on a per hectare basis. The absence of measures to address this lack of capacity is one of the most concerning aspects of the proposal.

20.12 The Terminal Pump Station is designed with a 1 in 5 ARI for raw sewage overflows, to be released to the Grehan Stream and onto the Childrens Bay foreshore – a poorly flushing bay currently with high ecological values and used extensively for marine and shore based recreational activities. This area is also slated to receive the treated overflows. There has been no community consultation on this location for overflows and no consideration of the cumulative effects.

20.13 All of the risks identified are compounded by the threats of climate change, in particular the increase in wet weather events. As well as increasing peak flow volumes, such events increase the risk of slips in irrigation fields, and of the tank platform failing.

20.14 The system will be expensive and complex to operate, and this also exacerbates the risks, as corner cutting, poor management and monitoring, and over-irrigation are likely results.

20.15 The monitoring and adaptive management proposed by the Applicant and various experts is an unrealistic answer to the system risks. For example, tunnel gullying and nitrogen saturation may not be detected until it is too late to remediate. There is no extra land to enable reduced irrigation rates or substitute for areas that have become unsuitable for irrigation, so such problems could persist for many years before a solution is found. This is likely to become even more challenging as the effects of climate change and other global factors create increasing financial pressures for Councils and ratepayers.

20.16 We are disappointed in the poor quality of the CRC assessment of effects, which has failed to pick up on the uncertainty of the key assumptions that its experts rely on, the level of storage exceedances and the lack of assessments for critical components which are needed under its LWRP rules. This has led to conclusions that every effect will be no more than minor, because they will be mitigated by a myriad of conditions.

20.17 We have therefore carefully re-examined the proposal, including the uncertainties around key assumptions, and taken our own expert advice regarding the soil capacity, geotechnical soundness and overall capacity of the system. From this we have identified that the effects of the proposal are likely to be substantial, and include:

a) nitrogen pollution of Robinsons Bay stream and bay,

b) a high risk of increased land instability,

c) negative impacts on the environment and human health at Childrens Bay due to both raw and treated overflows.

20.17.1 We have identified that the treated overflows will be much greater than currently forecast once a full geotechnical assessment of the irrigation fields is carried out and the irrigation management cut off and restart triggers necessary to avoid saturation and run-off are established, preferably deficit irrigation.

20.17.2 We are concerned that all the effects will increase further:

a) as climate change results in increased frequency and intensity of storms,

b) because there is no headroom or secondary discharge plan built into the system, and

c) due to poor operational management as the Council becomes more financially constrained and this complex system becomes an unsustainable expense.

20.18 We consider that the Applicant is taking a high risk approach both in the system design and then with its piecemeal approach to consenting. We are alarmed that the Canterbury Regional Council appears to condone this approach advising the Panel that it does not need to consider the big picture, only the application in front of it, particularly given that its own LWRP specifically references community wastewater treatment systems and their discharges.

20.19 We therefore conclude by requesting the Hearing Panel does take a big picture consideration of this Application, does consider the very real risks and adverse effects, including effects with high potential impact, and does not approve the application as it stands.

20.20 In the next section we set out the relief we seek in the form of three options in order of preference, and the reasoning for each.

Section 21. Relief Sought

21.1 Application should be declined

The Applicant has classified the application as discretionary. In our view it is non-complying because the discharge location for treated overflows is undefined, untreated overflows will enter the Grehan stream and there will be irrigation to wetlands.

21.1.1 We request the Panel to decline this Application in full for the following reasons:

a) The Scheme does not present a viable land option that can remove all human effluent from the harbour as directed by the 2015 decision declining the harbour outfall.

b) No solution has been provided for the storage exceedance discharges meaning the effects of this part of the proposal cannot be assessed,

c) There is no consent for the untreated wastewater discharges.

d) The Application relies on extensive and complex monitoring and adaptive management to address the many identified risks and uncertainties, but does not provide any spare capacity or headroom for that adaptation if required

e) The complexity of the system, high levels of I&I, location of the Terminal Pump Station, the reliance on electricity to pump large volumes of sewage uphill, and irrigation to loess slopes leave it highly vulnerable to climate change or seismic events.

f) The system does not attempt to address chronic summer water shortages in Akaroa and Duvauchelle. .

g) The proposal will result in adverse effects that are more than minor and are potentially significant.

h) The proposal does not represent an efficient use of resources.

i) Given the issues with this proposal, and its high cost, there has been an insufficient consideration of alternatives that could ameliorate these issues.

21.1.2 Declining the application, with a directive to consider further alternatives to balance the cultural concerns with pragmatic realities, would enable CCC, rūnanga and the community to find a better way forward with a safe, resilient and more cost-effective system. **Declining this entire application is our strongly preferred option.**

21.2 If not declined then defer a decision until all relevant consents can be considered.

21.2.1 If the Panel is not of a mind to decline this application outright, then we once again request that final consideration of the ATWIS system is deferred until all relevant applications are lodged. This includes the applications for Duvauchelle, treated storage exceedance discharges, untreated overflows, land use consents for Terminal Pump Station and Wastewater Treatment Plant, and all pipes, pump stations and all other associated consents required are lodged. We request this for the reasons given in our deferral request of 14 October 2024 and to address further omissions that have

been exposed during the course of the hearing.

21.2.2 What the CCC intends is a single community wastewater scheme with a common wastewater treatment plant, treated storage and overflow discharges, using 3 separate irrigation fields at Hammond Point, Robinsons Bay Valley and Duvauchelle.

21.2.3 The ATWIS Application as it stands is incomplete and a decision should be suspended so that all additional consent applications can be lodged and assessed alongside it.

21.2.4 Failure to do so creates the following risks:

a) he Applications being assessed with a less onerous activity status,

b) not all relevant matters will be considered when making the decision

c) the environmental effects of the whole system cannot be fully assessed.,

d) the consent authority would compromise its position,

e) consents for individual aspects may not be publicly notified,

f) leaves the Applicant and community with uncertainty as to whether the necessary consents will be obtained, and,

g) above all that the system will not be properly designed.

21.2.5 This detailed submission has expanded on our legal submissions on the first day of the Hearing, and demonstrates the intrinsic link between the three main activities and how they are co-dependent:

a) The two communities of Akaroa and Duvauchelle are now to share a WWTP, treated storage in Robinsons Bay and the storage exceedance discharge. In order to calculate the volume, frequency and recurrence of treated storage exceedance discharges, details of the inflow and irrigation capacity of both Akaroa and Duvauchelle are needed. The PDP *Akaroa & Duvauchelle Combined Storage Exceedance Discharges* report does this, but as it is not an Application, there is no certainty that the 6.4ha area it sets out for the irrigation at Duvauchelle irrigation will be found to be suitable.

b) Having full information of all the land irrigation locations and effects, the storage exceedance discharge location and effects and the untreated overflow effects allows a full, and not a piecemeal, assessment of the effects of the community wastewater system, and allows trade-offs between the primary land and secondary harbour discharge mechanisms to be made to minimise the overall effects on the environment.

21.2.6 We have heard nothing from the Applicant or CRC during the hearings to change our view on this.

21.2.7 We acknowledge the desire of the rūnanga for the process to keep moving, and of CCC to continue with its work programme. However, we submit that this is not a reason for the Hearing Panel to make a decision in the absence of relevant and full information. The ATWIS system will be in place for at least another 30 years, probably far longer, so it is important to get it right. Its assessment must balance urgency with diligence.

21.2.8 We do not see that the current Akaroa outfall consent conditions present a hard deadline, but in fact appear to be quite flexible.

21.2.9 As Mr Coutinho and Mr Deans have set out in their evidence, CCC could still progress the ATWIS programme by carrying out the geotechnical work and developing the Irrigation Management Plan while they progress a complete proposal. These are both critical components needed to determine the actual feasibility of the system, and we recommend that if the Panel does decide on the deferment option, it requests that this work is also completed and presented as part of a revised combined application.

21.2.10 We would, however, expect there to be appropriate public consultation in determining the discharge location options, as the current Childrens Bay option is wholly unacceptable.

21.2.11 We acknowledge there will be some delay with regard to this. However, the Applicant was aware by April 2024 that treated overflows would occur, and of the need to include Duvauchelle in the scheme. Instead of pursuing an increasingly fraught proposal it could have put the application on hold or withdrawn it while it worked through these issues and kept the Akaroa community and rūnanga informed and involved.

21.2.12 The future of our environment and community health and wellbeing should not be traded off against an artificial timetable.

21.3 If not declined or deferred, then adopt a precautionary approach

21.3.1 If, despite the arguments for decline or deferral above, the Panel is of a mind to grant the application, we request a precautionary approach is taken.

21.3.2 We have shown how for every key assumption underpinning this proposal, the Applicant has taken an optimistic rather than cautious approach to the risks involved.

21.3.3 We do not support a scheme that frontloads risks through optimistic assumptions and then relies on extensive conditions and a “monitor and adapt” approach to deal with problems as they arise, but provides no spare capacity for that adaptation should it be needed. This approach will not work. We already have seen that CRC fails to cross check the information provided by CCC. This has included failing to detect the incorrect flow data provided in both 2015 and 2023 AEEs, or that incorrect flow data was reported for the Harbour Outfall consent. There have been no repercussions for the failure to bring I&I down as set out in the Harbour Outfall consent.

21.3.4 On this basis we have little confidence that issues will always be correctly picked up by monitoring.

21.3.5 Once a system is in place, if there are no easy answers or the capacity to resolve problems, they can persist for years harming the environment.

21.3.6 We therefore recommend that a **precautionary approach** is taken in the first instance.

21.3.7 A precautionary approach is risk averse in the initial stage, but still involves careful monitoring. If monitoring over time reveals that greater loadings can be absorbed (such as increased irrigation) then these can be gradually increased. This is exactly what was recommended by the consultants who worked on the original land based scheme in 2010, and is set out by Andrew Dakers in the letter we reproduce in Appendix B.

21.3.8 If the ATWIS system it is to proceed, then we request that the Decision set out clearly what is actually being consented, to dispel the confusion caused by the Application, including which

components of the overall system it applies to and what aspects.

a) Components referenced should include the Terminal Pump Station, pipes from TPS to WWTP, WWTP itself, WWTP raw buffer tank, wetland, wetland discharge, pipes and pumps to irrigation fields, irrigation fields (including infrastructure such as pumps), treated storage, and a clear and unambiguous map showing which areas are to be used for irrigation, the areas excluded for wetlands and heritage/archaeological purposes including setbacks, and which additional areas are to be used for nutrient uptake and firebreaks.

b) Consents granted and any further consents required for each component including construction, land use, operation, and discharges to air, water and land.

21.3.9 Instruction or guidance is needed on how all the missing consents are to be handled.

a) There needs to be a clear list of which each of the missing consents are.

b) In fairness to the public and to achieve the best environmental outcomes, a directive requiring all further consents to be bundled and publicly notified is requested,

c) A further direction stating that the raw and treated discharge consents require full public consultation including longlisting and shortlisting of options before applications are developed.

21.3.10 The following missing pieces of critical information need to be obtained from the Applicant before the consent conditions are finalised. These include:

a) A flow diagram showing each stage of the treatment train and the capacity limits at that stage to identify any bottlenecks. This diagram should include the anticipated Duvauchelle flows.

b) Geotechnical assessment of each irrigation area or block within area to determine any additional constraints applying to its irrigation.

c) The Irrigation Management Plan rules around ceasing and restarting irrigation, and the maximum application rates for each block

d) A timetable of different project stages, including when grazing is to be withdrawn from different areas and when irrigation is to start

e) An Operational Management Plan showing how the system (Treatment Plant, pump stations and the irrigation fields) are to be operated, managed and maintained

f) Geotechnical assessment of the tank platform, including a flooding risk analysis to the irrigation field and properties down hill and downstream should there be a tank or platform collapse, and a revised plan on how the tanks could be sited further from the platform edge without compromising the risk of proximity causing a cascading failure of multiple tanks,

g) Seismic rating of the tanks and options available for colours.

Section 22. Conditions if the Panel is of a mind to approve

This section presents what a precautionary approach entails and a minimum set of conditions to achieve this.

In forming these conditions, we have taken into account the concerns and views of several other community organisations, including the Akaroa Civic Trust, Akaroa Ratepayers and Residents Association, Robinsons Bay Residents and Ratepayers Association, and Robinsons Bay Community Heritage Trust.

At the time of writing the draft set of conditions being developed by the planning experts is not available to us.

We have closely considered the Recommended Conditions in Appendix 1 of the CRC s42A report. We can see value in many of the recommendations, however these may be revised or extended by the experts' discussions, so we reserve our comments at this stage.

22.1 Conditions regarding consent applications for aspects of the ATWIS that are not yet lodged

22.1.1 All outstanding consent applications for components of the ATWIS system, including the Duvauchelle irrigation, are to be bundled and publicly notified.

22.1.2 Prior to operating the new ATWIS consents for all components have been obtained.

22.2 Conditions regarding discharges:

22.2.1 Prior to operating the new ATWIS, either:

a) the existing Akaroa harbour outfall consent (CRC2024086 has been modified to provide the secondary discharge for storage exceedances via the current outfall at Green Point and the outflow pipe has been connected to the ATWIS, or,

b) a secondary discharge which has the same or lesser environmental effects has been consented and constructed. The same or lesser environmental effects means the same or higher standard of wastewater treatment and the same or greater degree of dilution and mixing as the Greens Point outfall.

22.2.2 Prior to operating the new ATWIS I&I reduction that meets the conditions in the existing Akaroa harbour outfall consent has been achieved, meaning a reduction in I&I to below 40%. Consent condition 6 stating how I&I is to be measured must be clarified to state that 40% is the daily maximum. A revised methodology must be in place to more accurately estimate the Legitimate Wastewater Flow used to assess the percentage of I&I.

22.2.3 Prior to operating the new ATWIS, a land use consent for the Terminal Pump Station has been issued. The design of the TPS should be for an ARI for untreated overflows of 1 in 10 years to match the rest of the network upgrade.

22.3 Conditions to avoid over irrigation

22.3.1 Irrigation is conducted on a deficit basis to field capacity only, measured by soil moisture meters. Irrigation is to cease if the moisture meters indicate that an irrigation block is at field capacity.

Irrigation is only to restart when moisture has dropped to below 85% of field capacity.

22.3.2 Irrigation is to cease if heavy rain (greater than 50mm in a day) is forecast and soil moisture is at or above 85% of field capacity.

22.3.3 The irrigation fields at Robinsons Bay and Hammond Point are to be used to irrigate that portion of the wastewater volume originating from Akaroa only, and not Duvauchelle flows, as measured on a rolling weekly basis.

22.3.4 Irrigation is to cease if annual irrigation amount applied to the irrigation fields at Robinsons Bay and Hammond Point, and measured as a rolling 12 month total has reached the lesser of:

a) 220,800m^3, or,

b) the total wastewater flows derived from the Akaroa community during that 12 month period

22.4 Conditions regarding the wastewater treatment standard

22.4.1 There are absolute limits set on the quality of treated wastewater from the WWTP for nutrients, chemical and biological contaminants emanating from the treatment plant, including a reduction in total nitrogen from 10mg/L to 5mg/L as measured on a daily basis.

22.4.2 Current wastewater flows shall be sampled for emerging contaminants and micro plastics

22.4.3 Wastewater quality results must be checked and audited by a qualified independent third party.

22.5 Conditions to improve the safety of the treated storage tanks

22.5.1 The number and/or size of the 2,400m3 treated storage tanks in Robinsons Bay is reduced to fit on the platform well back from the edges and with a safety margin around each.

22.5.2 The seismic rating of the tanks is IL3

22.6 Conditions regarding monitoring

22.6.1 Monitoring of the Robinsons Bay stream should occur in the following locations:

a) Opposite the northeastern boundary where the first tributary draining the irrigation field enters the stream

b) at the point where the stream enters the property (just below the Foley farmhouse),

c) at the point where it enters the proposed heritage area and,

d) at the Sawmill Road bridge.

22.6.2 The comparator estuary for coastal monitoring should be Takamatua

22.6.3 Reporting is to also include all storage exceedances, including the volume and number of days of the exceedance and all untreated discharges, including the volume, number of hours and location.

22.6.4 To ensure accountability and the timely provision of information, as a general principle all monitoring outcomes must be publicly available as soon as possible.

22.6.5 All results from the monitoring of flows, irrigation limits and sampling are to be made public by the Applicant as soon as practicable and no later than within 1 month of collection (via the website or

similar future mechanism).

22.6.6 For other monitoring and inspections relating to the irrigation fields, storage tanks and geotechnical matters, any identified issues must be reported to the Community, and where appropriate directly to affected parties, as soon as they are identified.

22.6.7 All data made publicly available should be raw as well as aggregate data. All data should be retained and archived.

22.6.8 The CCC should establish a direct point of contact for the Community to report or enquire about issues that may arise.

22.7 Conditions to reduce the impacts on amenity

22.7.1 All hours of work on all the sites, including during construction and operation are Monday to Friday 7:00am to 5:00pm, except for emergency work, with the exception that construction on or along public roads may take place outside these hours, including at night, provided it is at least 100m from the nearest dwelling. Particular care needs to be taken with the opening of the Terminal Pump Station.

22.7.2 Construction is not to take place on public holidays or during the Akaroa peak season – December 23 to January 31 and Easter Week.

22.7.3 Residents of areas where construction is taking place are to be informed by the Applicant at least 1 month prior to commencement, with a statement of the activities to be carried out, times of operation and duration of construction work.

22.7.4 All alarms on machinery are to be Broadband, not Tonal alarms to reduce disturbance

22.7.5 Access to the Upper Robinsons Bay site is via the main entrance off the Valley Road, and not across the Sawmill Site from Sawmill Road.

22.7.6 Any pumps are to be situated so that no noise can be heard outside on other properties, including when the wind direction is from pumps toward neighbouring properties.

22.7.7 Odour monitors are to be installed on the site between the closest irrigation area and the boundary with each adjoining property containing a dwelling, the entrance to the land at Hammond Point from the State Highway, at the WWTP and at the Terminal Pump Station. No odours are to be detected.

22.8 Conditions to reduce impacts on and protect heritage

22.8.1 The heritage area (as set out on the map in Figure 15) is to be fenced and managed for its archaeological, heritage values and amenity values, and will not be planted for irrigation, irrigated, or used for irrigation related construction. Grazing will be light and only with sheep. Willow windrows are to be removed.

22.8.2 The current site access at the Sawmill site is to be removed and returned to a grass track and restricted to use by light vehicles in dry weather only

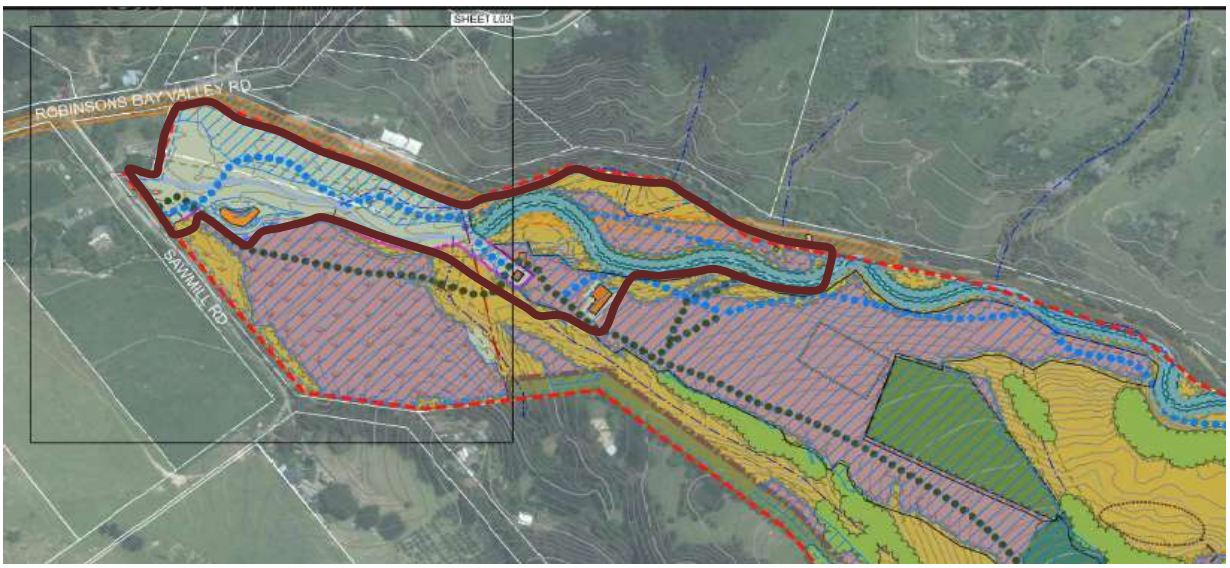

Figure 15 Heritage Area 11 Sawmill Road Robinsons Bay

22.9 Conditions to give effect to the Applicants proposed positive effects for amenity and heritage

22.9.1 The heritage area in Robinsons Bay is to be developed and managed in conjunction with the Robinsons Bay Community Heritage Trust. The area is to be developed with full public access, walking tracks, interpretation and associated facilities and interpretation.

22.9.2 Walking tracks are to be constructed on Hammond Point and 11 Sawmill Road, These walking tracks are to be designed in conjunction with the Robinsons Bay community, CCC Regional Parks team and optionally Rod Donald Banks Peninsula Trust. Walking Tracks are to be maintained by CCC. Walking tracks are to facilitate public monitoring of the scheme and to improve connectivity with other walking routes.

22.10 Potable water supply

22.10.1 The CCC shall provide a potable water supply, without restriction, to properties with water supplies affected by the irrigation sites. The CCC shall guarantee that such properties will not be charged water rates or for the supply, and this shall be recorded on the LIM for such properties.

22.11 Conditions to reduce fire risk

22.11.1 Fire breaks to be planted with low flammability species or kept open.

22.12 Conditions for pest and weed control

22.12.1 The Applicant is required to develop a pest and weed control strategy for all properties used by the ATWIS system, and to fully fund this strategy for the lifetime of the system

22.12.2 The strategy will, at a minimum, aim for eradication of Old Mans Beard, sycamore, gorse and control of possums and rats.

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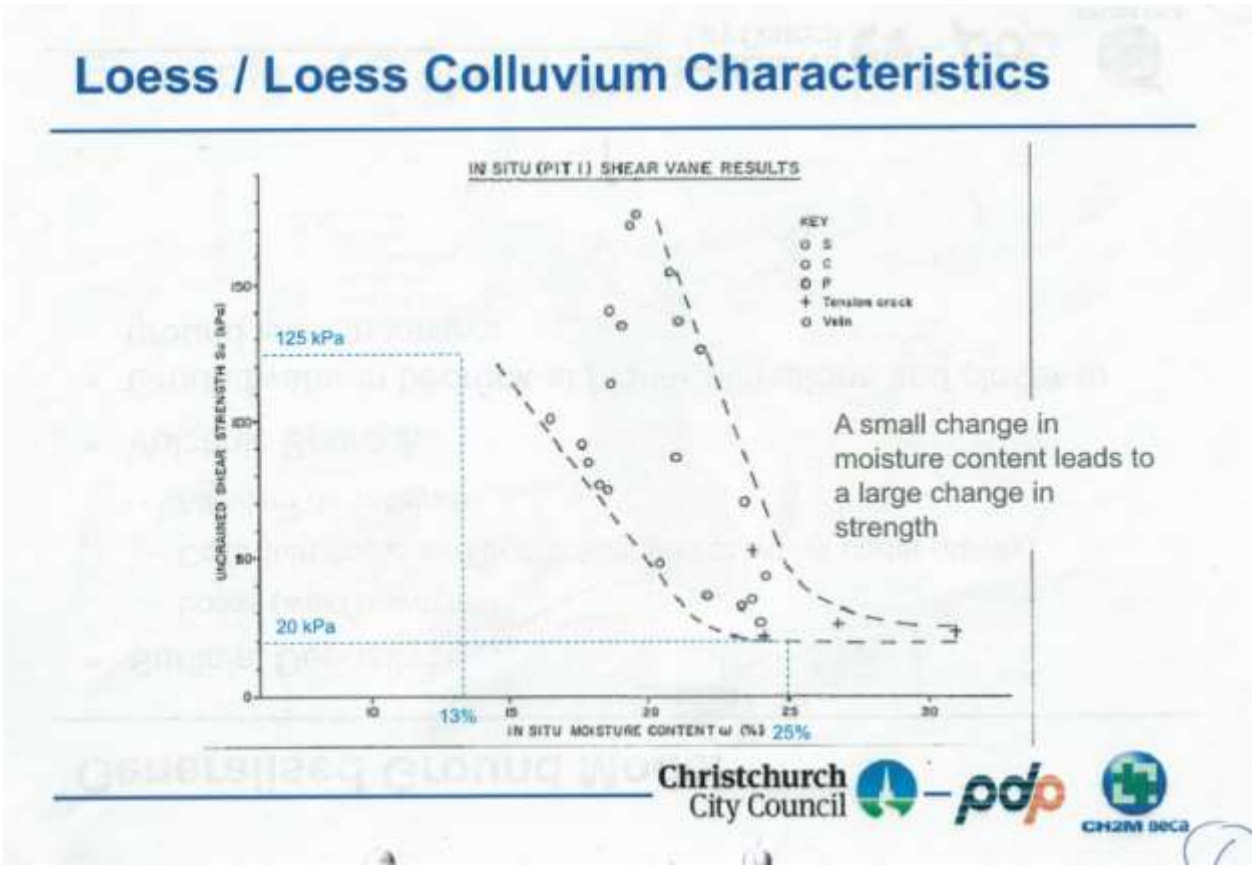
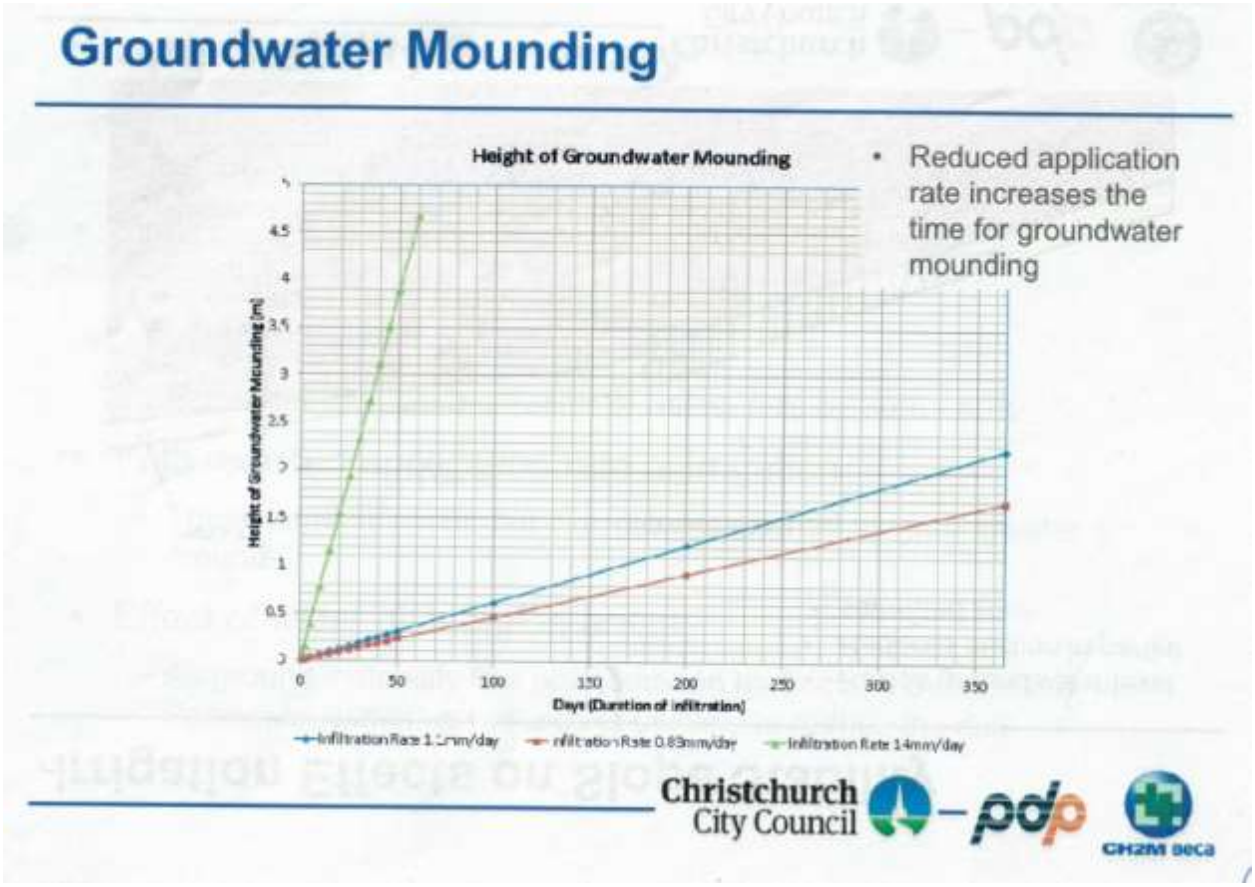
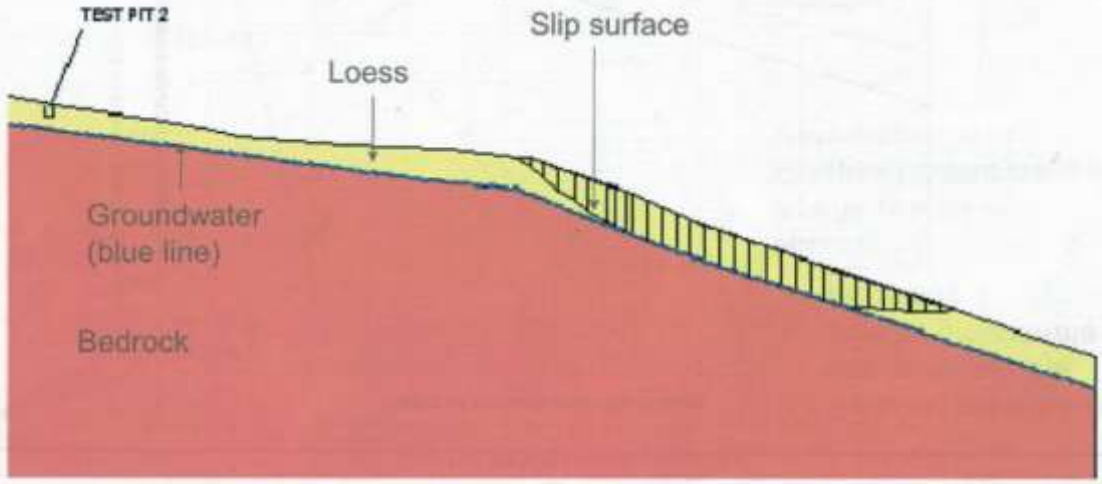
Appendix A Presentation by CCC, C2HM BECA and PDP regarding slope stability dated 1 March 2017





Irrigation Effects on Slope Stability

- Raises groundwater level
- Reduces suction in partial saturated zone



Christchurch City Council – pdp CH2M beca

Slope Stability Summary

- Current likely Factor of Safety [of Slopes > 19°] is 1.1 – 1.3
- With irrigation
  - Extent of instability increases
  - Factor of Safety falls by 10% - 20%
  - For an earthquake the Factor of Safety falls by 30% - 40%
- With reduced application rate of irrigation
  - These aspects occur, but over a longer period as groundwater mounds
- Effect of wider distribution areas
  - As ground instability is a phenomenon that occurs over Banks Peninsula, widening the area is unlikely to reduce the risk

Christchurch City Council – pdp CH2M beca

Land Stability Selection Criteria

Selection Aspect	Criteria Adopted
Land Stability	- Less than 15 to 19 degrees and downslope to coastline same grade or less - No identified instability below - Account for downslope residences, infrastructure and runout distance - Site aspect ratio (width to length)
Historical Instability Zones	Tonkin & Taylor 2008 erosion zones excluded

Christchurch City Council – pdp CH2M beca

Appendix B 2017 letter from Andrew Dakers

Ecological water and wastewater engineering

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Memorandum

6 April 2017

To: FBPI
From: Andrew Dakers
Subject: Akaroa Wastewater Land Application Proposal

Attention Sue

This letter is in response to a letter from members of Robinsons Bay community requesting statement from me on the risks of year round land based wastewater application on the Banks Peninsula.

Banks Peninsula soils, topography, geology, land use and catchment configurations make large scale year-round wastewater land application of treated domestic wastewater, very technically challenging, with potential for high risks with respect to:

- Public, and private health
- Land and water based ecosystem integrity,
- Cultural and social values of the local affected communities and individual land owners
- Affected land values
  and
- Unacceptable economic burden to present and future rate payers.

My reasoning for stating the above follows.

- The upper soils are generally poorly draining loess soils, often with compacted pans and other anomalies that further restrict the vertical movement of applied water. These soils overlay bed rock. (Note: The Pattle Delamor Partners soils reports have noted significant shallow red and grey mottling at relatively shallow depths, indicating significant seasonally saturated soils over many years).
- The topography is highly variable, steep in parts, with geological structures giving rise to slope stability risks, both in terms of mass earth movement and shallow erosion (some areas of dispersive soils).
- Within the Akaroa Harbour catchment there are many surface streams and water courses draining into the harbour. Some of these steams and receiving harbour bays are used for recreational purposes as well as supporting biodiversity and are potentially at risk.

The above factors make both large scale year round irrigation of treated wastewater and provision of large affordable storage facilities significantly more challenging than many other sites.

This does not mean that treated wastewater cannot not be safely applied to Banks Peninsula land areas at certain times in the year without significant risk. It does mean that should such a proposal be adopted it would be wise to proceed with caution, careful monitoring and in sensible stages, perhaps over many years to provide knowledge for the unknowns referred to later. **The ultimate goal may be to achieve year-round land application of all treated wastewater from the new Akaroa WWTP**. I know of no other similar year-round large scale wastewater land application system in NZ on similar soils and topography that has been operating successfully for a substantive period at design load. This proposal is essentially a first for NZ.

The latest consultation document, CIT0630 Final 2, lists 5 options:

1. Irrigation of trees or pasture at Robinsons Bay
2. Irrigation of trees or pasture at Pompeys Pillar
3. Irrigation of trees or pasture at Takamatua Valley in combination with another area
4. Non-potable reuse in Akaroa in combination with another option
5. Disposal via a new outfall pipeline to the mid-harbour

The same draft document made it clear that Options 1,2 and 3 are to be year-round irrigation to land. The consultation document does not seek submissions any options that are a combination of land application and harbour discharge, even as a staged development option.

A staged combined land/harbour discharge option, after full scale advanced treatment, is likely to result in an immediate and significant step towards long term protection of the harbour ecosystem, with minimal risk to land based ecosystems (and embedded human communities) both in terms of ecological sciences, harbour water quality and protecting and enhancing the mauri (life force) of the harbour. This may not fully satisfy the immediate expectations of Ngāi Tahu, but it likely to be the most pragmatic and optimal compromise that will enable life to resume for Banks Peninsula residents with minimal cultural, public health and environmental risks and without unacceptable economic burden to affected rate payers. Furthermore, a staged combined land/harbour discharge option will require significantly less storage.

What do I mean by staged combined land/harbour discharge option?

a. Install the new advanced treatment plant essentially as consented (i.e. a new full capacity treatment plant)
b. Upgrade Akaroa sewer network over an acceptable time period to achieve significant reductions in I&I
c. Install land application for summer period when soils and vegetation is most receptive to the application of treated wastewater to land and discharge to the harbour for periods when land and vegetation is not receptive to land application.
d. Allow appropriate harbour discharge, perhaps via a low cost wetland or infiltration gallery, for times when the land is not safely receptive to land application
e. Implement (c) and (d) in stages to increase discharge to land and reduce discharge to the harbour over time as knowledge with respect to safe land application is gained.

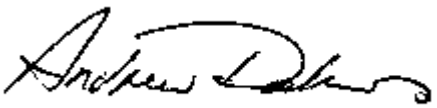
It is acknowledged that a previous consultation document noted that *options involving a coastal infiltration gallery located at the end of the Takamatua Peninsula ….* were not acceptable to Ngāi Tahu.

The staged combined land/harbour discharge option would seem to me to be an eminently sensible compromise, given the current high degree of uncertainty and risk for the year-round irrigation option.

In summary, the reasons I believe an option of (staged) combined land/harbour discharge post advanced treatment should be considered more seriously are:

- Banks Peninsula soils, topography/geology, land use, catchment configurations and settlement structures make year round irrigation of treated wastewater a high geotech, public health, environmental, social/cultural and economic risk. There is no similar long-standing large scale year-round land based wastewater irrigation system in NZ to model options 1 to 3 by.
- There are a number significant technical knowledge gaps. Staged development of combined land/harbour discharge option will provide not only more time but also feedback monitoring data. The current knowledge gaps include:
    - The actual (rather than theoretical) site specific down slope risk in relation to different hydraulic loading rates
    - The site specific effect of tree roots on slope stability
    - Once a specific site has been chosen a more detailed site specific water balance modeling may be required – to take into account additional input variables such interflow, and output variables such as deep percolation (LTAR), evapotranspiration, interception, and maybe other factors. At the moment modeling variables are unrefined due to sparse specific field data and lack of local specifics and knowledge.
    - Long term site specific nutrient uptake coefficients (especially for trees) and nutrient pathways for Banks Peninsula soils require refining and modeling.
    - Climate change science continues to be improving and likely impacts (especially extreme events) becoming more predictable.

Yours faithfully



Andrew Dakers
Director and Principal Engineer

Appendix C Council Resolution approving Inner Bays scheme

Councillor Daniels left the meeting at 4.14pm and returned at 4.16pm during consideration of item 33.

Councillor left the meeting at 4.27pm during consideration of item 33.

33. Hearings Panel report to the Council on the Akaroa Treated Wastewater Options - continued

The Council continued consideration of this item. The Chair of the Hearings Panel advised of minor amendments to recommendations 4. and 12. which were accepted by the Council.

Council Resolved CNCL/2020/00176

That the Council:

1. Acknowledges that many submitters advocated for a sustainable development approach to water in Akaroa and that the Council recognises the value of water as a precious resource and taonga.
2. Acknowledges that the water supply in the Akaroa area and wider Banks Peninsula will be increasingly under threat as climate change increases and that working towards non-potable reuse is supported by the Hearings Panel and most submitters.
3. Acknowledges the concerns of the community about the poor state of the wastewater network and recommends that the Council aims for less than 20% inflow and infiltration through its work on the Council network and that it also require private property owners to repair their pipes.
4. Increases the promotion of water conservation measures in Akaroa to reduce the volume of wastewater, including the use of Smart Meters funded as part of the 3 Waters Reform funding and notes the support by the Hearings Panel and some submitters for excess water charges to assist with this.
5. Regularly communicates progress on the repairs and of conservation measures to the community, Community Board and the Council and that the name of the project change to the Akaroa Reclaimed Water Treatment and Reuse Scheme.
6. Requests Council Officers to work with the Community Board to establish a Community Reference Group including members from the local Rūnanga to ensure that community concerns about the approved Akaroa Reclaimed Water Treatment and Reuse Scheme are listened to and, where possible, addressed.

In response to question one of the Akaroa Treated Wastewater Options consultation document, "should we discharge highly treated wastewater from our new treatment plant to land or should we continue to discharge into Akaroa Harbour?"

That the Council:

7. Rejects that Akaroa's highly treated wastewater is discharged from the new treatment plant to the Akaroa Harbour.
8. Approves that Akaroa's highly treated wastewater is discharged from the new treatment plant to the land.

In response to question two of the Akaroa Treated Wastewater Options consultation document, "if it decides to develop a scheme where highly treated wastewater is used on land for irrigation, where would you prefer the Council to irrigate? Inner Bays (Robinsons Bay, Hammond Point, Takamātua), Goughs Bay or Pompeys Pillar?"

That the Council:

9. Approves that Akaroa's highly treated wastewater is used on land for irrigation at Inner Bays (Robinsons Bay, Hammond Point, Takamātua)

10. Requests Council Officers to investigate and incorporate where practical the following into detailed design of the scheme:

    a. additional wetland site options as part of the detailed design, with the goal of reducing the size of the storage ponds.

    b. maximize the planted areas of native bush to both reduce the size of the ponds and increase biodiversity outcomes.

    c. investigate additional areas for irrigation of public space within the Akaroa catchment with the goal of increasing non-potable use.

    d. futureproofing for potential non-potable reuse.

    e. the re-use of the current UV treatment unit in the new treatment plant to enable non-potable reuse.

    f. native tree plantings in Robinsons Bay to avoid key archaeological sites as recommended in the Heritage New Zealand submission and installation of interpretation signage for visitors to the site.

    g. softening the contours of the plantings by following the natural contours of the land, running down gullies where possible and raised boardwalks where appropriate for recreation in new wetland areas.

    h. Notes that water conservation and Inflow and Infiltration reduction measures aim to reduce the size of the pond.

11. Requests that Council Officers investigate the use of storage tanks instead of storage ponds and if practical discuss the option with the Community Reference Group.

12. Requests Council Officers to investigate and report back to the Council on the option of a scheme for local employment for the planting and maintenance of the native trees.

In response to question three of the Akaroa Treated Wastewater Options consultation document, "would you support us irrigating public parks in Akaroa with highly treated wastewater?"

That the Council:

13. Approves irrigating public parks and flushing public toilets in Akaroa with highly treated wastewater as part of the scheme.

In response to question four of the Akaroa Treated Wastewater Options consultation document, "would you like use to explore the feasibility of a purple pipe scheme for Akaroa, so that residential property owners could use the water for garden watering and other non-drinking purposes?"

That the Council:

14. Supports and requests Council Officers to explore the feasibility of a non-potable reuse (purple pipe) scheme for Akaroa, so that property owners could use the water for garden watering and other non-drinking purposes.

15. Requests Council Officers work with the Ministry of Health, the Canterbury District Health Board, Ngāi Tahu and water suppliers that are interested in non-potable reuse to develop non-potable re-use guidelines or standards for New Zealand.

16. Requests Council Officers discuss options for enabling non-potable reuse of treated wastewater with the Council as soon as practicable, should the regulatory framework change.

That the Council:

17. Includes consideration of additional budget in the draft Long Term Plan 2021-2031 to implement the approved Akaroa Reclaimed Water Treatment and Reuse Scheme.

Councillor Templeton/Councillor Coker **Carried**

Councillors Chu, Gough and MacDonald requested that their votes against the resolutions be recorded.

31. Ōtākaro Regeneration Company Due Diligence Report Findings

Council Resolved CNCL/2020/00177

That the Council:

1. Notes that the Development Christchurch Limited preliminary due diligence report recommendations that the proposal does not warrant progression to a detailed due diligence stage.

2. Declines to enter into an exclusive arrangement (at the current time) with the Ōtākaro Regeneration Company, for the purposes of collaborative master planning the proponent's development proposals.

3. Noting that work is being done on establishing a co-governance entity, additional advice on a collaborative master planning process will be required.

Councillor Davidson/Councillor Coker **Carried**

35. Resolution to Exclude the Public

Council Resolved CNCL/2020/00178

That Lindsay McKenzie remain after the public have been excluded for Item 42. Chief Executive Performance Agreement and Amended Committee Terms of Reference, of the public excluded agenda as he has knowledge that is relevant to that item and will assist the Council.

AND

That at 4.33pm the resolution to exclude the public set out on pages 1032 to 1037 of the agenda be adopted.

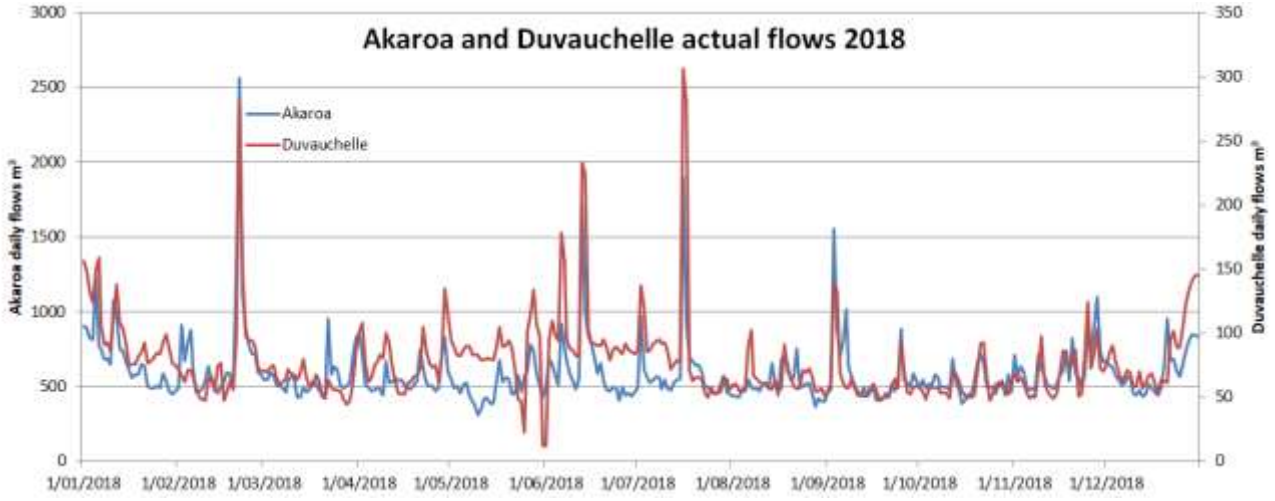
Councillor Chu/Councillor MacDonald **Carried**

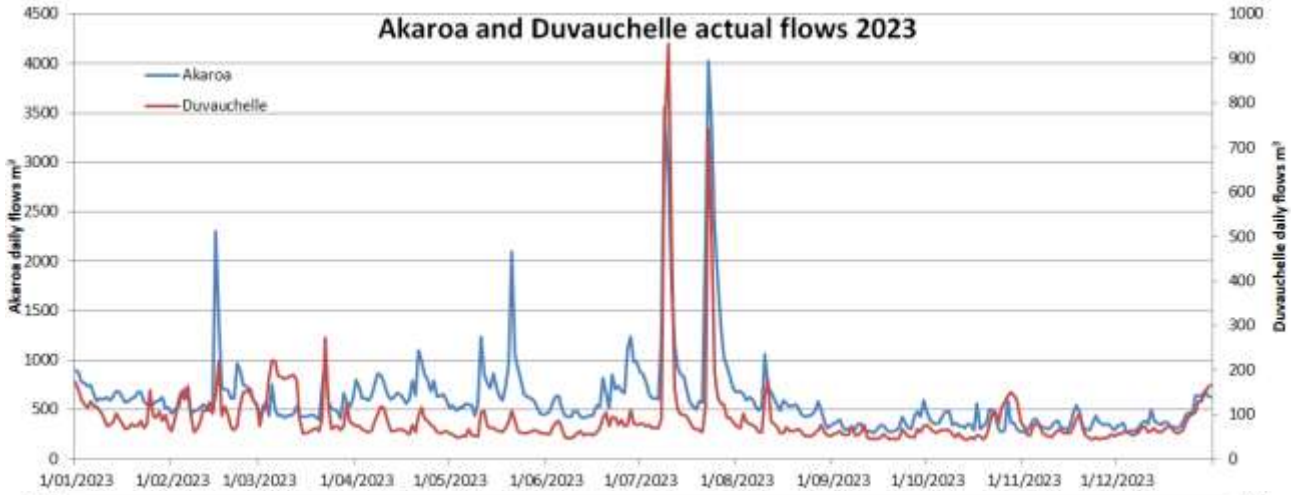
Appendix D Comparison of Duvauchelle and Akaroa wastewater flows

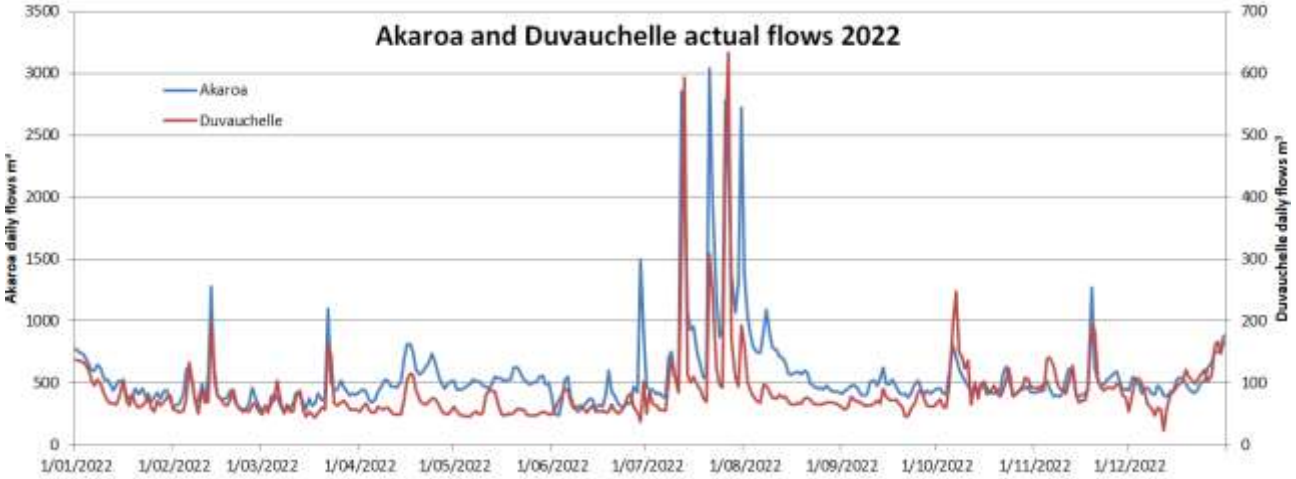
The graphs below show four example years comparing Akaroa and Duvauchelle flows. 2018 is an average year. 2022 and 2023 were wet years. 2024 is a dry year.

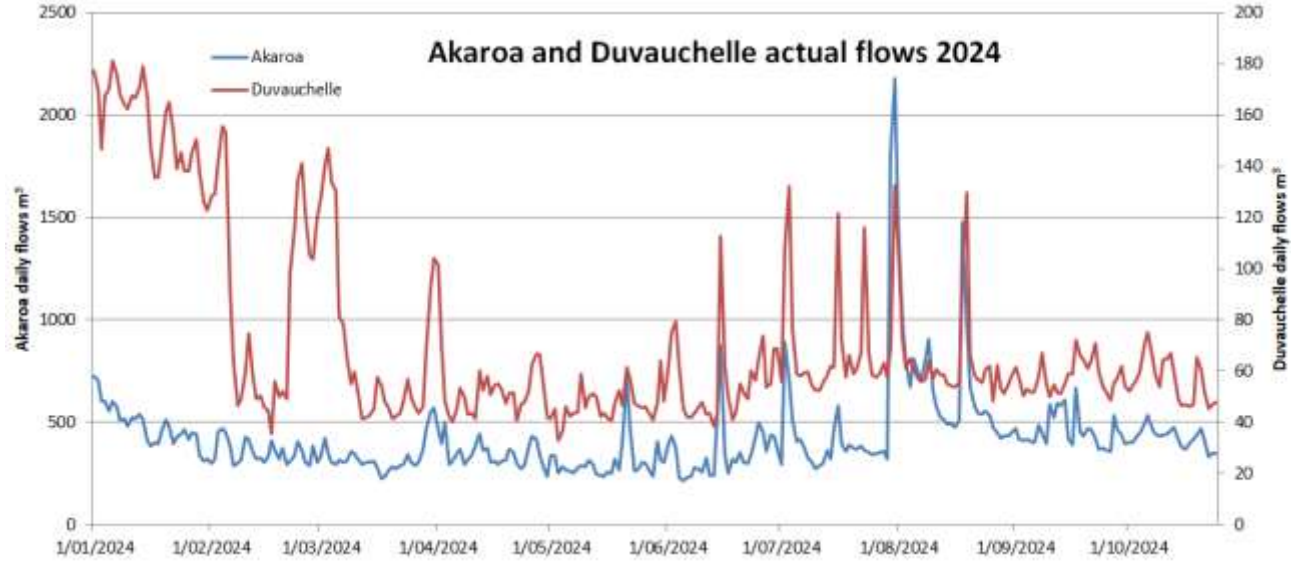
The purpose of these graphs is to show the degree to which peaks coincide. Two different scales are used, the one on the left is for Akaroa, the one on the right is for Duvauchelle. This enables direct comparisons to be made in the graph peaks and troughs. Without the different scales, the Duvauchelle line would be much smaller than Akaroa.

The main point to note is that peaks generally coincide. Therefore the use of the same storage by the two communities does not result in much offset. Occasionally there is some offsetting, but in general Duvauchelle is spiking at the same time as Akaroa, increasing the storage requirement or exceedances.




Akaroa and Duvauchelle actual flows 2023
Akaroa
Duvauchelle
Akaroa daily flows m³
Duvauchelle daily flows m³
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1000
900
800
700
600
500
400
300
200
100
0
1/01/2023
1/02/2023
1/03/2023
1/04/2023
1/05/2023
1/06/2023
1/07/2023
1/08/2023
1/09/2023
1/10/2023
1/11/2023
1/12/2023


Akaroa and Duvauchelle actual flows 2022
Akaroa
Duvauchelle
Akaroa daily flows m³
Duvauchelle daily flows m³
3500
3000
2500
2000
1500
1000
500
0
700
600
500
400
300
200
100
0
1/01/2022
1/02/2022
1/03/2022
1/04/2022
1/05/2022
1/06/2022
1/07/2022
1/08/2022
1/09/2022
1/10/2022
1/11/2022
1/12/2022


Akaroa and Duvauchelle actual flows 2024
Akaroa
Duvauchelle
Akaroa daily flows m³
Duvauchelle daily flows m³
2500
2000
1500
1000
500
0
200
180
160
140
120
100
80
60
40
20
0
1/01/2024
1/02/2024
1/03/2024
1/04/2024
1/05/2024
1/06/2024
1/07/2024
1/08/2024
1/09/2024
1/10/2024

Appendix E Childrens Bay overflows

E.1 Childrens Bay overflow location proposed

The images below show the location of the outflow based on the information in the PDP report.

Figure 16 Aerial image of Childrens Bay, Boat store and surrounding area

Figure 17 Photograph of Childrens Bay beach and seawall below Boat Store

E.2 Effects of overflows on ecology of Childrens Bay

E.2.1 We have reproduce two maps from that AEE showing the shallow nature of the bay and the relative weakness of the currents flushing it in the main body of this submission.

E.2.2 These maps confirm the shallow and poor flushing of this location

E.2.3 The Estuary Ecology report provided as Appendix I with the current AEE notes that: Deep drowned valley hydrosystems are characterised by slow flushing time, particularly in the headwaters (Hume et aL, 2016). Hydrodynamic model simulations of Akaroa Harbour have calculated an overall residence time of up to -120 days for a non-decaying substance (Bell etaL, 2014). This time can vary on a small geographic scale, with tidal exchange reducing the flushing time closer to the harbour entrance, while contaminant loading from freshwater runoff in the upper harbour may remain in the system for longer. [215]

E.2.4 The 2015 AEE comments that There is a stronger ebb-tide flow around Green Point where the existing short outfall is located south of the township. This is confirmed by the previous measurements of Hicks & Marra (1988).[216]

E.2.5 Discharged treated wastewater at Childrens Bay will therefore take much longer to disperse than wastewater from the current outfall.

E.2.6 The Estuary Ecology Appendix sets out that there are seagrass beds in Childrens Bay as shown below. Dr Burns states that seagrass (Zostera muelleri) beds *support high biodiversity of fauna, act as a nursery for juvenile fish, provide important ecosystem services, and buffer the effects of climate change* and that they are classified as 'At risk declining' . The map below is taken from that report and shows where these beds are located.

217

Figure 18 Location of sea grass beds in Childrens Bay from EOS Ecology report

[215] AEE Appendix I Estuary Ecology Report p8
[216] 2015 AEE p26
[217] AEE Appendix I, p14

E.2.7 As already noted in the case of Robinsons Bay, the New Zealand Coastal Policy Statement (2010) Policy 11 states that adverse effects should be avoided on indigenous taxa that are listed as threatened or at risk in the NZTTC List. This is the highest level of protection in the Coastal Policy Statement.[218]

E.2.8 Applicant's evidence from Jessie Burns, lead author of the EOS Ecology report has upgraded her assessment having read Melanie Burns assessment and now concludes: *The intertidal estuary receiving environment of the ATWIS has a high ecological value, and contains ecologically and culturally important species including seagrass (Z. muelleri), with a conservation status of 'At Risk – Declining', and cockles (A stutchburyi), which are an important mahinga kai species.*[219]

E.2.9 Dr M Burns further states in her evidence that The direct discharge of untreated or treated wastewater to surface water and/or the coastal marine area were not considered as part of this application or assessed within the Estuary Ecology Report. These overflows could increase the pathogens and viruses, organic matter, nutrients, heavy metals, and other contaminants entering the coastal marine area. This will likely have a short-term impact more acute than that is anticipated in the routine discharge to land.[220]

E.2.10 Dr M. Burns concludes that: In Childrens Bay there is potential for contaminant losses from irrigating Jubilee Park which is an old landfill. I consider it [Childrens Bay] to have moderate to high ecological values. Overall, I consider that the risk of adverse effects on coastal water quality and estuarine ecology are low provided that: a. Wastewater is treated to a high standard; b. Irrigation and wastewater storage are managed so there are **no direct discharges of wastewater**. (treated or untreated) to coastal water, wastewater is applied at low rates to unsaturated soils; [221]

E.2.11 In other words, if there are direct discharges of treated or untreated wastewater to coastal waters, then the risks of adverse effects will not be low.

E.2.12 J Burns in her Applicant's evidence is of the view that treated discharges will have low impact on Childrens Bay, but has based this on information that we challenge. She has based this on the 1 in 4.3 treated overflow years, which we state for reasons given above should be 1 in 2.5 years. She also states that there will be no untreated overflows to Childrens Bay, so is unaware that the design ARI for the Terminal Pump Station is 1 in 5 years and has not considered the cumulative effects.

E.3 Effects of overflows on human health

E.3.1 The AEE states: *Treated wastewater has the potential to significantly affect public health where there is a risk of public exposure to and contact with the wastewater. Exposure to contaminants of concern to human health including pathogens can result in significant illness in the community, and in extreme cases public health emergencies. Wastewater networks, treatment and disposal is therefore critical to maintain public health and avoid the potential for serious adverse effects on the public from contacting wastewater, or from*

[218] CRC S42A Burns, cl 15-16, p3
[219] Applicant's Evidence, Burns J, Cl 81.
[220] CRC S42A, Burns, cl28 p4
[221] CRC S42A Burns, cl36-27 p 6

*wastewater contaminants in the receiving environment.*222

E.3.2 It is hard to square this statement with the beach at Childrens Bay shortlisted as the ONLY option for discharge of the treated wastewater.

E.3.3 As the images above show, the foreshore and the land above it is a high use recreational area, used for boating, kayaking, walking, childrens facilities including Playcentre and Skatepark, Sports Clubs, Sports Grounds Events, Festivals, Freedom camping and the main car park for the town.

E.3.4 Furthermore, the area behind the seawall is reclaimed land over a cap landfill. The whole reclaimed area is highly floodprone. [223]

Figure 19 Akaroa Recreation ground flooding

E.3.5 In assessing a discharge of treated wastewater to the Childrens Bay foreshore, there would be need to consideration of the moderate to high ecological values, its poorly flushing nature, the health risks to a high recreation and flood prone area, and the cumulative effects from irrigation of Jubilee Park, raw overflows designed in on the basis of a 1 in 5 ARI, any additional raw overflows from emergencies such as breakdown and storms, and the release of treated wastewater at least 1 in 2.5 years (or more if the irrigation regime is improved for Robinsons Bay) and in some years these being volumes equivalent to many Olympic swimming pools.

E.3.6 Adding to the poor picture the water quality will be lower than that sent to Robinsons Bay due to passing through the wetland where it is likely as the presence of faecal coliforms may increase due to regrowth of microorganisims in the wetland, faecal matter from birds and mobilisation of previously deposited solids. [224]

[222] CRC235038, p76
[223] Thompson, 2008, Akaroa Harbour Settlement Study Areas Historical Flooding Research and Mapping Project
[224] PDP 2024 Combined Akaroa Duvauchelle Storage Exceedance Shortlist p18

Appendix F Dam Break analysis from 2020

The following chart is one of several different scenarios presented in Akaroa Wastewater Summary of Disposal and Reuse Options Prepared for Christchurch City Council Prepared by CH2M Beca Ltd 17 July 2020BECA Appendix R.

It shows the type of analysis carried out when the 19,500m^3 dam was proposed rather than the storage tanks.