Akaroa Treated Wastewater Options Consultation (2020)

Second draft

FULL SUBMISSION

Released August 21, 2020

We wish to be heard in support of our submission

Includes:

Executive Summary

Short-form Submission

Full Submission

- Visit www.friendsofbp.org.nz to endorse this submission any time up to August 23, 2020.
- We welcome feedback to: info@friendsofbp.org.nz
- Final submission will be released August 22
  - It will include your feedback and our engineering and quantity surveyor opinions
- We encourage you to make a personal submission. Please read our notes for assistance

Executive Summary

Akaroa's wastewater network is being replaced at a time when the challenges of climate change are becoming increasingly clear, with potable water supplies and storm and wastewater systems particularly at-risk. This adds to Akaroa's current issues of water shortages, and an old and leaking wastewater network that suffers from extreme infiltration and inflow of storm water.

The Council's Integrated Water Strategy recognizes these issues, but the wastewater disposal options proposed in the current round of consultation do not address them; rather they leave the system even more vulnerable to climate change impacts, at an extremely high per-connection cost.

Friends of Banks Peninsula therefore does not support any of the proposed options, and instead puts forward an integrated approach to reduce, reuse and recycle the treated wastewater in Akaroa, where water is most needed. We ask Council to reject their current proposals and instead adopt this approach to build sustainability and future resilience to climate change in this community.

A new wastewater system requires a very substantial investment of funds and must be safe, efficient and sustainable well into the future. It must be as risk free as possible because the need for **sewage treatment cannot be 'switched off' if a system fails.**

The sudden and on-going shock of the COVID-19 pandemic has further highlighted the need for resilience and fiscal prudence, but the costs of the Akaroa wastewater system have escalated substantially. **The options are similar to those proposed in 2017 but their costs have increased by between 116% - 245%.** The volume of water is more than double that previously thought and it is now established that **over 60% of the wastewater flows are storm and ground water caused by extreme levels of infiltration** into Akaroa's broken and leaking sewer network. This peaks during times of heavy rain or prolonged wet weather when land-based options are unable to irrigate, driving the need for huge and expensive storage ponds. A raw sewage pond to smooth out these large peaks is also required for **all** options, opposite the Treatment Plant near the town entrance.

It is misuse of public funds for the Council to construct a costly new wastewater disposal system without fully fixing the pipes first. Failing to do so results in a system that is much bigger, more expensive and with greater negative impacts than necessary, while at the same time lacking capacity for future expansion. Having high levels of infiltration (especially in wet weather) has not been a major issue for the Council to date because the current discharge to the sea is not limited by volume. Moving to a land-based volume limited system without dealing with unlimited inflow is a recipe for disaster when we face increasingly intense storms and sea level rise. Future generations will be saddled with debt and a sub-standard wastewater and water system.

All the land-based options have high risks and constraints, are untested and their positive outcomes are overstated. Of these, **the Inner Bays scheme is the worst. It has an unacceptable impact on existing communities, is the most land-constrained and has the highest potential for environmental impacts as it drains to streams flowing through the irrigation areas to poorly flushed mudflats.** Goughs Bay and Pompeys Pillar involve pumping over a high hill and have unwilling landowners. Harbour Outfall, as proposed by the Council, does not incorporate mitigation measures to meet the cultural needs of mana whenua. We consider all options to be unsustainable management to differing degrees, and therefore have not chosen between harbour and land-based disposal, nor have we ranked the land-based options.

New Zealand's legislative framework is changing rapidly to put a focus on future resilience as the impacts of climate change become better understood. Hence, the Council needs to set aside yesterday's thinking and adopt an integrated long-term solution that provides resilience for future generations.

We present a "Reduce, Reuse and Recycle" integrated approach to guide the Council on this course.

Short-form submission

We present a summary of our arguments in this Short-form submission, and provide detail and technical backup in our Full submission.

Christchurch City Council has a difficult problem that it needs to address - the disposal of Akaroa's wastewater. It has been searching for a solution since 2007 and this is the fifth time it has consulted on the issue.

Friends of Banks Peninsula is Akaroa's community environment society. It has been closely involved with the Akaroa wastewater issue since 2007. In its submission to the Council's wastewater consultation in 2017 the Society advocated a staged approach toward reusing the wastewater in Akaroa to address its chronic water shortages. **Reuse gained the most public support of all the options in the 2017 consultation**. [1.2]

However, this consultation had to be abandoned because the solutions proposed were designed based on faulty flow meter data and were therefore significantly undersized. [1.3]

In the three years since, while the search for alternative solutions has been underway, the need for re-use in Akaroa has become even more apparent. Last summer, (2019/20) a total outdoor watering ban was abruptly introduced after stream levels dropped precipitously[1.] The public and government agencies are much more aware that climate change will increase the frequency and intensity of storms and droughts, as the impacts begin to be felt around the country. Scientific research has revised predictions for the worse. Akaroa is identified as a settlement that is likely to be water stressed in the future[2]. The Resource Management Act has been amended to require particular regard to the effects of climate change, the Council has developed its Integrated Water Strategy, the Canterbury Air Regional Plan is operative, and the government has announced Three Waters reform and funding. [1.4]

The land based options now being proposed are substantially the same as those on offer three years ago, but with the added problem that there is now *more than double* the volume of wastewater to deal with, due to the massive levels of infiltration through leaking pipes – 61% in an average year, rising to 68% in the wettest years is due to stormwater inflow and groundwater infiltration.[1.6] The cost of all options has risen dramatically because they have to deal with this extra water.

We share the disappointment expressed by the Akaroa Treated Wastewater Reuse Options Working Party Joint Statement, especially in relation to climate change and scarcity of water. Genuine reuse in Akaroa, where the water is most needed, is once again pushed down the list of priorities. Plans to fix the sewer pipes are conservative and substantially fail to deal with the problem.

The three land-based disposal systems presented are all flawed, and none more so than the Inner Bays Scheme favoured by the Council staff. While the Harbour Outfall solution is an improvement over the previous one as it now includes the core infrastructure for beneficial re-use, it still fails to address the cultural requirements and still disposes of the bulk of the water

Hence in this submission the Friends of Banks Peninsula is once again asking the Council to design an integrated solution that facilitates re-use of the water in Akaroa, eventually recycling it back to the potable supply. In coming to this view we have kept abreast of developments via the Akaroa Wastewater Working Party, reviewed the technical documents, taken professional advice and conducted community meetings to understand the public views.

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[1] https://newsline.ccc.govt.nz/news/story/council-closely-watching-water-levels-in-banks-peninsula

[2] CCC Infrastructure Strategy 2018-2048 pp52,100

Consideration of issues common to the Land-based options in the consultation document [Refer Section Chapter 3]

We find that all of the land based options presented by the Council are flawed.

- **All the irrigation options proposed are disposal options**, aimed at getting rid of the water. Native trees have been selected to absorb the water, rather than pasture based options, because they enable winter irrigation and therefore reduce storage requirements. Nevertheless, they all require major earthworks and construction of very large storage ponds to facilitate the disposal of the water on the *minimum* feasible areas of land. Genuine reuse for biodiversity and carbon sequestration would seek to **maximise the area of native trees** and minimise destructive and carbon emitting construction. The area would be as large as possible, rather than minimum feasible.
- **Disposal of wastewater to intensively planted native trees would be a first for New Zealand.** The land and storage requirements are based on theoretical modelling that is highly sensitive to assumptions, particularly around the ability to irrigate throughout the winter. Assumptions used to determine the area of land for disposal and size of storage include:
    - soil absorption rate,
    - canopy intercept rate
    - that irrigation during wet weather (up to the point where 50mm has fallen in a single day) will not exacerbate slips or harm the plants,
    - nitrogen uptake by trees, and,
    - weather patterns based on historical data rather than future predictions.
- **Should any of these assumptions prove incorrect then the storage and land irrigation areas will be too small** – resulting in the need for system expansion or release of wastewater, along with nutrients and other potential contaminants, to streams. The anticipated level of nutrient leaching for the Inner Bays option could be as high as that of a dairy farm.
- **Population growth parameters are minimal.** Disposal capacity does not allow for both modest growth in Akaroa and any future sewerage reticulation for Takamatua.
- **The water is directed away from where it is most needed - the Akaroa catchment** from which it emanates. Re-use of the wastewater in Akaroa would be a major step toward resolving Akaroa's water shortages.
- **Water will leave the treatment site without testing for compliance** because no outflow buffer is incorporated into the system. This leaves storage ponds and the irrigation fields at risk of receiving contaminated water.
- **Scarce, high value agricultural land would be taken out of production.**

Consideration of issues specific to each of the individual Land-based options

Inner Bays option [Chapter 4]

The Inner Bays option would require consent as a non-complying activity, due to its reliance on some level of discharge to a water body**. It carries the highest economic, social and environmental risks due to the complexity of the system proposed compounded by the proximity to populated areas and downstream infrastructure.**

The Inner Bays solution is not practical because it:

- Relies on the Council managing to purchase several private properties – one of which is potentially earmarked for another public purpose.

- Critically relies on achieving at least a 20% reduction of inflow and infiltration (I&I) up-front, without making this a budget priority (the budget is capped).
- Relies the most heavily on modelling assumptions around the wetland function, tree canopy intercept rates, storm frequencies and nitrogen uptake. There is little scope for error because the expansion capacity is very limited and the catchments drain to shallow inner harbour mudflats. Further private properties will need to be purchased if the system is undersized.
- Has high social impact because wastewater infrastructure of large storage ponds and irrigation is in close proximity to communities and residences. This exposes many people to risks such as odour, midges, loss of amenity, dam failure, disruption during construction and loss of property value.
- Uses a significant archaeological site in a historically sensitive area as its principal area for storage and disposal.
- Creates the greatest cumulative impacts on the Inner Harbour communities, and adds more sites to the already large inner harbour footprint of the new Akaroa Wastewater Treatment plant and terminal pump station. The new proposed Duvauchelle scheme will further add to this.

Goughs Bay option [Chapter 5]

Goughs Bay would be a discretionary consent and would require pumping the wastewater over the crater rim to an outer headland area.

The Goughs Bay scheme is somewhat more practical than the Inner Bays, but carries different risks:

- The longer pipe and pumping water over the hill carries some risk of pump failure. However, it does open the potential to include high-level fire ponds, which would be of general benefit.
- Unlike the Inner Bays proposal, the scheme would be barely visible, much further from any houses and has room for expansion should it turn out to be undersized. Based on the land purchase costs, we presume the Council plans to purchase and retain the bulk of the farm for future expansion.
- However, the system has raised environmental concerns from locals passionate about the biodiversity of the area, and the landowner who was at one stage a willing participant has become alienated by the process and withdrawn his support. The neighbouring farm owner also has concerns about impacts on his antibiotic-free status being compromised by any leachate from the irrigation area close to his boundary.
- The ability to successfully establish irrigated native trees is unknown, given the altitude and exposed nature of the site.

Pompeys Pillar option [Chapter 6]

Pompeys Pillar would also be a discretionary consent and would require pumping the wastewater over the crater rim to an outer headland area. While it is similar to the Goughs Bay option in these respects, it is less practical and acceptable because:

- The ability to successfully establish irrigated native trees is unknown, but likely to be even more difficult given the exposed nature of this coastal headland.
- The proposal to exclude the Outstanding Natural Landscape zone creates an unnatural visual effect on the headland.
- **The land has been farmed by the same family for over 7 generations and is currently in transition to the next generation. Removing the land identified for wastewater from production leaves the farm unviable. This would impose a severe social injustice upon the family and their longstanding intergenerational relationship with their land.**

Consideration of issues specific to the Harbour Outfall option [Chapter 7]

Harbour Outfall as proposed would be a non-complying option because it involves a direct discharge to Akaroa Harbour without first making land contact, and would only be consentable in this form if there are no other acceptable alternatives. However, it is otherwise a practical option:

- It presents the lowest risk because it uses proven technology and is the simplest to operate. It provides the greatest degree of certainty and resilience as it is not inherently limited in the volume of water it can process, and is entirely gravity fed. It will require the least energy and has the lowest operating cost.
- The disposal of the treated wastewater to the centre of the harbour would mean its rapid dispersal. The outfall would be much further away from the shore than the current one, negating impacts of nitrogen or nutrient build up.
- In terms of social and environmental wellbeing the Harbour Outfall scores well. There is no need to acquire private land, no treated wastewater storage ponds required, no risks from irrigation failure and no visual effects. The enhanced level of treatment minimises any environmental and health impacts.
- In terms of sustainability, while the outfall itself is a disposal option, the option directs the water through Akaroa where it is most needed, rather than constructing infrastructure elsewhere. The pipe would be run through the town, providing the core infrastructure for a purple pipe re-use system in Akaroa, and meaning this option can be easily expanded in future to include non-potable re-use. This is markedly different from the scheme for which consent was declined in 2015 and is now based on the Friends of Banks Peninsula submission to the 2017 consultation.
- The addition of a purple pipe system would provide reassurance that water will always be treated to the consented standard as an outflow buffer pond is included at the treatment site and the water will receive additional UV treatment prior to release from the site. The first stage of purple pipe re-use can come on stream at the low extra cost of $270,000 (as opposed to $3.7 million for the land based options).

From an environment, economic and social perspective the Harbour Outfall has the least impacts of the options proposed.

The issue is that even with the purple pipe system there is likely to always be some level of residual disposal, and the continued use of a harbour outfall as proposed does not incorporate mitigation measures to meet Ngāi Tahu's cultural needs.

If the Council decides to adopt a harbour outfall, we urge it to work with Ngāi Tahu to explore whether a constructed sub-surface wetland or some other form of land-contact could mitigate cultural concerns for the entire wastewater flow. **The long process of looking at alternatives has now suggested that there are ways to incorporate a treatment process that restores mauri prior to discharge to a water body**. A wetland with 2-3 days of contact is already incorporated into the Inner Bays option and supported by the Ngai Tahu parties, and is essential to the feasibility of the Inner Bays option. A wetland discharging every winter is now also proposed for the Duvauchelle scheme.[3] If wetlands are considered able to restore mauri of the water in this way, then serious consideration should be given to making use of them to treat all flows, particularly where this facilitates reuse.

Consideration of Costs

Cost is an important factor when considering the practicality of the options.

In our view the **consultation document has been disingenuous in its presentation of the option costs**. The options proposed are for the disposal of the treated wastewater, but the costs presented include the construction of the new Wastewater Treatment Plant, terminal pump station and pipe network that have

[3] Beca Report July 2020 Appendix D, p2

already been consented. These are a constant across the options and account for approximately $30 million of the total cost of each. Operating costs of the treatment plant and the disposal options have also been bundled together. Taking out these common costs, the relative differences between the proposed disposal options are:

Table 1 Costs of the disposal component of each option

Option	Capital cost	Operating cost p.a.
Harbour outfall	$18 million	$0
Inner Bays	$27 million	$40,000
Goughs Bay	$35 million	$177,000
Pompeys Pillar	$40 million	$177,000

- **We are concerned about the validity of these costs after a re-costing exercise was carried out by the Council in March 2020.** The result was the cost of the consented Treatment Plant and ancillary works increased by $6 million, the **cost of the Inner Bays disposal reduced by $10 million** and the **cost of the Harbour Outfall increased by $8 million**. These are substantial differences compared to the most recent figures produced by Beca and result from large changes to overheads and contingencies, markedly increased costs of pipelines, reduction in planting costs and various other additions and omissions. **We strongly urge these costs are independently reviewed by a Quantity Surveyor**, before the Council makes any decision. [8.3]
- Notwithstanding these concerns, based on these costings, all the options come at an extremely high cost per connection. Akaroa has around 830 connections and the total cost is $57,000 - $68,000 per connection.
- A new wastewater system must be safe, efficient and serve the community well into the future. In considering practicality and weighing costs the Council must consider the ongoing operational costs and the risk of future costs if the system does not perform as designed, or if greater capacity is needed. **Council should also take into account the additional funds that will still be needed to improve Akaroa's water supply and to fix the sewer pipe network.**
- On the basis of the costs presented it is clear that the land-based options presented are all significantly more expensive than the Harbour Outfall option. This represents a significant sunk cost toward directing water away from Akaroa rather than facilitating re-use.

<u>Summary of our views on the options presented</u>

Should the Council take the view that it must select one of these options, we make the following observations:

- **Harbour Outfall** should be modified with some form of land contact to restore mauri to water, such as a constructed sub-surface wetland. Given the large cost difference between this and the land-based options, it would still be the lowest-cost option with the least environmental and social impacts. The costs (particularly contingency and design overheads) should be reviewed as there may be considerable further savings.
- **Goughs Bay** should be reworked in collaboration with the landowner, neighbouring community and Wildside stakeholders to find an acceptable solution that maximises benefit and minimises disruption during construction. An acceptable solution could be either pasture-based, in a manner that is beneficial to the previously-willing landowner (such as CCC accepting they must carry some of the risk associated with regulation compliance and marketing of products from stock grazed on wastewater), or a genuine reforestation project that maximises environmental benefits while minimising impacts on the operation of the farm. While this is a higher cost option it does at least contain space for expansion on the farm, and the opportunity to construct high-altitude fire ponds would bring general community benefits as Banks Peninsula faces a drier future with an elevated fire risk.

- **Pompeys Pillar** would only be acceptable if it could be designed in a way that was acceptable to the farm owners and their neighbours, and therefore avoided the need for compulsory purchase. Otherwise, it is a totally unacceptable option because of the social injustice to the owners.
- **Inner Bays is totally unacceptable** because it has a huge footprint across valuable inner harbour land, involves placing wastewater infrastructure close to many homes with significant ongoing impacts, has no room for expansion without even further incursion on these communities. It puts the shallow coastal bays of the inner harbour at risk of environmental degradation. We cannot see how these impacts can be mitigated.

We cannot see how it could be sustainable and integrated management to spend many millions of dollars building a wastewater system that is extremely expensive per connection, but leaves Akaroa with its sewer network of broken pipes, increasingly vulnerable to climate change effects, raw sewage overflows, and with worsening water shortages.

We strongly urge the Council to stop and rethink its path forward. It needs to set aside the current options and instead adopt a new integrated solution, focussed on reducing the wastewater volume, re-using treated wastewater where it is needed and wanted and recycling pure water back to the Akaroa catchment. We believe a solution can be found that is acceptable to the whole community, addresses Akaroa's issues and creates resilience for future generations.

Our proposed Integrated Akaroa Wastewater solution: Reduce, Reuse and Recycle

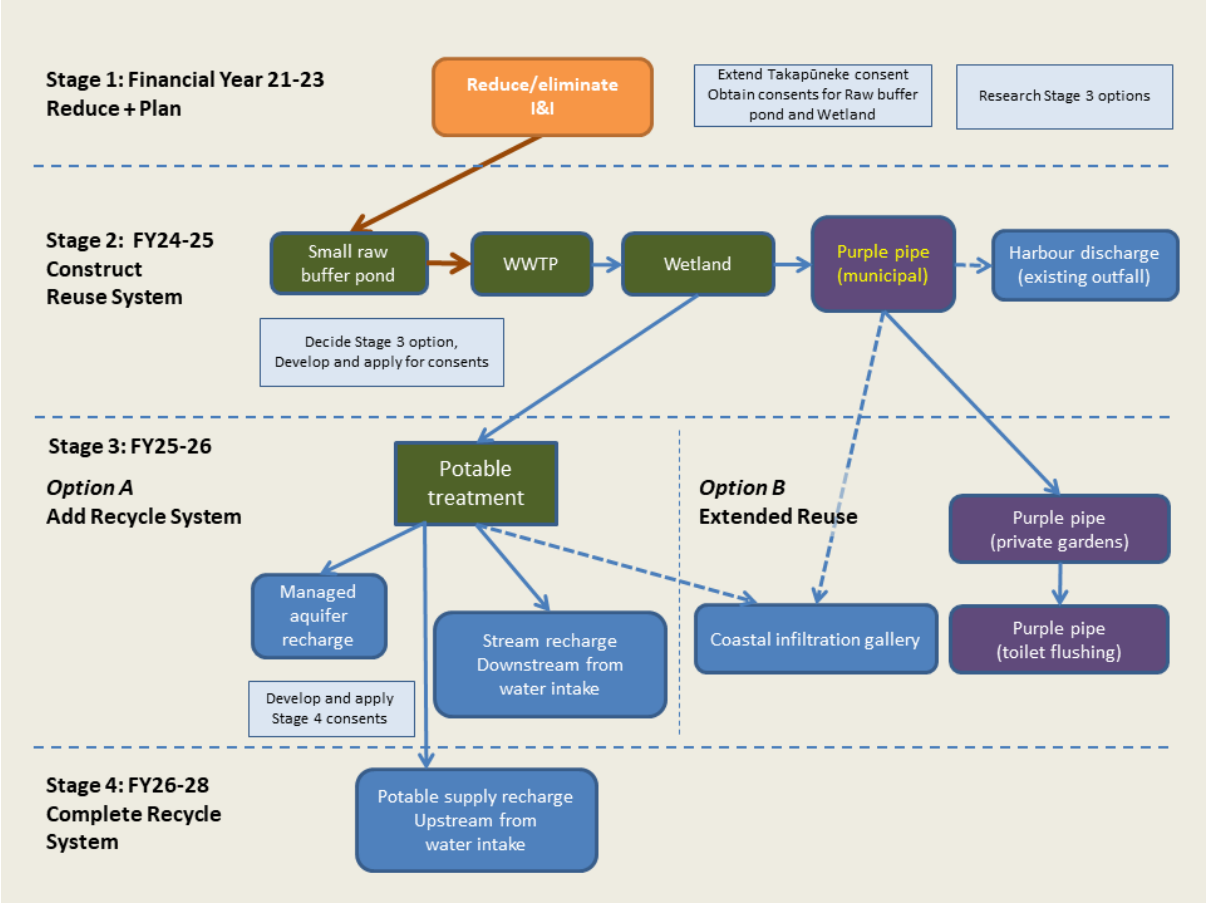
In September 2019 the Council adopted its 'Integrated Water Strategy'. This recognises that water is a taonga, fundamental to the life of our communities. It is an overarching strategy that sets a vision and framework to manage water resources in an integrated way over the next 100 years. It sets goals and objectives for infrastructure efficiency and resilience through integrated three waters (water supply, wastewater and surface water) management and a proactive risk-based approach. This includes ensuring the sustainability of water supplies and wastewater systems, understanding and adapting to climate change and sea-level rise and reducing wastewater overflows and infiltration.

We suggest that the Council develop and prepare a staged solution over the next 8 years – the same timeframe as proposed for the implementation of the land-based options[4]. The harbour discharge would cease at about the same time as it would for the land-based options proposed.

We see it being implemented as follows:

[4]CCC Presentation March 2019

Figure 1 Integrated Akaroa Wastewater concept based on a Reduce, Reuse and Recycle philosophy



We envisage the integrated solution being introduced in 4 stages, completing in 2028. This matches the timeframe for the Council's proposed land-based options which require the Takapūneke outfall to continue until 2028 to allow the native tree areas to establish sufficiently prior to full irrigation.

Stage 1. Council invests in maximum reduction of stormwater inflow and groundwater infiltration (I&I). Consents are obtained for the additional new components of the wastewater system and to retain the Takapūneke plant and existing harbour outfall until Stage 3. Research is done on Stage 3 options.

Stage 2. The new WWTP (wastewater treatment plant) is constructed at Old Coach Road along with a much smaller raw buffer pond, larger wetland and purple pipe system along Akaroa's main street. The old Takapūneke plant closes at this stage. The disposal still connects through to the existing harbor discharge pipe as an interim solution to disposing of unused water. The wetland assists to restore the mauri of the water. No additional sunk cost is invested in a new harbour outfall. A decision is made on which Stage 3 option to pursue and appropriate consents are obtained.

Stage 3. **Harbour outfall ceases** either through the development of recycling or extended re-use.

Option A –Under our preferred option, the treatment process is upgraded to produce potable water. This opens opportunities for safe managed aquifer recharge (MAR) stream recharge (below the water take) or disposal of potable water to the harbour via coastal infiltration.

Option B – If potable recycling is not selected, then the purple pipe network is extended throughout more of Akaroa, and harbour discharge is replaced by coastal infiltration.

Stage 4. If Option A has been selected, then once NZ government standards permit, the potable water is recycled back to the drinking supply via stream discharge above the intake.

We give more detail on our proposed solution in Chapter 12 of our full submission.

Conclusion

Council could elect to borrow to invest in one of the consultation options, leaving the issues of leaking pipes, climate resilience and water shortages unresolved and a high level of debt for future repayment.

Alternatively the Council can move on from yesterday's thinking and follow Te Wai Ora o Tāne, its own Integrated Water Strategy, by designing and investing in a Three Waters solution built for the future and in conjunction with new government initiatives.

We seek genuine beneficial re-use and water recycling through treatment to a potable standard so that the water becomes an asset for the benefit of the whole community and the environment.

We wish to be heard in support of our submission.

Long-form submission

The remainder of this document presents the full submission of Friends of Banks Peninsula and provides supporting evidence for the Executive Summary and Short-form submission.

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Chapter 1 Introduction

The Friends of Banks Peninsula Inc. (FOBP) has been Akaroa's Community Environment Society since 1990. It works to protect and enhance the environmental heritage of Banks Peninsula. Our involvement with the Akaroa wastewater issue goes back more than 20 years and we have been closely monitoring and following developments since the previous consultation in 2017 and regularly meeting with our community. Our submission is based on a thorough understanding of the options and how the Council has progressed these over the years, what the community wants its wastewater system to deliver and the legislative framework.

We are part of a community with a strong conservation ethic and desire to respect culture and heritage.

This submission first sets out:

- the background of the work to date on the Akaroa wastewater;
- the elements, constraints and impacts of the new wastewater treatment plant that will be common to all the options; and,
- the elements in common across all the land options.

It then presents:

- detailed consideration of each of the options proposed,
- comparison of the costs; and,
- comparison of the carbon and climate impacts.

This is followed by a summary of our view of each of the options taking into account the four well-beings of the Local Government Act, and the circumstances under which the harbour outfall would be appropriate and consentable.

We then consider whether the options meet the criteria of sustainable management, and as we find this wanting, we outline our preferred solution –a future focussed vision aimed at solving the problems with all three of Akaroa's waters and creating a holistic and more resilient future that is not envisioned by any of the options currently proposed.

1.1 Background

The first Akaroa Waste Water Working Party was convened in 2007 and was tasked with the issues of finding a new location that would remove the treatment plant from the culturally sensitive site at Takapuneke where it has been since the 1960s, ending discharge to the harbour and avoiding wastewater infrastructure south of Akaroa near the Ōnuku marae settlement. It concluded that, while there was potential to locate the wastewater treatment plant at northern end of Akaroa, it would be more pragmatic and much cheaper to move it slightly further south. It also concluded that it was not possible to avoid a harbour discharge altogether, because irrigation to land was not feasible in winter.

This work fed into the first Council consultation exercise in 2010. In 2014 the council developed a resource consent application to relocate the treatment plant to the north end of Akaroa, despite the additional expense, but to dispose of the treated water to the harbour as land options were not considered feasible. Consent was granted for the treatment plant to be situated at the top of Old Coach Road and for a primary filtration and pumping station (needed to push the wastewater up the hill) in the town itself, on reclaimed land behind the Akaroa recreation ground. However, the harbour outfall was declined on the grounds that it would have a significant adverse effect on the

environment from the perspective of tangata whenua and that the Council had not adequately considered alternatives.

In 2016 the Council consulted again with disposal options based on the Takamatua headland opposite the new treatment site and some additional sites in Takamatua valley. This consultation exercise was terminated after submitters' concerns that the Takamatua headland was not geotechnically suitable for irrigation to trees were substantiated. The other options involving some form of land treatment in combination with coastal discharges were also discounted as they were generally unpopular with the public and thought not to meet the cultural concerns.

Later in 2016 Council announced new proposals to irrigate wastewater in flat settled areas of Takamatua and Robinsons Bay valleys, and including large storage ponds to hold the winter surplus. At this point residents turned to Friends of Banks Peninsula for assistance feeling that any solution needed to be driven by an environmentally based organisation. Friends of Banks Peninsula worked with these residents to produce the *"Community Strategy toward an Acceptable solution to the disposal of Akaroa Wastewater"* and presented it to the Community Board. The Board responded by setting up an Akaroa Wastewater Working Party once again. Friends of Banks Peninsula was not given representation on this Working Party, but has been kept informed by the Robinsons Bay community representatives as matters have progressed.

1.2 Reuse widely supported in 2017 consultation

The next round of consultation in 2017 featured options substantially similar to those presented now. These were not well received by community with a strong voice from Friends of Banks Peninsula (supported by 300 people) and many individual submissions asking for the water to be re-used in Akaroa with the remainder to go out into the harbour initially, but eventually all re-used in Akaroa. Re-use was by far the most popular choice of all the submitters, followed by harbour discharge.[5]

1.3 Incorrect flow readings: Akaroa has an I&I problem

This consultation also terminated – after it was found that the options had been designed based on faulty wastewater volume data and were substantially undersized.

1.3.1 Faulty flow metre detected in 2010

Council had been advised of the faulty flow meter in in 2010 by their consultants Harrison Grierson who noted 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 wastewater generation rates".*[6]

The Council has never given an indication that a flow meter fault had been detected in 2010 or whether this fault had been fixed. Instead the design flows used for the 2015 consent application, and the consultation exercises in 2016 and 2017 were based on flow data going back to 1972. It seems likely therefore that, despite being advised on the fault in 2010, it was never dealt with and the Council staff overlooked it.

It is disturbing that this fault was not rectified at the time or picked up by any of the staff or consultants working on the project given the patterns shown by the data were so obviously in error. Indeed, FOBP flagged in their "Community Strategy toward an Acceptable solution to the disposal of Akaroa Wastewater" delivered to the Council in January 2017 that "*infiltration could be as much as*

[5] Beca Report July 2020, p135

[6] Harrison Grierson 2010: Technical memorandum, starts page 57 (67 of 132), bottom of page 2

80% of the water flowing through the system. There is currently much less difference between winter and summer flows than the population alterations in Akaroa alone would cause."

Had this flow meter been fixed in 2010 there would have been many more years of reliable data available now. An enormous amount of work by Beca consultants, and the costs, both monetary and social, associated with a resource consent and two failed consultations based on faulty data could have been avoided.

1.3.2 Infiltration and inflow problem revealed by correct measurement

Wastewater flows measured since the meter was replaced now show that the volume is more than double the amount that the 2016 and 2017 consultation options were based on. The Akaroa wastewater network has a big problem with inflow and infiltration (I&I). Beca estimate that an average of 61% of all wastewater flows are either groundwater infiltration or rainfall-derived stormwater infiltration, rising to 68% in the wettest years.[7]

1.3.3 Akaroa infiltration levels are extreme

To put Akaroa's I&I problem into perspective, groundwater infiltration is considered to be excessive when it exceeds 20% of average *dry weather flows*[8]; in Akaroa the proportion in an average year is 52%. Rainwater incursion is considered excessive if peak wet weather flows are more than eight times the average dry weather flows; in Akaroa the peak rainfall inflows can be as high as 30 times the population-based flows[9].

1.3.4 Design and cost implications of I&I levels

This level of infiltration has enormous implications for the design of the wastewater disposal systems and the overall cost.

- The extraordinarily expensive land disposal systems proposed include storage and irrigation fields that are more than double the size of what would be required to deal with the actual sewage volumes.
- The treatment plant and new wastewater network mains must be larger to deal with the extra volume.
- The treatment plant volume-based running costs (electricity, disposal of sludge/screenings) are doubled.
- The system is highly susceptible to extreme weather events when large volumes of water enter the system through the leaking pipes and can overwhelm the network leading to raw sewage overflows. Also, it is during prolonged wet weather that wastewater can't be irrigated, so all of the extra water needs to be stored, leading to much larger storage dam requirements.
- A raw sewage buffer pond is needed at the plant, because it cannot process the inflow fast enough in these conditions for it to be buffered at the plant.
- Where infiltration occurs, sewage can also leak out and this may account for times when the Akaroa main beach is polluted.
- These problems are set to increase with climate change, with rainfall patterns shifting to storms of increased intensity and sea level rise affecting ground water levels.

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[7] Beca Report July 2020, p8

[8] Water New Zealand I&I 2015, p13

[9] Calculated from BECA Report July 2020 Appendix B Model Results, p5: maximum flow / average population flow

- Unless the network is comprehensively repaired then there is a serious risk that any I&I reductions achieved now could be negated in the future

1.4 Developments since 2017

It has become increasingly apparent over the three years since the previous consultation, that the issues facing Akaroa in dealing with its three waters are as much about long term sustainability as cultural issues. However, the options developed have not moved forward in this respect. We attribute this to the pressures of the process to deal with cultural concerns about harbour disposal. The Council and community have been placed in a difficult position by the 2015 decision to approve a Treatment Plant but with nowhere to put the treated water it produces.

Staff effort has focussed on the Inner Bays irrigation option at the expense of wider investigation.

1.5 Long term sustainability issues

1.5.1 Climate change

The public and government agencies have developed a much greater awareness of climate change and an understanding that it will increase the frequency and intensity of both storms and droughts. The impacts are now beginning to be felt around the country as events such as the collapse of the Fox River landfill and chronic water shortages in Auckland and Northland graphically demonstrate. These impacts are predicted to intensify[10], and the Resource Management Act has now been amended to include climate change implications as a key consideration. The latest NZ climate change assessment lists the potable water supply as one of the top ten climate change risks[11]

1.5.2 Water shortages

Akaroa has been identified as a settlement that is likely to be water stressed in the future (Christchurch City Council 30 Year Infrastructure Strategy 2018–2048, page 52, 100) and the abrupt introduction of a total outdoor watering ban in the most recent 2019-20 summer underlines the severity of that threat.

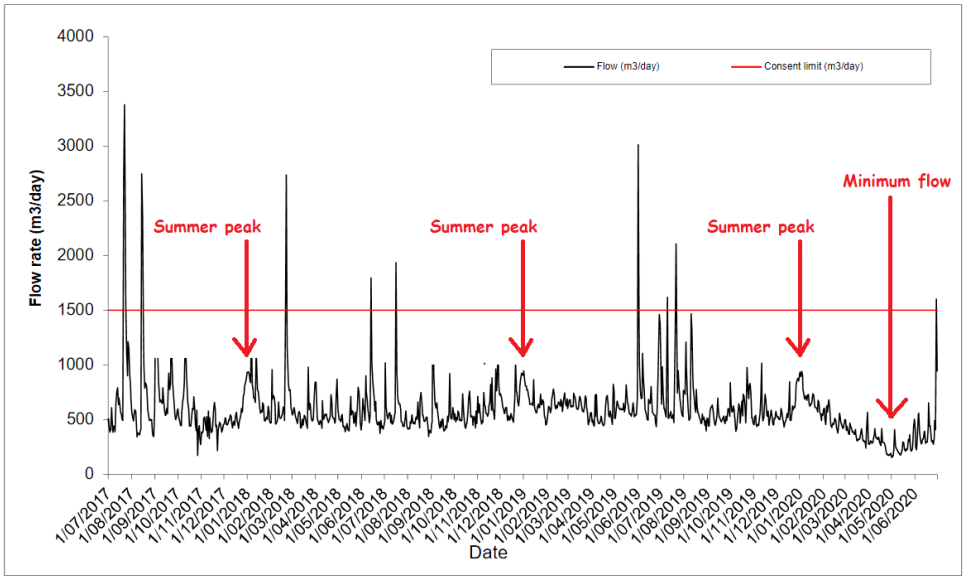
1.5.3 Leaking pipes

The Council has done some initial work to identify why the inflow and infiltration is happening. This has identified that it is a mix of storm water from private properties, leaking manholes and leaking pipes. However, the Council's plan to address these issues is unambitious, with a goal of achieving only a 20% reduction.

The potential benefits for the size of the wastewater treatment system from reducing the I&I were borne out earlier this year. Owing to the particularly dry summer and autumn, flow dropped significantly from January until the beginning of May. The minimum flow fell from around 500m3/day typically to under 160m^3/day, demonstrating the large proportion of flow that is normally groundwater (up to 340m^3/day), and closely matching Beca's modelling of 328m^3/day. Once significant rainfall occurred, flows began to climb back towards previous levels, strongly suggesting the drop was attributable to the weather.

[10] Environment Aotearoa 2019, p99
[11] Climate change risk 2020, p5

Figure 2 Flow pattern with groundwater drop



The spikes are infiltration during rainfall events. The summer sewage peaks are below 1000m^3 per day and broader. The difference between the base level prior to December 2019 and the minimum point at the end of April 2020 shows the level of ground water infiltration. The decline from December 2019 to April 2020 represents the 2020 summer drought and demonstrates how ground water levels dropped. The level picks up again when it started to rain in May.

As the minimum flow point on the graph above shows, eliminating inflow and infiltration and dealing only with the real sewage would more than halve the wastewater flows and therefore the size of the system needed to deal with them. It would remove the fundamental problem that the wastewater volumes are greatest at the time when water is least needed and most difficult to get rid of.

Even more importantly, it reduces the times when the pipe network is simply overwhelmed by storms and general leakages – both of which release raw sewage into the environment and streams, near where people live, recreate and gather food. This causes the greatest health and environmental risk and should be the highest priority to address.

1.5.4 Integrated Water Strategy

In September 2019 the Council adopted the "Te Wai Ora o Tāne /Integrated Water Strategy" (IWS). This recognises that water is a taonga, with significant cultural values and fundamental to the life of our communities. It is an overarching strategy that sets a vision and framework to guide decision making and manage water resources in an integrated way over the next 100 years. It sets goals and objectives for infrastructure efficiency and resilience through integrated three waters (water supply, wastewater and surface water) management and for a proactive risk-based approach. This includes ensuring the sustainability of water supplies and wastewater systems, understanding and adapting to climate change and sea-level rise and reducing wastewater overflows and infiltration.

The IWS (page 4) sets 4 goals:

- *Goal 1: The multiple uses of water are valued by all for the benefit of all. This includes increasing awareness and enhancing natural and cultural values;*
- *Goal 2: Water quality and ecosystems are protected and enhanced. This includes Improving water quality and enhancing the natural, cultural and ecological values of waterbodies and Reducing the effects of wastewater overflows – by network upgrades, targeting efforts to address overflows and reducing inflow and infiltration.*

- *Goal 3: The effects of flooding, climate change and sea level rise are understood, and the community is assisted to adapt to them. Understanding risks due to sea level rise and consequences resulting from climate change, and developing an adaptive response.*
- *Goal 4: Water is managed in a sustainable and integrated way in line with the principle of kaitiakitanga:*
    - *Managing assets across all of the Council's activities (such as roading, water supply, wastewater and stormwater operations, parks, etc.) in an integrated manner to maximise attributes such as place making, collaborative benefits, eco-system service harmonies which may not be realised when assets are developed in isolation for a single discipline.*
    - *Managing wastewater systems to meet community needs – including through reviewing and revising trade waste and biosolids management and developing long term solutions for Christchurch's future growth and for the disposal of treated wastewater from the Akaroa Harbour communities.*
    - *Managing water sources to meet reasonable demands by improving understanding of water sources and water use, implementing demand management projects and securing access to water supplies.*
    - *Infrastructure efficiency and resilience – by utilising a risk based approach, proactive monitoring, and the implementation of intelligent technology.*

These goals are followed by 11 Objectives, the most relevant in this case being:

- *Objective 2: Efficient and resilient infrastructure. Ensure efficient use of three waters infrastructure through a completely integrated management structure and ensure the resilience of entire networks (including natural waterbodies) to future environmental, social and/ or cultural changes and natural hazard risks over the long term through timely asset renewal and/or better alternative solutions.*
- *Objective 8: Sustainable wastewater systems. Manage the effects of the wastewater systems to meet community needs for environmental, social, cultural and economic sustainability over the long term*.

Guiding principles include:

- Kaitiakitanga – actively seeking to protect our water resources and improve their state for future generations
- Longevity – the strategy should not be time bound, but will be intergenerational, while also being aspirational yet pragmatic, affordable, 'real' and achievable.
- Efficiency – there is a need to rationalise the three existing water-related Council strategies, to respond in the short-term to the effects of the earthquakes and to maximise the cross-benefits when considering replacement or new assets.

The IWS identifies 11 key issues, including:

- 5.4 Wastewater overflows and effects on surface water
- 5.9 Long term availability of water for water supply
- 5.10 Long term sustainable wastewater treatment and disposal
- 5.11 Infrastructure efficiency and resilience

Of particular relevance is:

5.5 Treated wastewater discharges into Akaroa Harbour

Two wastewater treatment plants at Akaroa and Duvauchelle discharge treated wastewater into Akaroa Harbour. There is a dual issue for these discharges – the concern of the community and Ōnuku Rūnanga about ongoing discharges to the harbour (notwithstanding the wastewater is treated to reasonably high levels), and the issue for the Council of the feasibility, practicality and cost of land disposal or land contact of the treated wastewater.

Why is it a key issue?

Discharging treated wastewater to the harbour is offensive to members of the community. The discharge is particularly offensive to Ōnuku Rūnanga, whose preference is for the treated wastewater to be taken out of the harbour and irrigated onto land. The Council will be making a Local Government Act (LGA) decision on which reclaimed water disposal option to pursue.

It must take into account social, cultural and economic interests; the option must be efficient, effective and appropriate; and it must be consentable as sustainable management under the Resource Management Act (RMA). Discharge to water is not sustainable management under the RMA unless land-based options have been adequately investigated and reasonably discounted.

The IWS goes on to give detailed goals and objectives. Recurring themes are valuing and respecting water, enhancing ecological, cultural and natural values, **managing water in a sustainable and integrated way, efficiency and resilience, proactive risk-based approach, resilience and adaptation to climate change, reducing wastewater overflows and I&I**.

Objective 8 (Sustainable wastewater systems) identifies providing a long term solution to the treated wastewater discharges into Akaroa Harbour as an immediate challenge. This objective proposes **reducing wastewater at source including I&I and investigating potential reuse of treated wastewater**. It also describes the Duvauchelle wastewater treatment plant and its consent requirements.

FOBP welcomes this Integrated Water Strategy. It offers the sustainable and integrated management approach that our Society has been promoting for three decades. We suggest that the Akaroa wastewater project provides an ideal test for the IWS and would inform the proposed Implementation Plans. The Akaroa community is engaged and asking for this.

The Consultation document (page 6) states that all three land based options align well with the Integrated Water Strategy. Other than removing wastewater discharge from Akaroa Harbour (and not completely for the Inner Bays scheme), in our view the land based options ***do not*** appear to align at all well with the IWS and are in fact contrary to it. They do not provide integrated and sustainable management or resilience and adaptation to climate change. They are untried and risky and very costly. They do not address water supply problems or I&I and wastewater overflows or seek to maximise cross benefits.

We argue that the proposed options ignore the Integrated Water Strategy and do not give effect to its goals of efficiency and sustainability, proactive risk-based approach, resilience and adaptation to climate change, reducing wastewater overflows and I&I and supporting the wellbeing of current and future generations.

1.6 Why the process so far has failed to address these issues

The options presented in the current consultation are based on storm, ground and sewage water continuing to mix. The result, particularly for the land-based systems, is that they are more expensive, with higher impacts and risk than if they had to deal with the real sewage volume only. Our concern is that of the Commissioners' decision in 2015 – if the Council has a large sunk cost invested in the disposal of the mixed water, they are unlikely to dedicate further funds to the Akaroa

system in the future to deal with its broken pipe network, leaving it vulnerable to the effects of climate change and prone to failure.

We identify a number of reasons why this situation has got to this point:

- The Akaroa network has been allowed to run down over the years, due to age-related deterioration and earthquake damage.
- **Failure to address the faulty flow meter in 2010 when it was first identified means the various options designed since have been based on incorrect data,** and the problems compounded by then trying to retrofit the existing designs to accommodate the true, much greater, volume.
- The legislative paradigm within which the options have been developed has not been conducive to solutions dealing with three waters in an integrated manner, although this is now starting to change.
- New Zealand's unique cultural environment compounds the difficulty – but may also provide the answer through its more holistic approach.
- The Council and community have been placed in a difficult position by the 2015 decision to approve a Treatment Plant but with nowhere to put the treated water it produces.
- Council has been under pressure since to produce a solution with no discharge to water body, but on extremely difficult terrain.
- Hence, once staff had identified a geotechnically suitable piece of land in Robinsons Bay of reasonable size and with a willing seller, they pursued the option relentlessly, as has been evident to Working Party members. Most of the Working Party's time was devoted to considering the different manifestations of this option, including the size of the storage dam needed, addition of the wetland adjacent to the Treatment Plant and its provision for emergency discharge to the Harbour in order to bring down storage requirements and finally the addition of three more land parcels for irrigation.
- The result is the complex Inner Bays option with its multiple sites and wetland. Far less effort has gone into developing the Outer Bays options, and opportunities with willing landowners and potentially receptive communities squandered. No effort has gone into holistic or staged approaches, or Working Party discussions with Ngāi Tahu examining what might make for culturally accepted practices.
- The skewed effort is evident in the resulting consultation document with far more pages dedicated to the Inner Bays option, the unbalanced assessment of the options and the clear statement of staff preference.

Chapter 2 New wastewater treatment plant

The consultation options all presume that the new treatment plant will be constructed at the Old Coach Road site as consented in 2015, at a time when a harbour outfall was proposed for the wastewater, the wastewater flow assumed was less than half the actual volume, and when untreated bypass flows during wet weather were proposed as acceptable by the Council engineers.

In order to assess the different disposal options, it is useful to have an overview of the new treatment plant components that are already consented, their impacts and how they constrain what is possible.

2.1 New WWTP system description

The Treatment Plant is being moved from its current site at Takapūneke at the south end of the town because it is on a culturally sensitive location.

The new plant and its associated components will have a significant and ongoing impact on Akaroa. These are placed over several sites at the entrance to and through the town, and pipes will need to be relaid.

Figure 3 Akaroa Wastewater Treatment Plant system

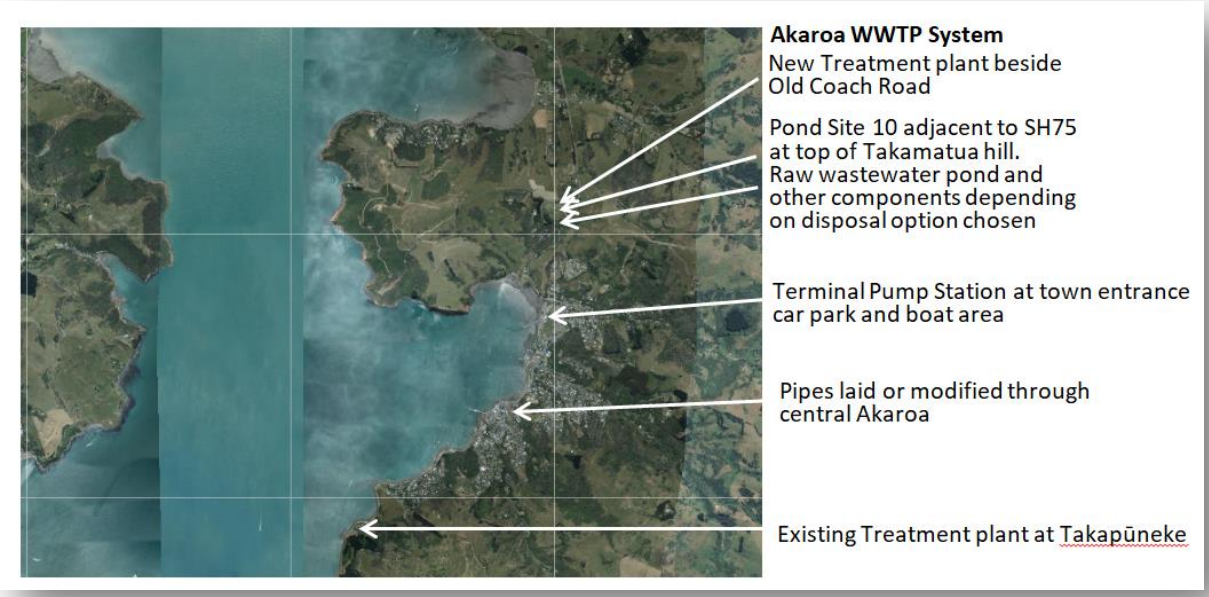


Figure 3 above shows the different components of the new wastewater treatment system consented in 2015. These consents were extended to 2028 as part of the settlement the Council reached with the Environment Court on the withdrawal of its appeal to the 2015 outfall decision.

2.1.1 Treatment Plant

The Treatment Plant itself will be located on a small site owned by the Council along the eastern side of Old Coach Road at 120m above sea level on the top of the headland between Akaroa and Takamatua.

The plant is physically constrained by its small site and this brings limitations to the treatment options possible and volumes it can handle. A compact ultra-filtration plant is proposed rather than

a traditional plant with oxidation ponds. The plant will have the capacity to process normal flows (up to 14L/s). Sludge will be removed weekly and tankered to Christchurch.

2.1.2 Terminal Pump Station

Much of the pipe network needs to be re-laid or modified along the main route to redirect the flow to the new Treatment Plant via the Terminal Pump Station.

The Terminal Pump Station will require construction of a new building near the town entrance in the car park area near the Recreation ground. The building will be alongside the road leading to the main tourist car parking area opposite the boat storage compound and adjacent to the designated freedom camping area.

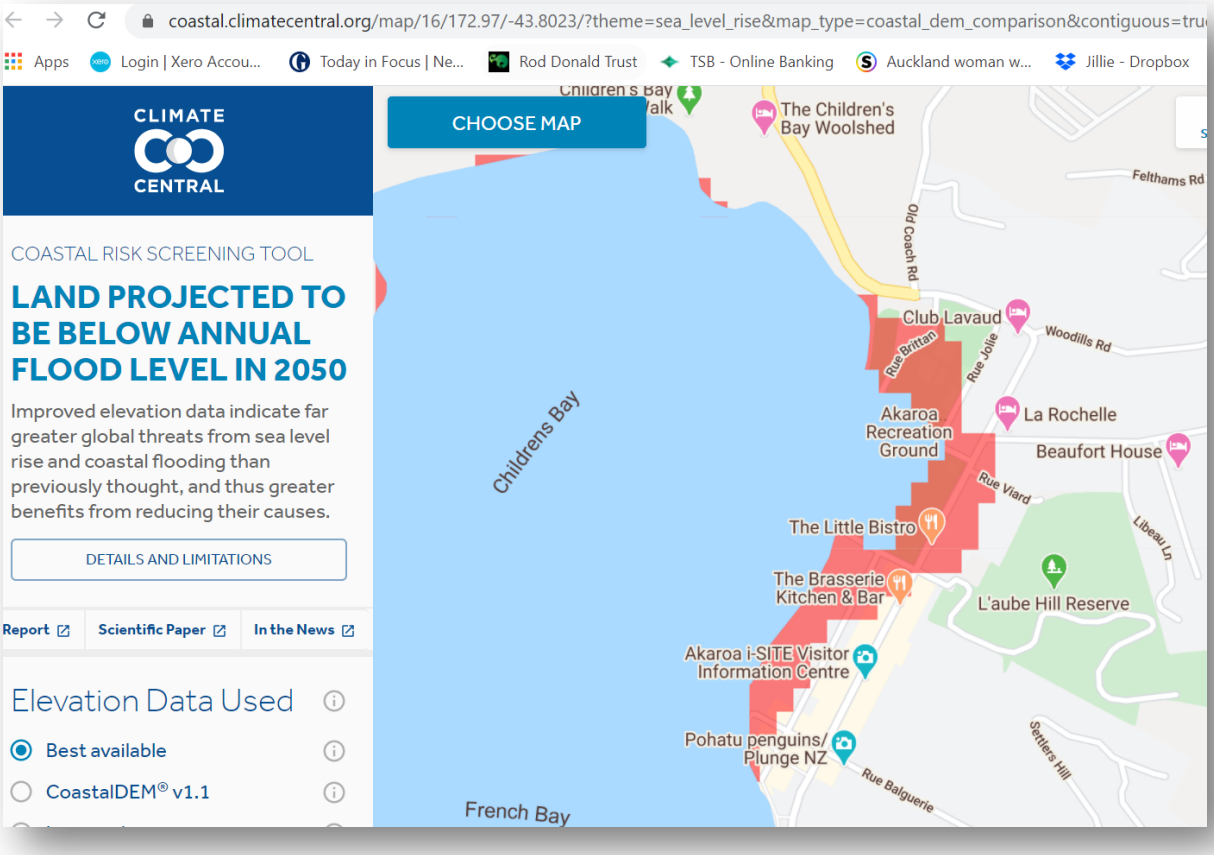
The building will house the pump feeding the rising main to the Treatment plant. Primary raw sewage treatment to screen material to less than 1mm and grit removal to protect the pumps will be carried out here. The building will be opened on a regular basis to empty these solids for trucking away. As part of its Environment Court Appeal withdrawal settlement, the Council was successful in its appeal to relax the odour constraint conditions for the 2015 consent.

The Terminal Pump Station is a large concrete building (7.5m high and 17.5m long). It will be highly visible from the highway entering Akaroa and to any users of the main car and boat park and foreshore area.

The Terminal Pump Station is located on reclaimed land on top of the former Akaroa refuse disposal site and is only slightly above sea level. The area is projected to be below the annual flood level in 2050.[12]

[12] **Climate Risk**: Link to coastal.climatecentral.org-

Figure 4 Land projected to be below annual flood level in 2050 in red



2.1.3 Pond Site 10

In 2019 the Council purchased "Pond Site 10" land opposite the Treatment Plant site. There is a large and relatively flat paddock at the top of the site, which then slopes steeply down sandwiched between the State Highway and private properties on the western side of Old Coach Road.

The flat area at the top provides space for a 6,000m^3 raw wastewater buffer pond, needed because of the increased flows discovered since a working flow meter was installed and also to avoid the need for bypass flows (which would receive lesser treatment) during heavy rain as had originally been proposed. This pond is needed for all options as its purpose is to buffer the plant when sewage is arriving faster than it can be processed. The raw wastewater pond will be covered and security fenced. The size of the raw wastewater pond is limited by the space available; Beca have calculated that with a raw wastewater pond of this size the network will overflow approximately once every 15 years, while increasing the size to 8,800m^3 (and also increasing the pump capacity slightly) would reduce network overflows to one in 47 years, i.e. virtually eliminating them[13].

The property also opens the opportunity for some further storage ponds and other equipment, but there are limitations due to the steep nature of most of the site.

A treated wastewater storage pond is included for the Glen Bay harbour outfall and for water that will be sent down a purple pipe if this is chosen to go with any of the land based options, but not if wastewater is to be irrigated as this will be pumped directly from the treatment plant to the irrigation storage ponds.

The Inner Bays option also includes a constructed wetland on this site.

[13] Beca report July 2020, p115

2.1.4 Treatment standard

The level of virus and bacteria removal will be relatively good compared to other plants around the country, however, the nitrogen removal is relatively poor. Nitrogen residue expected is 15-30mg/l, which does not compare favourably with other new plants such as the as 4.3mg/l proposed for the Rotorua upgrade[14], to deal with the nitrogen issues caused by its current land disposal site. We will come back to this later in Chapter 4 Inner Bays option where it presents the most serious issues.

2.2 Impacts of the new Treatment Plant components on Akaroa

There were relatively few submitters to the 2015 resource consent, with residents of Akaroa mostly unaware of the potential impacts of locating the sewage treatment plant and the terminal pump station so close to homes and public facilities. Friends of Banks Peninsula did not submit to the process as the plan for the harbour outfall discharge was in-line with the Working Party recommendations in 2010 and the potential impacts of the terminal pump station were not recognised at the time.

2.2.1 Impacts during construction

Constructing the new plant will be disruptive to Akaroa, with large earthworks at Pond Site 10, major works to build the terminal pump station and digging up the streets to upgrade the pipes. This may be disruptive at a time when the town needs to be at its best to keep its visitor industry alive. Domestic visitors have returned to Akaroa, but word is likely to spread quickly, particularly to the Christchurch market, if the town is a construction mess.

2.2.2 Ongoing impacts

The new Treatment Plant will be visible along Old Coach Road, and Pond Site 10 from the State Highway and many parts of Akaroa.

However, it is the ongoing impacts at the Terminal Pump Station that are of most concern. This will be opened at least fortnightly, and is close to the playcentre, skate park and many community amenities such as the main parking area, boat ramp and sports clubs.

The building is constructed on a coastal reclaimed land with a capped landfill under it. This makes it susceptible to sea level rise and storm damage.

Raw sewage overflows will occur here at times when the amount of water flowing through the network is more than the pump can handle.

2.3 Cost component of the new treatment plant

The cost of the treatment plant and associated consented components are bundled in with the disposal costs for the options given in the consultation document. They account for about $30million of the total costs for each option.

[14] Rotorua wastewater upgrade consent application 2018

Chapter 3 Common to all land based options

The three land based options in the consultation document all contain similar features. They are all based on irrigating water to areas that are currently pasture land and will be planted with native trees. They all involve storage ponds, and they are all a considerable distance away from the treatment plant.

In this section we discuss why these land based options all constitute disposal rather than beneficial re-use, the difficulties in finding suitable sites, how the sites and storage have been sized, and their sensitivity to modelling parameters. We also discuss how the levels of I&I in the Akaroa system compound risk.

3.1 Why they are disposal – not beneficial reuse

There is a clear distinction between *disposal* of wastewater and its *beneficial re-use*. This distinction, and its implications for the receiving environment, is an important consideration in this submission.

Under a *disposal* system, the water is distributed to the receiving environment whether that environment needs it or not. The purpose of the irrigation is not to benefit the receiving environment, but to dispose of the maximum amount of water on the minimum amount of land.

When the water is put to *beneficial re-use*, the level and times at which it is irrigated or used are determined by the needs of the receiving environment. For example a garden or farm paddock will be watered only when soil moisture is low and the plants will benefit from the water, not when soils are already moist and additional water would not add benefit, or indeed could be detrimental.

All of the tree irrigation proposals have been sized to dispose of the maximum amount of water on the minimum amount of land possible. Clearly they are disposal systems.

Native trees do not require water to flourish in most parts of Banks Peninsula –and indeed watering at the rate proposed for up to the 40 year expected life of the scheme may well cause harm to their long term health and root strength. Given appropriate land management such as cessation of grazing, native trees regenerate naturally and rapidly grow into strong and diverse forests. Planting is not the most ecologically or cost effective way to restore forest to Banks Peninsula.

3.1.1 Side-benefits do not equate to beneficial use

The consultation document makes much of the side benefits of planting native trees to use the irrigated wastewater. These side-benefits do not in themselves make for beneficial re-use and we express some doubt about the claims made for the use of these areas for public recreation.

While there will be some minor biodiversity and carbon gains from these areas, 30-40ha of native trees is insignificant on Banks Peninsula where there are already extensive areas of native vegetation (Hinewai alone is nearly 1500ha). Much greater biodiversity and carbon sequestration gains could be secured by choosing a cheaper option and dedicating the balance of funds to protecting areas of marginal land where natural regeneration is already advancing. Further detail is provided on this in Chapter 9.

Public access to the sites is mentioned as a benefit, but not included in the costings. This is unlikely to eventuate unless walkways are planned in advance and there are good setbacks for the trees, as the vegetation planted at the level proposed will be too dense to walk through, and walkways and any associated areas such as parking remove areas for irrigation which is tightly sized. A visit to the Duvauchelle tree trial plot aptly demonstrates this. In any case, given the wealth of scenic bush walks already publicly available in the area, these planted disposal areas may not prove very attractive for recreation.

3.1.2 Directing water away from where it is needed

Water is needed most in Akaroa, not out in the land disposal areas. Akaroa is chronically short of water each summer. These land disposal areas are currently farmed and have adequate water supplies to maintain pasture and stock.

Hence not only are the land based options in themselves disposal options, but they also direct the water away from where it could be most beneficially used, the catchment from which it emanates.

3.2 Difficulty of finding suitable sites

The topography and geology of Banks Peninsula present significant challenges to land disposal as most of the land is steep, with the volcanic bedrock coated in a layer of slip-prone loess soil. Stream gullies and ephemeral streams punctuate the slopes, testament to the huge volumes of water that cascade down to the valley floors below in heavy rain events.

A set of design parameters was adopted and used by Council to screen land for suitability, working outwards from the treatment plant. We examine these briefly and question whether they are reasonable and defendable.

3.2.1 Environmental parameters

Slope is a major constraint on the availability of, as irrigation must take place in areas no greater than 19° and with downslopes no greater than 15 ^{o} to avoid slips.

The storage ponds must be excavated on land with slopes no greater than 4 ^{o}.

Most of the land on Banks Peninsula is steeper than this. Land matching these criteria is scarce and is either settled, or the best farm land.

Setbacks from streams are 25m from the centre of flowing streams and 10m from ephemeral streams to avoid nitrogen leaching.

3.2.2 Social parameters

The social parameters adopted to select the sites and design the options have been set at levels that appear much less restrictive than those set in the Canterbury Air Regional Plan and for similar activities in the District Plan.

The setback used for irrigation from neighbouring properties is only 5m. This is very close given the shading effects of native trees that are likely to grow to heights well over 5m, and the potential for the water to be odorous[15]). There is no additional setback from residential dwellings. In contrast, the setback from boundaries for plantation forestry in the District Plan is 10m to a boundary or 30m to a residential unit. The permitted activity setback in the Canterbury Air Regional Plan for human effluent surface irrigation is at least 20m from the property boundary. The setback of storage ponds from residential dwellings use is only 100m (and the interpretation put on this by Council is from the water itself, not the earthworks). By contrast District Plan requires activities such as intensive farming to be located 200 metres from sensitive activities (which includes houses). The permitted activity setback in the Canterbury Air Regional Plan requires the storage of human effluent in uncovered vessels to be at least 50m from the property boundary and 150m from sensitive activities (which includes houses).

The standards set by the Canterbury Air Regional Plan and those for similar activities in the District Plan are considerably greater than the minimum setbacks used for the design of the options. **There has been no consultation with the public on these setback distances or any explanation of why they have been set at such permissive levels.** Perhaps this is because geotechnically suitable land has proved to be so scarce, but if so, this should form part of the informed consultation and consideration.

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[15] Beca Report July 2020, p70

3.3 Sensitivity to modelling assumptions

The proposed land-based systems all have two main design parameters:

- size of the irrigation area, and,
- volume of storage required.

These in turn are based on modelling, which relies on the following input parameters:

- Anticipated wastewater flows until 2052, including growth
- Long-term application rate (LTAR) that can be sustained, which is dependent on the soil being able to take up the applied nutrients, as well as remaining stable

3.3.1 Impacts on storage volume

These parameters impact most critically on the storage volume required, since it has to deal with excess flows when the total wastewater flow exceeds the ability for it to be irrigated. No storage is required when the water can be irrigated at the rate at which it arrives. Once that limit has been reached, the amount of storage required grows rapidly.

As an example, the following table illustrates the sensitivity of the storage volume to these parameters for the inner bays option (Beca report July 2020, Appendix B p9):

Table 2 Storage requirements relative to land area and I&I levels

Land area	Storage required – 20% I&I reduction achieved	Storage required – no I&I reduction achieved
30 ha	40,000	463,000
40 ha	**24,000**	36,000
60 ha	16,000	21,000
80 ha	15,000	19,000

The green cell highlights the design conditions for the Inner Bays solution where 40 ha of trees will be irrigated, and 20% I&I reduction is assumed.

The light red cells show the effect of either reducing the effective land area available or failing to realise the expected 20% I&I reduction: in both cases, the storage required rises sharply. If both of these issues occur, the dark red cell shows that the required storage grows massively, because there is now not enough land to dispose of all of the water, and therefore it keeps building up.

3.3.2 Assumptions underpinning design parameters

The projected total wastewater volume and long-term application rate are themselves dependent on the following *assumptions*:

- Population growth (permanent and visitor) between now and the end of the consented period (2052);
- Level of I&I
- Amount of rainfall intercepted by the tree canopy
- Ability of the proposed areas to accept extra water to the levels proposed, over their entire area and continuously over many years, without loss of stability or nutrient build-up.

3.3.3 Population growth and limits

Population growth has been modelled by Council based on Statistics New Zealand's medium projections.

The current number of Akaroa residents is estimated at 765 in winter and 2077 in summer, and the growth projections used equates to an additional 75 (10%) winter and 271 (13%) summer residents over the next 35 years. The COVID-19 pandemic creates uncertainty about future population - both permanent residents and visitors. As technology and social change enables more people to work from home it is possible that many more holiday homes (currently estimated at around 60%of Akaroa's houses) will become permanently occupied.

Takamatua residents have argued that their properties should be reticulated to the network if they are to suffer its effects and are relatively close to the new treatment plant. This would also remove the potential for leaching from septic tanks on small, steep, coastal properties. We understand that the potential to reticulate the Takamatua area was one of the factors that influenced the decision to locate the Treatment Plant at Old Coach Road, despite this being a more expensive site option.

There are approximately 170 Takamatua properties on sections of less than 1ha using septic tanks. There is insufficient headroom provided in the system to connect these properties. If most of them were connected there would be no scope for growth in Akaroa.

This serves to illustrate the inherent limit on Akaroa's growth potential that moving to a land based system creates. Under the current harbour disposal system an increase in wastewater flows does not create subsequent downstream disposal issues, because the outflow is not physically limited. **Once a fixed size land based system is in place, there could come a point when the capacity of the system is reached and no more growth should occur until such time as the disposal system capacity had been increased.**

3.3.4 I&I reduction

Reducing I&I has the obvious effect of reducing the total wastewater volume requiring treatment, storage and disposal, proportionally reducing the size, cost (capital and operating) and carbon emissions of the scheme.

It also has a much larger impact than this because rain-derived I&I causes the volume of wastewater to "spike" during rainfall events. In Akaroa the flow during wet weather can be more than ten times the dry-weather flow. This requires extra storage to accommodate this excess volume, both for buffering raw wastewater, and for the treated wastewater prior to land disposal. The table below (derived from BECA report July 2020 Appendix B) shows the impact of I&I reduction on the storage required for the Inner Bays option with the proposed 40ha of land.

Table 3 Storage required for Inner Bays option relative to I&I reduction

I&I reduction	Storage volume required M^3
0%	36,000
20%	24,000
40%	14,000
60%	9,000

If I&I reductions are not achieved, the storage size becomes too large to be workable. On the other hand, a more aggressive 60% reduction in I&I could bring the storage down to a much more manageable 9,000m^3 – small enough for example to store in two 46m diameter uncovered or five 21m diameter covered Kliptanks[16].

3.3.5 Land area

The land areas have been sized based on the minimal land area required given the local conditions, in part because this minimises costs, and also because, for the Inner Harbour option in particular, land meeting the design criteria is very scarce.

[16] https://www.kliptank.com/products/

The minimum land area required for the Inner Bays option has been calculated at 40 ha based on soil acceptance rates. However, this land area rests upon several assumptions:

1. Rainfall interception by the tree canopy will match modelling
2. Measured soil parameters are correct and apply to the entire sites
3. All of the land is available for purchase, and at a price the Council is willing to pay

If any of the above assumptions fail to hold, the effective land area available will be insufficient, and the Council will need to acquire more land, likely by compulsory purchase.

Further, if the effective land area turns out to be less than that calculated *or* I&I reductions aren't achieved, the proposed scheme becomes unworkable. There would be insufficient land to irrigate the year's total wastewater and so the amount required to be stored increases indefinitely.

3.3.5.1 **Rainfall intercept**

Irrigation to native trees is preferred by the Council (now that there are no farmers willing to partner in a pasture irrigation system) in part because the tree canopy intercepts a proportion of the rain enabling irrigation in wet weather.

All the options have assumed a canopy interception rate of 37%[17]. This is the New Zealand-wide average, but is for Kanuka/Manuka only (native bush overall has a lower average interception rate), and subject to wide uncertainty[18]. Davie urges caution when using the annual averages, because canopy intercept varies with species, tree size, time of year, rainfall type and measurement methodology and is subject to climate conditions[19]. The actual canopy intercept will not be known until the native trees have been planted, established to a stage where there is canopy closure and the effect can be measured.

All of the land-based options rely on this assumed level of canopy intercept in orderto be able to accommodate the required level of irrigation.

The consequence of rainfall interception being less than expected is twofold:

- More land area will be required because the total (rainwater and wastewater) water to be absorbed is higher, ***and,***
- Storage is much greater because there will be more days when it is too wet to irrigate

3.3.5.2 **Measured soil parameters**

Beca and PDP have carried out soil infiltration testing on all of the proposed irrigation sites. This is to get an indication of the likely moisture uptake over the entire site. These measurements are then used to estimate the maximum long term application rate (LTAR) to avoid soil degradation and failure. This in turn is used to calculate the land area required.

Calculation of the LTAR (and therefore the land area) is an estimate only. For this reason two other engineering reports have recommended they be used with caution:

- Geotech Consulting advised using total additional water as the initial limiting factor, and recommend initially irrigating no more than 250mm per annum, excluding the summer peak of January to mid-March when evaporation rates are higher. They further advised making the available irrigation area as large as possible in case sustained irrigation rates above

[17] Beca July 2020 Appendix B Model, p1
[18] Rowe 2002
[19] Davie 2007, slide 24

250mm (non-peak) per annum are not feasible [20] **The irrigation rate that the land based options presented are expected to cope with is over 400mm pa.**

- EcoEng advised operating a hybrid (irrigation plus outfall) model for several years to lower the risk of soil instability, until the actual maximum take up rate is known[21].

3.3.6 What happens if assumptions prove incorrect

If any of these assumptions – the I&I reduction achieved, the tree canopy intercept rate, the ability of the soil to absorb the water or the overall flows – are significantly out, then the system will be undersized. This means the storage capacity will be exceeded and more water will need to be released to the environment through overflows.

3.4 Why high I&I levels compound the problem and risk

The volume of storage required and the land area required for disposal by irrigation is critically sensitive to the assumption that I&I can be reduced by 20%. It is acknowledged, however, that it is difficult to estimate the reduction that will be achieved from piecemeal improvements because storm water may simply move elsewhere and find another place to leak in. Raw wastewater will also be leaking out of these pipes at present, also making it difficult to assess the true volumes and reductions that may be achieved.

Because maximum I&I occurs during prolonged or heavy wet periods when the least irrigation is possible, the effects of reducing I&I on storage and land requirements can be substantial. Eliminating I&I to the fullest extent possible would significantly bring down the costs and impacts of the land based options.

The Joint Statement of the Working Party states

Regardless of the decision made by Council, as an integral part of the wastewater project, the working party urges the Council to reduce stormwater inflow and groundwater infiltration in to the wastewater network before the project commences. While the Council has indicted that the amount of reduction that can be achieved is difficult to assess, these reductions would reduce the size and the cost of of the entire scheme (including the treatment plant), potentially paying for the work itself. The cost of doing this should be included in all options. [22]

The current proposals do not address the I&I problem satisfactorily, because the target is only a 20% reduction and is for the land based options only. This means money would be wasted building a system that is oversized to cope with all the infiltration. The system will also be left vulnerable to being overloaded if the I&I reductions fail or I&I increases in future due to climate change, further compounding the risks of the other modelling assumptions.

Council staff have argued that by not addressing the I&I now, the system will inherently have growth capacity because I&I can be reduced in the future. However, this piecemeal approach is risky. Firstly, there is a clear link between I&I and sewage overflows. Secondly, it is not possible to predict whether the 20% reduction will be achieved with a piecemeal approach because leaks are likely to emerge higher up the system as lower leaks are fixed, and the leaking system is still left vulnerable to the increased intensity storms and rising sea levels that climate change will bring.

To provide a sustainable solution to the current wastewater problem and future resilience to climate change and earthquakes **now is the time to undertake substantial remediation** (such as lining all pipes)[23] or to consider a replacement network. Then the correct wastewater system can be

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[20] Harrison Grierson 2010, p116
[21] Harrison Grierson 2010, p111
[22] Working Party JS 2020 p2
[23] Tektus 2020, p??

designed and future growth planned for up-front, based on known future capacity rather than unknown flow reduction. (Please refer also to Section 1.3)

3.5 Wastewater leaves treatment plant site without testing

Water will leave the treatment site without testing for compliance if one of the irrigation options is chosen because no outflow buffer is incorporated into the system.

The Beca Report states: "*Council has advised that the treated wastewater storage pond should only be included for use with a non-potable reuse scheme and for the option of a harbour outfall from Glen Bay. This is on the basis that, in the absence of a reuse system, wastewater can be pumped directly from the treatment plant to theirrigation storage pond at the instantaneous flow rate hence no storage is required*".[24].

The existing Treatment Plant frequently discharges wastewater that fails to meet its consent standards. The lack of an outflow buffer pond at the Treatment Plant site for the irrigation options leaves the receiving environments at risk of receiving contaminated water that does not meet consent conditions. Inclusion of a suitably designed outflow buffer pond would enable wastewater to be tested prior to release from the plant site, and recycled back to the Treatment Plant for re-processing if it failed to meet consent conditions. This is a particularly important consideration when wastewater is being stored and irrigated close to houses.

[24] Beca Report 2020, P116

Chapter 4 Consideration of Inner Bays option

The Inner Bays option is the most complex of the options presented.

Several sites are required and it is a tight squeeze to fit because the flatter land in the Inner Bays is settled. The system is placed close to houses, property boundaries and streams at the minimum allowed by the design setbacks for all the sites, and a wetland with an overflow feature has been added to cope with extreme weather events.

This option is critically reliant on the Council achieving 20% I&I reduction. Without this, the storage and land size will be insufficient and there is no ability to expand on the irrigation sites currently earmarked. (Please refer Sections 3.3.1, 3.3.4, 3.4)

4.1 Highest sensitivity to modelling assumptions

Due to the scarcity of land, the greatest risk with the Inner Bays option is whether the many components of this complex, uncertain and untried system perform as modelled. Assumptions around wetland function, tree canopy intercept rates, storm frequencies and nitrogen uptake will have to work in practice because the expansion capacity is very limited and the catchments drain to shallow inner harbour mudflats. Design parameters are pushed to their limits, so there is little "give" in the system. (Please refer section 3.3)

If the system turns out to be undersized, then the Childrens Bay overflow will need to be used more frequently than currently planned until further private properties can be purchased. This is likely to be costly, take time and cause considerable community anxiety and offence.

The location of this infrastructure within communities exacerbates the risk and the potential liability for the Council. A storage pond or irrigation that is far from people may smell or be infested with midges, but this will not cause adverse effects. Placing the infrastructure close to people and the sensitive activity of residential living means any problems will cause immediate impacts. If any of the inner bays become nitrogen saturated and smell this will become a very public problem.

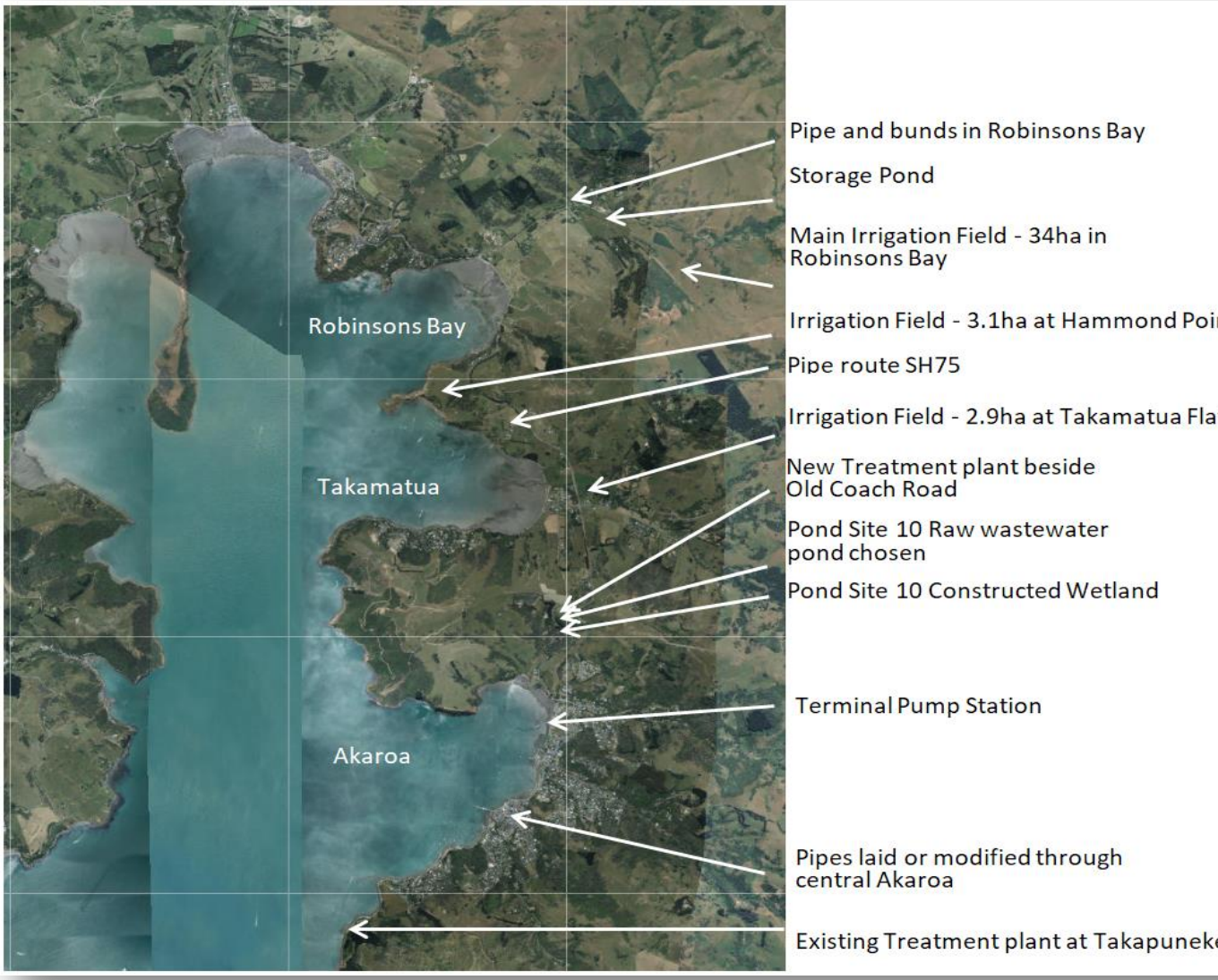
4.2 System design and components

Four different land parcels in Takamatua and Robinsons Bay make up the 40ha needed for the irrigation field area. The largest of these parcels is the Thacker land on Sawmill Road in Robinsons Bay, and this is where the storage pond holding 19,000m^3 would also be sited.

Figure 5 below shows where the Inner Bays option infrastructure would be placed in relation to the new Treatment plant.

This shows the large combined footprint of the new Treatment system with the Inner Bays option. It should be noted that the Duvauchelle scheme will add further wastewater infrastructure into the Inner Bays area on the Duvauchelle golf course and showgrounds should this also become a land based scheme.

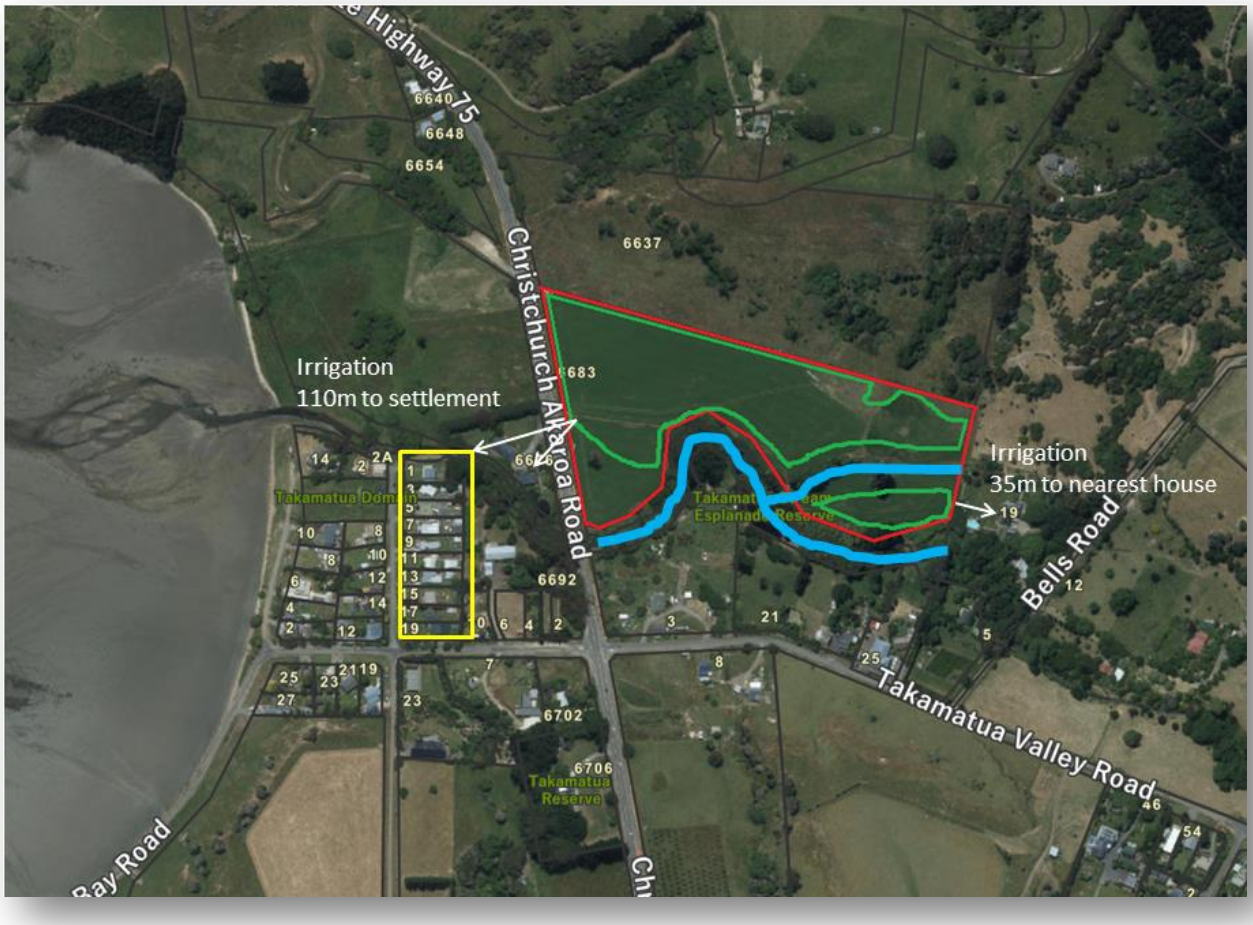
Figure 5 Large footprint of Inner Bays infrastructure in addition to Treatment Plant infrastructure.



We now examine each of these sites, working outwards from the new Treatment Plant site. Google satellite images are used to map each of the sites, as these **give a clearer picture of the placement of the sites within communities than the maps in the consultation document**.

4.2.1 Takamatua Valley irrigation site

Figure 6 Takamatua Valley site



The site at Takamatua Valley is 2.9ha on the valley floor immediately to the east of the State Highway. It is low-lying and near sea level, with a stream along one boundary and houses to the east and south and a residential settlement downstream on the west side of highway.

4.2.2 Hammond Point irrigation site

Figure 7 Hammond Point site

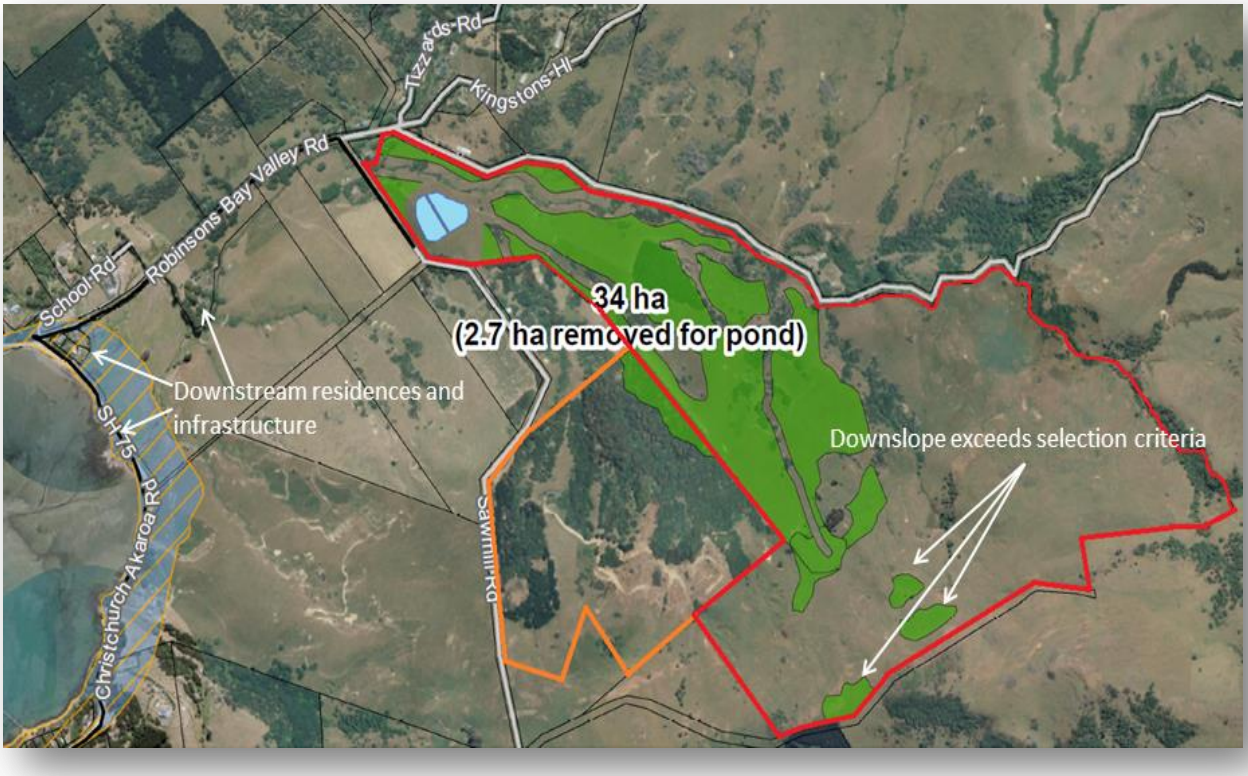
The site at Hammond Point is 3.1ha on the headland between Robinsons Bay and Takamatua. There is a settled area on the northern side and two other houses nearby. The land is within Coastal Environment and Coastal Landscape planning zones.

The area for irrigation is circled green. It is unclear what the Council's intention is for the rest of the site not used for the wastewater and whether it will be retained or sold.

Diagrams in the consultation document indicate there will be an open pasture area between the irrigation plantings and the existing stands of bush. If the land is retained, then there will be an unnatural visual break in the appearance of the headland and unless the open area is fenced and grazed it will become a fire hazard. it

4.2.3 Robinsons Bay storage and irrigation sites

Figure 8 Robinsons Bay site



- The land in Robinsons Bay is split over two properties – the Thacker property outline in red and a small portion of the adjacent Reid property outlined in orange.
- The lower part of the Thacker block, which includes the storage pond site is surrounded by houses and contains a heritage listed site.
- There is a listed heritage building immediately below the site
- Use of the Reid property means the water supply of the property below is compromised and a new water supply will need to be sourced.

4.3 Pond Site 10 subsurface wetland

The concept of the subsurface wetland at Pond Site 10 was introduced in August 2019 to facilitate the Inner Bays option.

In April 2019 the Inner Bays option was priced at $60,470,000[25]. This made it the most expensive of the options -$6 million more expensive than Goughs Bay and $4 million more than Pompeys Pillar. The proposal at that stage was for a series of constructed wetlands as well as irrigation on the Thacker site, but this required a 40,000m^3 storage pond, given the limited area of land available for the wastewater disposal. This added $8 million to the cost because of the size and construction required.

The option could have been discarded as too expensive, but instead the wetland was shifted to Pond Site 10 with the added concept of **releasing water to Childrens Bay during extreme weather.** According to the Beca report:

[25] Appendix S 2019

"The subsurface wetland was [sic] been proposed as a result of collaborative discussions between the Council and the Ngāi Tahu parties, who originally suggested the concept."[26]

It further states that one purpose of the wetland is to:

"Address cultural concerns relating to infrequent discharges to harbour of treated wastewater by allowing flows to pass through the sub-surface wetland to provide additional treatment and restore the mauri of the water before being discharged to the harbour."[27]

The retention time for water in the wetland is 2 days in summer and 3 days in winter[28]. This appears to set a benchmark for the acceptable length of time water needs to spend in a wetland to meet the cultural need to restore mauri prior to discharge. This concurs with the report on the Duvauchelle Wastewater scheme which, in reference to the wetland proposed for it, states: *"A minimum of 2-3 days residence time in the wetland is provided to effect meaningful treatment and "passage through land" to address cultural concerns of Ngāi Tahu."29*

Ngai Tahu's acceptance of the release water to Childrens Bay during extreme weather brought down the size of the storage pond required in Robinsons Bay by 21,000m^3 and substantially reduced the construction cost and lowered the storage consenting requirements. In this way the option favoured by Council staff was again considered viable.

4.3.1 Inconsistencies in presentation

The wetland at Pond Site 10 is a relatively new concept, and there are inconsistencies with how the wetland is presented in the Beca Report.

- It is unclear whether the wetland will need to be covered with a cage to prevent bird fowling. The example wetland shown in Section 5.2 p46 of the Beca Report is fully caged, however, the landscape plan in the report and the artist's impression used in the Consultation document do not show caging.
- The visual impacts are unclear – on the one hand, the artists impression shows the wetland as a flat area screened with trees with minimal visual impact, but on the other, the technical diagram in Section 9.3, P117 shows that substantial earthworks adjacent to the State Highway and states that pond embankments must be kept free of trees and shrubs so that their integrity can be observed. (Beca Report Section 9.3 P119)
- The overflow path is unclear. The landscape plan shows it going down the site and out to Childrens Bay at the bottom of the hill. However there is no stream on Pond Site 10 and Section 5.2 P 43 of the report makes it clear that: "*Discharge to the harbour of greater than 2 L/s will be from an overflow pipe from the wetland. This pipe would be directed from the wetland, into the creek on the property opposite the WWTP, and down the hill to Childrens Bay."* The route of this is not shown on a map – but is likely to follow the natural drainage path shown in the dam break analysis Section 9.4 P121. This comes down the main gully below the wetland site, crosses SH75 in a culvert and drains through the gully in the Akaroa Cottages development to Childrens Bay stream.

4.4 Constraints and Risks

The Inner Bays solution is highly constrained by the availability of suitable land – both for irrigation and for the large amount of storage required, and is placed close to homes and communities. Both these factors exacerbate the impacts and risks to people and to the Council if the design does not perform according to the theoretical modelling or if the underlying assumptions prove incorrect.

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[26] Beca Report July 2020, p42
[27] Beca Report July 2020, p42
[28] Beca Report July 2020, p19
29 Beca Report July 2020 Appendix D, p2

4.4.1 Difficulty of finding land in Inner Bays

The Beca Report identifies that *"a minimum of 40 ha is required for a practical and workable inner bays irrigation scheme"*[30]. As described, 5 separate sites are needed in the Inner Bays to provide 40ha of land for irrigation and storage that meets geotechnical criteria and minimum system design setbacks from streams, property boundaries and houses.

The difficulty in finding suitable land is illustrated by the Thacker site itself. Despite this being a 114ha block, its provides less than 34ha available for irrigation even with the relaxation of the slope parameter to include some upper areas that significantly exceed the 15° down-slope selection criteria.[31] Therefore a small area on the adjacent 88 Sawmill Road property must be added, as well as the two additional properties at Takamatua and Hammond Point.

All of the identified land parcels carry risks:

- The Takamatua Valley property has already been potentially earmarked for another public purpose – the relocation of Duvauchelle Show to make room for the irrigation of Duvauchelle's wastewater to land currently used as the Show ground and Pony Club. The Beca July 2020 report makes no mention of this issue or what the implications are for either Hammond Point, running an A&P show and Pony Club on irrigated pasture, or the effect on the overall cost.
- The availability of this land is in doubt as the landowner is not a willing seller.
- The property at Hammond Point is currently on the market with a $3million price tag. This is considerably more than the RV +10% we understand the Council is allowed to offer, and could well be sold prior to any decision being made.
- If the Council fails to secure either of these pieces of land through a willing seller process, or by compulsory acquisition then it will need to acquire other land in either Robinsons Bay or Takamatua as indicated on the site screening map given in the Beca report. [32] These are all small sites and close to houses, and owners have not to date been willing to sell to Council – or they would already be earmarked.
- The site at 11 Sawmill Road contains a significant archaeological site.
- Use of the 88 Sawmill Road property compromises a neighbours water supply.

4.4.2 Risks associated with the storage pond on 11 Sawmill Road

Fitting the 19,000m^3 storage pond onto the Thacker Site (11 Sawmill Road) is problematic. See Figure 9 below.

- The pond site is sandwiched between the main Robinsons Bay stream and two ephemeral streams.
- There are houses surrounding three sides of the storage pond area as indicated by the white circles, two much closer than the 150m permitted setback in the Canterbury Air Regional Plan.[33]
- Extensive earthworks are required to level this site, meaning an area of 2.7ha is to be excavated. The earthworks protrude into the main stream in one place. The lower face of the pond is a 4m high bund to be constructed with loess excavated from the higher part of the site and stabilised with cement.

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[30] Beca Report July 2020, p48
[31] Beca Report July 2020, p59
[32] Beca Report July 2020, Figure 5-6, p45
[33] Canterbury Air Regional Plan, Rule 7.50

- A double pond with a central bund is designed to reduce the dam break risk to lower properties. A bund has also had to be included along Sawmill Road to lessen the risk of flooding the house opposite should a dam break occur.
- The site has the sawmill archeaological site area (shaded brown) immediately below it. The house between the Tizzards and Robinsons Valley streams is the historic Pavitt cottage

Figure 9 Storage Pond Thacker Site

- Where the main stream exits the site it passes under a small bridge on Sawmill Road. Should this block during heavy rain (and blockages like this have been the most frequent causes of flooding)[34] water could quickly back up below the dam face. The images below show the bridge in normal and in flood conditions, and the type of debris that comes down in a storm. These are provided to show how this constriction below the pond could block in a heavy storm and cause water to build up below the dam face.

[34] Tonkin & Taylor 2008, p8

Figure 10 Robinsons Bay stream below Sawmill Road bridge in normal conditions

Figure 11 Robinsons Bay stream below Sawmill Road bridge in flood conditions

Figure 12 Robinsons Bay stream flowing under bridge across Sawmill Road in normal conditions

Figure 13 Storm debris deposited by Robinsons Bay stream immediately below Sawmill Road bridge

- All of these factors combine to increase the likelihood of embankments failing during an extreme storm or storm and earthquake.
- Infrastructure downstream includes several houses. Despite the double pond, dam burst analysis identifies a rise in the level of flood waters under and around them should the wall of the storage pond break during storm events, putting these properties at risk.
- A bund along Sawmill Road is proposed to protect the house opposite at 8 Sawmill Road, but this could result in more water being directed toward Pavitt Cottage (5 Sawmill Road).
- The storage pond size is reliant on the 20% I&I reduction because the land proposed for irrigation is the *minimum viable area*. If the I&I reductions are not realised, or are negated in the future, the storage and land area would be insufficient[35].

[35] Beca report July 2020 Appendix B Results, p7

4.4.3 Risks associated with wetland at Pond Site 10

The constructed wetland is not designed to operate in the normal manner where water flows in one end and out the other.

Instead, under normal operating conditions, water will *not* flow through this wetland but only evaporate from it. Water will trickle in at the rate it evaporates, except when the main pond in Robinsons Bay is full and the overflow mechanism comes into play - anticipated as a one in 5 year event. This raises the question as to whether the water in the wetland will stagnate under normal conditions, whether nutrients will accumulate in the gravel bed, and if so whether they will then flush to the Childrens Bay stream during heavy rain.

The discharge of treated effluent to a stream is a non-complying activity, so this matter will need to be further examined at the consenting stage. However it does present another risk to the overall feasibility of the Inner Bays option.

4.4.4 Nitrogen leaching

As described earlier in Section 2.1.4 the water leaving the treatment plant carries a relatively high nitrogen loading, and the water will be irrigated year round, even when the ground is already at field capacity. This maximises the likelihood of water and nutrients draining through, or running off the soil when it rains, and is completely contrary to good irrigation practice.[36]

The areas proposed for irrigation at Takamatua and Robinsons Bay contain streams and water bores which have the potential to be directly impacted by nitrogen leaching from the irrigated land. Potential effects of nitrogen leaching include harm to sensitive whitebait spawning areas including the popular Robinsons Bay stream. Both the Robinsons Bay and Takamatua streams flow out to shallow inner harbour bays with large mudflat areas, susceptible to odour if they become too nutrient-rich. Robinsons Bay is important for food-gathering and well known for its whitebait and flounder.

The setbacks from streams are exercised to their limits. Irrigation will take place at 25m from the centreline of flowing streams and 10m from ephemeral streams.

The same may apply in time to Childrens Bay, if the wetland does not remove as much nitrogen as hoped and the overflow system needs to be used more frequently than proposed – due irrigation fields failing, or storage ponds being undersized, or increase in severe rainfall events.

4.4.4.1 Nitrogen issues with other land based systems

Several other land disposal systems have encountered issues with nitrogen leaching, including Rotorua, Ellesmere, Selwyn Huts and Ashburton. In all four cases the land treatment system design was intended to remove nitrogen from the wastewater through uptake via the grown vegetation, soil, and optionally a wetland, and in all the cases the system has failed to perform as designed, with the land treatment systems unable to perform within consent limits for nitrogen:

- Rotorua (Whakarewarewa) is being closed because of nitrogen leaching into and polluting the Puarenga stream, and the wastewater will be returned to Lake Rotorua[37].
- The Ellesmere field has already been increased in size once because of excessive nitrogen loading[38] but still leaches nitrogen into Tramway Drain, breaching its consent conditions. It has been expanded several times.
- Selwyn Huts has never worked satisfactorily and leaches nitrogen into Lake Ellesmere[39]. The local residents will be required to pay for a replacement system.

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[36] DairyNZ 2011, p9
[37] Rotorua Te Arawa Lakes Strategy Group 2013
[38] ECan R13/8 2013

- Ashburton's wetland has failed resulting in excess nitrogen, blocking of irrigation equipment and regular overflows into the Ashburton river[7]. It fails to perform to this day, and most of the cells are barren and either dry or open water, the latter attracting waterfowl.

The Technical Expert group has noted that nitrogen leaching is a potential issue, and that the movement of groundwater at the sites under consideration has not been fully investigated.

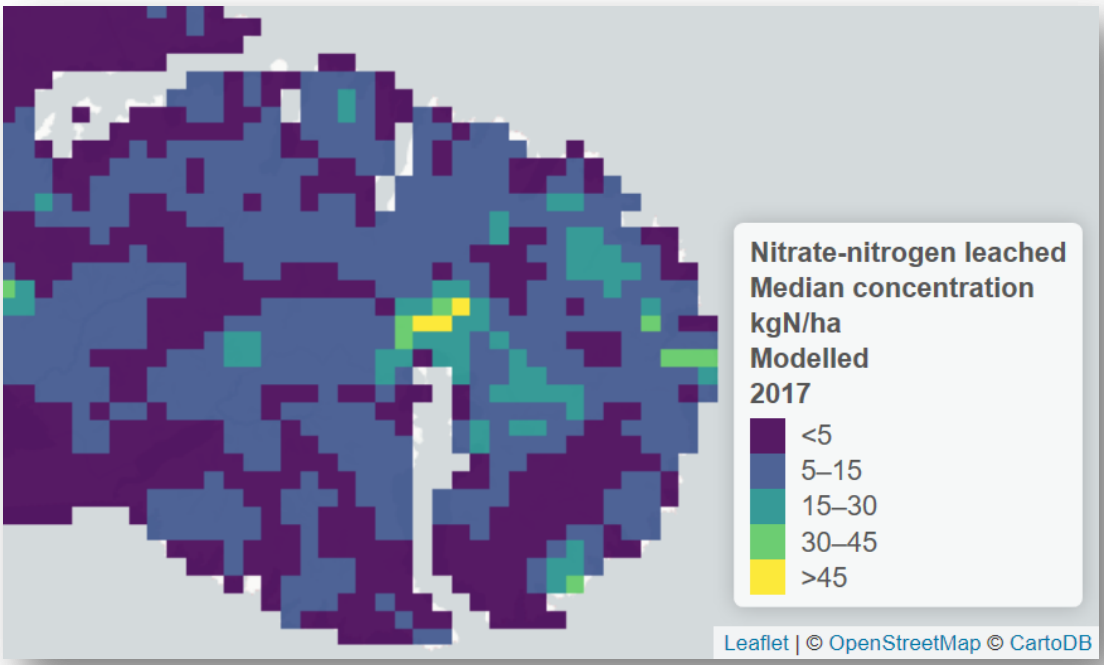
4.4.4.2 Lack of data on nitrogen flux for native trees

The Duvauchelle native tree trial has yet to produce nitrogen flux results, but an interim report based on literature review only estimates that the system will result in nitrate leaching of 15 - 60 kg/ha/yr, and further notes that regular removal of the grown native vegetation will be required to avoid the captured nitrogen being simply returned to soil[40].

The report further notes that this is similar to pasture farming in Canterbury and "patches of Banks Peninsula". However, the map below from Statistics New Zealand (2019) shows that relatively little land on Banks Peninsula exhibits more than 15kg per ha per year of leaching (turquoise on the map below) and very little at the upper end (>45kg/ha/yr – yellow in the below map). The yellow and green areas in the map coincide with the only dairy farms located around Akaroa Harbour.

If the level of nitrogen leaching was to be in the upper portion of the estimated range (>30kg/ha/yr), it would make this property one of the worst on Banks Peninsula – *the equivalent nutrient loss to a dairy farm*. Further, this estimate may not take into account the high level of soil moisture (field capacity or more) that will be maintained year-round, which will increase drainage, runoff and nitrogen leaching, and is contrary to best practice for irrigation to minimise leaching41. As well as environmental harm and reputational risk, there are also potential consenting issues raised by the increase. If irrigation to land is chosen, the Council needs to show good environmental stewardship by improving, not degrading the level of nutrient runoff from the selected irrigation site.

Figure 14 Nitrogen leaching levels on Banks Peninsula



[39] Selwyn Waihora Water Management Zone 2015
[40] Beca Report July 2020 Appendix C
41 DairyNZ 2011, p9

4.5 Highest social impacts

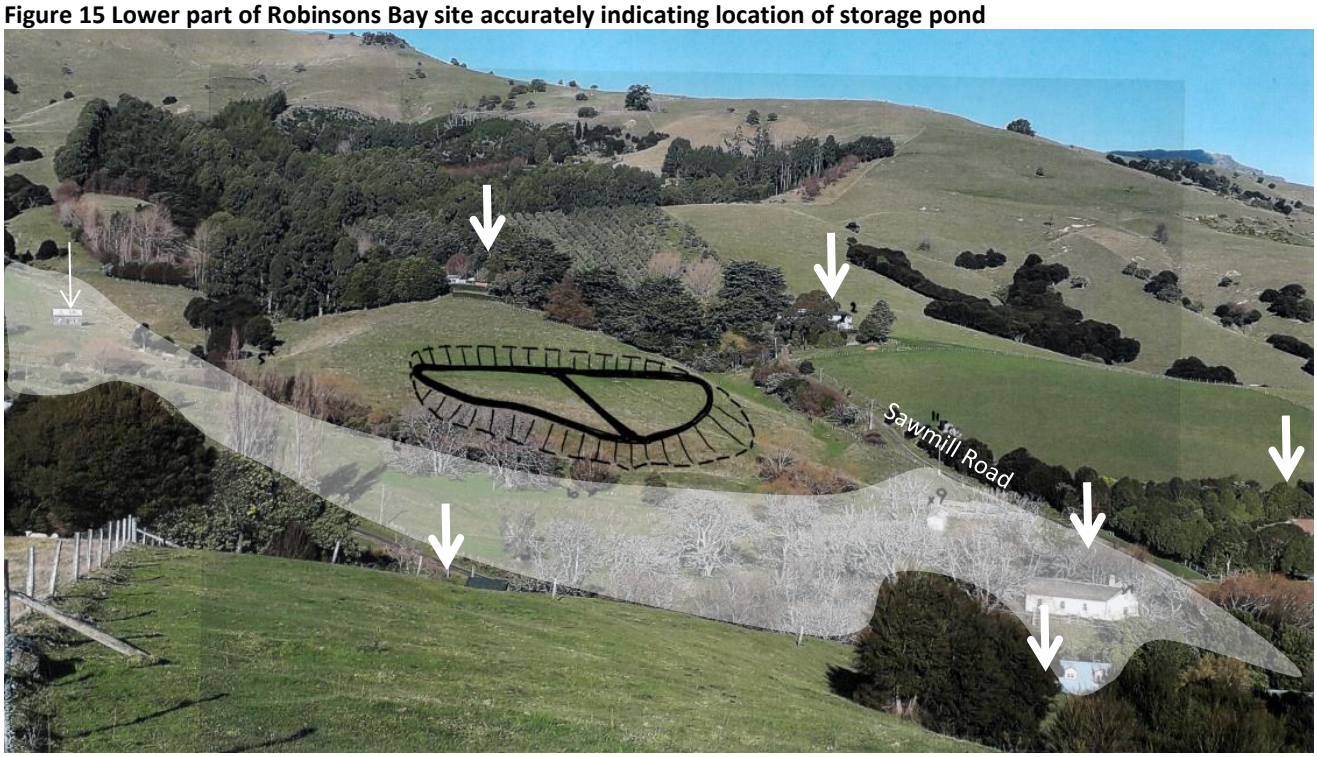
The Inner Bays option has the highest social impacts of the options proposed. This is due to the proximity of the wastewater infrastructure to communities and homes near the Treatment Plant site at Akaroa, in Takamatua and in Robinsons Bay. However, the consultation document neglects to mention these impacts, despite these concerns being well known to Council staff and to the Working Party.

4.5.1 From the storage pond location

The biggest social impact is on Robinsons Bay because the storage pond is located in the upper valley area adjacent to Sawmill Road and a number of houses as shown in the image below. These are not flagged in the consultation document views.

The white arrows indicate the location of the six houses closest to the site. The white shading indicates the heritage area which housed the mill, millpond, tramway and ancillary buildings. Frederick Wynn Williams (a later mill owner) lived in the cottage now abandoned indicated by the leftmost smaller arrow.

Figure 15 Lower part of Robinsons Bay site accurately indicating location of storage pond



- These properties will be severely impacted during the construction period, when the pond (occupying a construction area the size of four football fields) is excavated and the bund and channel along Sawmill Road are constructed. Noise, mud, dust and truck movements will impact on the nearby residents and those down the valley, and this is expected to take up to a year.[42]
- In the event that there are issues such as midges, odour, noise, pest birds, inadequately treated water coming through from the Treatment plant, or health impacts, then these are much more likely to cause adverse effects than if the storage pond was placed further away from homes.
- There will be a visual impact from properties that view this site, and from Sawmill Road, Robinsons Valley Road, and further afield from the Okains Bay Road, particularly as the pond

[42] Pers comm Kylie Harris after consultation meeting

will be an industrial structure – both in scale and character - introduced into this visually sensitive heritage landscape. The pond will be surrounded by a high fence and have a gravel road around the bund perimeter. The bunds cannot be planted to screen them as embankments must be grassed to enable leak detection. The pond will be kept as empty as possible for as much of the time as possible, exposing its plastic lining, as their purpose is to provide capacity for large surges of water in wet weather.

- It is reasonable for residents to have an ongoing concern about the potential for odour and midges.
- Residents downstream from the storage pond are at an ongoing elevated risk of property damage due to a dam burst and likely to suffer from stress during heavy storms or earthquakes.
- It is reasonable to expect property values in the vicinity of the storage pond and those downstream of it to suffer, and for there to be difficulties with selling properties given the stigma attached to wastewater.

4.5.2 Impacts of the other irrigation fields

The irrigation fields at Hammond Point and Takamatua are also close to houses and to the coast.

4.5.3 Cumulative effects on Akaroa area

The Inner Bays option will add to the effects that Akaroa will experience from the new Treatment Plant. Substantially more earthworks will be required at the entrance to the town on Pond Site 10 to accommodate the wetland, and this may have a lasting visual impact on views of the site from the State Highway and the town.

To compound matters for the residents of Takamatua and Robinsons Bay they will not be reticulated on the network, so they will gain no benefits from the system from which they will bear the effects, but will pay some of the costs from their rates. They will bear the effects of the system and contribute to its cost via rates (in addition to the cost of their own septic systems), but will receive no benefit from it.

4.5.4 Lack of consideration for community concerns

It was disappointing to see that Council staff failed to include any of these considerations or impacts in their weighing up of the advantages and disadvantages in the consultation document, although they were aware of the issues. The very first statement in the Working Party's Joint Statement is about the importance of the Council considering and recognising the negative social and cultural impacts on the affected communities. The Working Party was initiated because of the concerns of these communities and it has met with these staff 26 times. Toward the end of the second Joint Statement process, a letter signed by 227 people affected by the Inner Bays proposal was tabled setting out the risks and concerns they had with this system.

4.6 Cultural Impacts

The Inner Bays option has been assessed as meeting Ngāi Tahu cultural values.

We question whether the cultural concerns will be met in practice by the Inner Bays Irrigation scheme, if there is a significant risk of insufficient capacity resulting in direct run-off of wastewater and nutrients to nearby streams and/or increased frequency and volume of overflows from Pondsite 10?

However, cultural values are not limited to those of tangata whenua[43], and the Inner Bays proposal has a high impact on the cultural values of Robinsons Bay and for Canterbury in general, particularly because of its impacts on a significant heritage site and its surroundings.

4.6.1 Impact on heritage

Robinsons Bay contributes significantly toward Canterbury's heritage because the first power sawmill in the province was erected there in the 1850s on what is now 11 Sawmill Road - the Thacker land. The mill owner's cottage still stands on the adjacent site having been subdivided from the main site in May 2000[44] when it was purchased by a descendant of the original mill owners – the Pavitt family. They had pioneered the design and construction of this first mill in early Canterbury in conjunction with Samuel Farr, who later became one of Canterbury's most well-known architects. The mill was an extraordinary achievement, and many of the settlers of the bay and the wider area began life in Canterbury as mill hands.

A history of the mill was written in 1991 and the site has been marked since 1987[45] when the Historic Places Trust Christchurch branch erected an information board on Sawmill Road.

The image below shows the cottage and mill site after the original water wheel had been augmented with a steam driven system. It was chosen by Gordon Ogilvie as the feature image on the back cover of "Banks Peninsula, Cradle of Canterbury", his definitive reference book on the area.

Figure 16 Robinsons Bay Sawmill circa 1870

Council staff have been extremely reluctant to acknowledge the existence or importance of this archaeological site and the significance of the area to Canterbury history. Repeated requests made

[43] MCH Cultural Well-Being
[44] Maxwell and Hubert 2020, p13
[45] Mould 1991, p39

at the Working Party for a heritage assessment were declined and the consultation document does not mention the impacts on this heritage. However, a recent archaeological assessment of the neighbouring Pavitt Cottage property provided by the Pavitt Family Trust has been included as Appendix W to the Beca report dated July 2020. This describes the archaeological values of the cottage, the associated mill site on the Thacker land and the heritage character of Robinsons Bay valley.

The impacts on heritage values and archaeological site will be substantial.

- The only feasible access to the Thacker site is across the location of the mill itself.
- The storage pond and its associated earthworks will be less than 150m from the cottage, intruding into the area to the left of the mill as shown in the painting and dominating the area.
- Trees will be planted and irrigated with wastewater over the sites of the historic features evident in this painting – the mill ponds, tramlines, flume and related buildings.

FOBP, and indeed most of the residents of Robinsons Bay and descendants of the mill owner and workers, are passionate about restoring native forest and improving biodiversity, but this area needs to be kept open as a heritage site so that its story can be told and its archaeology undisturbed. This is not an appropriate place to cover in a dense planted forest.

The Pavitt Cottage is particularly at risk. The Pavitt Family Trust funds the maintenance and upkeep of this important heritage building from the income gained from holiday stays. That income will be severely impacted during construction, and then from the stigma, safety concerns and visual impacts of the storage pond so nearby. The cottage is at a physical risk of severe damage should the dam burst modelling prove incorrect, and from shading from trees located 15m from the rear of the house.

It seems an inconsistent application of justice to shift the treatment plant from the Takapūneke site out of respect for the historical and cultural events and values associated with the site, only to blight another significant historical and cultural site with wastewater and its associated infrastructure.

The consultation document neglects mention of these constraints and instead attempts to present a picture of native tree areas with public access. The heritage in Robinsons Bay is mentioned on the final page of the consultation document with the suggestion of a future opportunity for *"enhancement of visitor information at the historic sawmill site"*[46] As discussed in this submission, if the Council wishes to establish native bush areas for the benefit of biodiversity and carbon sequestration, this is not an efficient or effective use of funds. To state that visitor information about a heritage site would be enhanced when the site itself has been destroyed is disingenuous.

[46] Akaroa Treated Wastewater Consultation document p19

Chapter 5 Consideration of Goughs Bay option

The Goughs Bay option is much simpler than the Inner Bays option. Water would be pumped over the crater rim to a single remote farm on an outer headland area. The area is sparsely populated and no cultural or heritage sites are impacted by the scheme.

The proposed farm at 461 Goughs Bay Road is 614ha. Based on the Council costing to purchase the site, we assume that it intends to purchase the entire farm, and retain all of it apart from the dwelling. ($4.2million has been allowed to purchase the site; RV is $5.3million; with a land-only component of $4.6million[47].) The Goughs Bay option therefore has plenty of room for expansion, as the engineers have identified at least 112ha as suitable for irrigation.

With the amount of land available, the entire system can be constructed well within the design parameters, rather than pushing them to the limits, so setbacks from streams and neighbours are much greater. There is no need for a wetland facilitating overflow to the harbour as there is sufficient room at the farm for all the storage. Although the 20% I&I reduction is planned, it is not critical because of the additional irrigable area available.

However, perhaps because Council staff have been so focussed the Inner Bays option, much less effort has gone into detailed design for this option and unfortunately this means that opportunities to work with the landowner and the surrounding community have been missed, and both are now alienated from the process.

[47] Canterbury Maps

5.1 System design and components

Figure 17 Goughs Bay Farm

The area for the proposed irrigation system is on the headland containing the Crown Island stream. The storage ponds are on the northern side of the stream gully and the native trees would be planted on the southern side as shown in Figure 17.

The storage ponds will be built into solid rock and either completely in ground or with only small earthen bunds on the lower side. They will not be visible from public places or any houses, and the nearest house is approximately 700m away and on the other side of the ridge in Hickory Bay. Should the pond fail, then the drainage path is to the Crown Island stream and out to the ocean. There is no infrastructure downstream of these ponds.

The irrigation field will be set back over 100m from the Crown Island stream, but will come up to within 5m of the neighbouring property. This is a grazed farm; there is no sensitive activity adjacent to the irrigation field.

The design is based on achieving 20% I&I reduction, but there is plenty of room to expand.

No wetland is needed because no overflow discharges to waterways are anticipated, meaning substantially less earthworks on Pond Site 10.

5.2 Constraints and Risks

There are fewer constraints and risks with the Goughs Bay option than with the Inner Bays option.

5.2.1 Pumping over hill and distance from the plant.

The main concern with the Goughs Bay option has been the length of the pipe and the associated operational cost of pumping the wastewater over the hill. This is identified as a risk (Beca report July 2020 Table 13-1 p150 – Resilience to natural hazards), but the level of risk is not quantified.

The longer pipe and distance from the plant are disadvantages for the Goughs Bay system. Pumping over the hill requires more energy, and staff and contractors will need to travel further to access the site.

5.3 Environmental impacts

The wastewater will be the same quality as for the Inner Bays option, and irrigated at the same rate. However, there is much less risk of impacts from nitrogen leaching because:

- The irrigation field is set back much further from the main stream
- The stream itself drains to the open ocean, not to a shallow mudflat
- Once it reaches the ocean it will be rapidly dispersed
- There is no need for any discharge to the Inner Harbour.

The trees will be placed in an environment near to naturally regenerating native trees.

5.4 Social impacts

The social impacts of this system are also much less than the Inner Bays option:

- The nearest house is 720m from the storage ponds (seven times further than for the Inner Bays option), and there is a hill between it and the storage ponds. These ponds will not be visible from anywhere except the farm itself. The nearest house is also 1200m from the irrigation field, over 50 times further than for the Inner Bays option.
- This means that if issues develop with odour or midges from the storage ponds or irrigation, there is little risk to people.
- No heritage sites are affected.

However, residents of the area have expressed concern about aspects of the option including the impacts during the construction, the introduction of planted native forest into the “Wildside area” and impacts of contaminants on water intakes and neighbouring farms.

5.4.1 Construction impacts

The impacts during construction largely stem from the use of the narrow roads to install the pipes. The pipe will be routed up the Long Bay Road, which should be wide enough for a traffic light system during construction. The pinch point is approximately 3kms along the Hickory Bay road before the pipe reaches the farm. An existing farm track that is already used by vehicles will need to be shingled to enable larger vehicles to access the site. Spoil from the dam construction is to be kept on the site.

Construction will be extremely disruptive to local residents and road users for any of the land-based options. The Goughs Bay option will affect fewer people than the Inner Bays option – and perhaps the Council can find a way to compensate the affected residents, or to plan work to minimise the time when this road section needs to be closed.

5.4.2 Wildside impacts

The term Wildside is a description applied to the outer south-eastern bays and hills of Banks Peninsula because this area contains substantial areas of land protected for its biodiversity value, including the private Hinewai Reserve, the Council’s Misty Peaks Reserve, DOC’s Ellangowan Reserve, bush covenants on private properties and the Pohatu Marine Reserve. A combined

approach to pest control across the different land tenures has developed over the years, led by the Banks Peninsula Conservation Trust, and the Wildside is the area where Pest Free Banks Peninsula aims to start on its ambitious goal to eliminate pests.

There is a focus is on natural regeneration and hence the community is concerned about irrigated native plantings as this may impact the ecology of the area.

The community also doubts that irrigated native trees can be successfully established, given the altitude and exposed nature of the site.

5.4.3 Contaminants

The Council would need to provide detailed information about this risk to the community.

5.4.4 Cumulative effects on Akaroa

The cumulative effects of the Goughs Bay option on Akaroa would be less because there is no need for the wetland at Pond Site 10 and the ponds and irrigation fields are distant.

5.5 Less Sensitivity to modelling assumptions

While this option is still sensitive to the same modelling assumptions as the Inner Bays option, the risks of critical failure if they prove incorrect is much less because there is ample room for expansion on the site and because the site is distant from sensitive activities such as houses.

5.6 Community and Landowner opposition – an opportunity missed

The most disappointing factors with regard to the Goughs Bay option is that the Council has so palpably failed to work constructively with either the landowner or the community.

5.6.1 Once was willing

The landowner was a willing participant, aiming to use the water to improve his pasture productivity for cattle grazing, until the point where he found that MPI would require stand-down periods for milk or meat from these cattle, and that he alone would face the entire risk should this cause issues. He became worried that neighbours could report compliance concerns to MPI and that regardless of whether he was in breach or not, he would then need to deal with time-consuming and stressful bureaucratic processes. It seems that the Council, in their dealings with both this landowner and the Pompeys Pillar landowner, were not prepared to accept any of the risk involved with irrigating the wastewater to private farmland. They did not find out and inform landowners of the constraints involved in the first place, nor come up with a plan to manage those constraints and risks when the landowners became concerned. Had they done so, the Goughs Bay option of irrigation to pasture might have continued with a willing owner.

5.6.2 Community values ignored

Similarly, once the landowner was unwilling, and the decision was made to use a native tree irrigation system instead (because this requires less storage), the Council failed to work with the Wildside community and develop an environmental program that met their values and aspirations.

Instead of involving this knowledgeable community in the project and working to find ways to add native afforestation to boost naturally regenerating areas on the farm (including blending the planting in with existing forested areas to restore a far greater area of marginal land), the native trees are placed in the middle of the farm on the most productive land. There has been no attempt to design this as a Wildside enhancing project or to find ways to support the Wildside aspirations as a form of compensation to the people of this area.

5.6.3 High level Fire ponds

Firefighting capability is a matter of utmost importance to remote rural residents and to the Wildside with its huge investment in native forest. While pumping wastewater over the crater rim has its downsides and costs, it also opens the opportunity to create high altitude fire ponds that

could be kept full at all times (replacing water lost to evaporation or used for fire-fighting). High altitude ponds are very valuable for firefighting as they enable helicopters to fill monsoon buckets without having to fly water uphill. This greatly increases the speed at which they can transfer water from the source to the fire. A high altitude fire pond at Hinewai was the saving factor during the 2011 fire there.

An obvious site for a fire pond is on the relatively level land near the cabstand en route to the Goughs Bay site.

5.6.4 Renewable energy ignored

A downside to the Goughs Bay scheme is the energy cost of pumping the water over the hill. It seems that no effort has been put into identifying alternative energy sources such as solar panels or wind turbines at Pond Site 10 or on the site to generate this energy. Some energy could potentially also be recaptured as the water makes its way down the hill on the other side.

If this was done it could bring the running costs down and make the system more climate friendly.

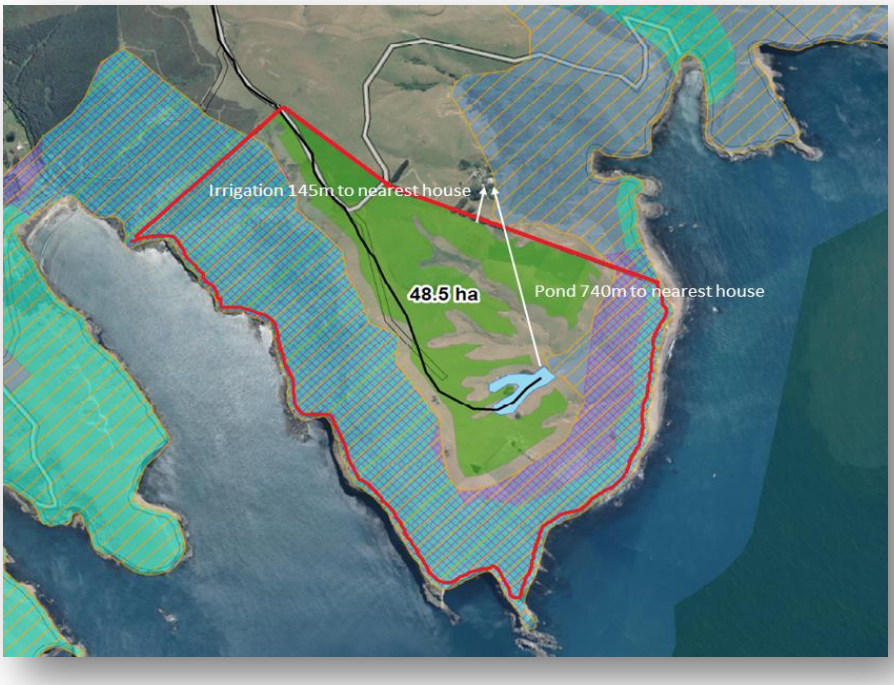
The Goughs Bay option has some potential advantages, and could represent beneficial re-use of the treated wastewater if it was either made into a far more extensive native regeneration scheme, or if the Council were able to ameliorate the landowner and community concerns with regard to a pasture-based scheme. Since neither of these are proposed, we do not support this option in its current form.

Chapter 6 Consideration of Pompeys Pillar option

Like Goughs Bay, the proposed site at Pompeys Pillar is a remote farm with few near neighbours, and with low visual impact on the landscape. The proposed irrigation area is on a pastoral headland, with no streams or areas of ecological sensitivity. The impact on neighbours and the local environment would be minimal, but the scheme again represents a lost opportunity because Akaroa's water would be pumped out of the catchment and used to establish a small area of planted native bush, rather than re-used in Akaroa where it is needed.

The key difference is that, unlike Goughs Bay which was recently purchase by its current owner, the Pompeys Pillar farm has been in the same family for seven generations and has strong heritage value to its owners. Given that this option would likely require compulsory purchase, the injustice brought upon the family would be severe. We consider such a proposal to be a violation of natural justice.

Figure 18 Pompeys Pillar location



We also agree with the concerns expressed by the landowner and Wildside community that establishing native trees on the coastal and windy headland would be very difficult and they could well take many years to establish and be more stunted in form, leading to less canopy intercept.

This could be offset by using more of the land zoned as Outstanding Natural landscape, as it makes no visual sense to plant trees on the centre of the headland and then leave a bare strip in the Outstanding Natural Landscape around the edges. It would make much more visual sense to plant the entire area and join it to the native vegetation on the northern slopes of Otanerito Bay to create contiguous forest.

We consider that any perceived benefits of this option do not justify the social injustice, and hence do not support it.

Chapter 7 Consideration of Harbour outfall option

In 2015 a harbour outfall from Childrens Bay formed part of the new Wastewater Treatment Plant resource consent application to Environment Canterbury. This component was declined on grounds that it would have a significant adverse effect from the perspective of tangata whenua and that the Council had not adequately considered alternatives.

The harbour outfall now proposed differs from the original 2015 proposal in several key ways:

- The outfall will start at Glen Bay rather than Childrens Bay. It will be serviced by a treated wastewater main passing through Akaroa which can double as a non-potable water supply ("purple pipe")
- The standard of wastewater treatment will be even higher; wet weather bypass flows have been eliminated, and microfiltration has been replaced with ultrafiltration which achieves a higher level of disinfectant. If non-potable re-use is included, the wastewater quality will be further enhanced by UV treatment.

These differences do not address the original reason for declining the harbour outfall, but they do **allow it to progress from a pure disposal system to an enabler of wastewater re-use in Akaroa.**

7.1 Environmental and social wellbeing

Of the four options, the harbour outfall has the lowest environmental and social impacts.

The combination of the higher treatment standard and placement of the outfall in the middle of the harbour, into deep water where there would be maximum dispersal, means the effects on Akaroa harbour (including risk to human health) will be negligible, and represent a substantial improvement over the existing outfall.

The social impacts of a harbour outfall on the community would be minimal; while there would be disruption caused by laying the new pipe through Akaroa, this would occur in tandem with the redirecting of the sewer main and other necessary network changes, which are required for all options. There is no need to acquire land, and there will be no storage ponds or other structures to create visual and social impacts. Because the outfall is in the middle of the harbour, there is no impact on recreational activity at the shore.

7.2 Economic impact and risk

The harbour outfall has the lowest cost and risk because:

- It is gravity fed, so is technically the simplest
- The outfall itself requires no electricity to run and generates no operational greenhouse gases
- It has no practical limits on volume, making it the most resilient in the face of climate change and uncertainty around growth. It could also readily accommodate expansion, such as reticulating Takamatua and Ōnuku.

7.3 Sustainable development through beneficial re-use

The pipeline through Akaroa that serves the outfall would complete the first step allowing Akaroa to reclaim its wastewater by making it available in the town, rather than sinking considerable cost into piping and disposing of the wastewater elsewhere. As noted in the consultation document, this dramatically reduces the cost of the first stage of purple pipe reticulation (municipal re-use) – to

$270,000 rather than $3.7 million for the other options. It could also provide a strong incentive to lobby government to develop the regulatory mechanisms required to facilitate private re-use.

Re-using the treated wastewater requires a higher level of treatment than disposal, and the cost of UV treatment has been already factored into the new plant build. If re-use is adopted, any wastewater returned to the harbour would also be receiving this even higher level of treatment - to a level safe for garden watering, including a further 1000-fold virus removal. This would ensure that the health risk from shellfish gathering or harbour recreation activities is essentially zero.

7.4 Cultural wellbeing

The proposed harbour outfall still does not address cultural concerns of tangata whenua around disposal of treated wastewater. In considering this option Council will need to weigh up the following:

- Could Ngāi Tahu cultural concerns be mitigated, for example an expanded wetland scheme similar to the one proposed for the Inner Bays option, and also the Duvauchelle wastewater scheme?
- How can cultural wellbeing be integrated and balanced with social, environmental and economic well-being?

Chapter 8 Consideration of Costs

The costs for the four disposal options presented in the consultation document range from $45 million at the low end for the least expensive option (harbour outfall), to $76 million at the high end for the most expensive option (Pompeys Pillar).

These costs include around $30 million for relocating and replacing the current treatment plant at Takapūneke, to address cultural issues. The cost of the disposal options is therefore $15-$46 million.

This compares to a current LTP budget of $35 million for both the new treatment plant and the wastewater disposal, meaning an additional $15-$41 million needs to be budgeted, depending which option is chosen.

All the options are extremely expensive and costs have escalated substantially since the last round of consultation.

8.1 High cost per connection

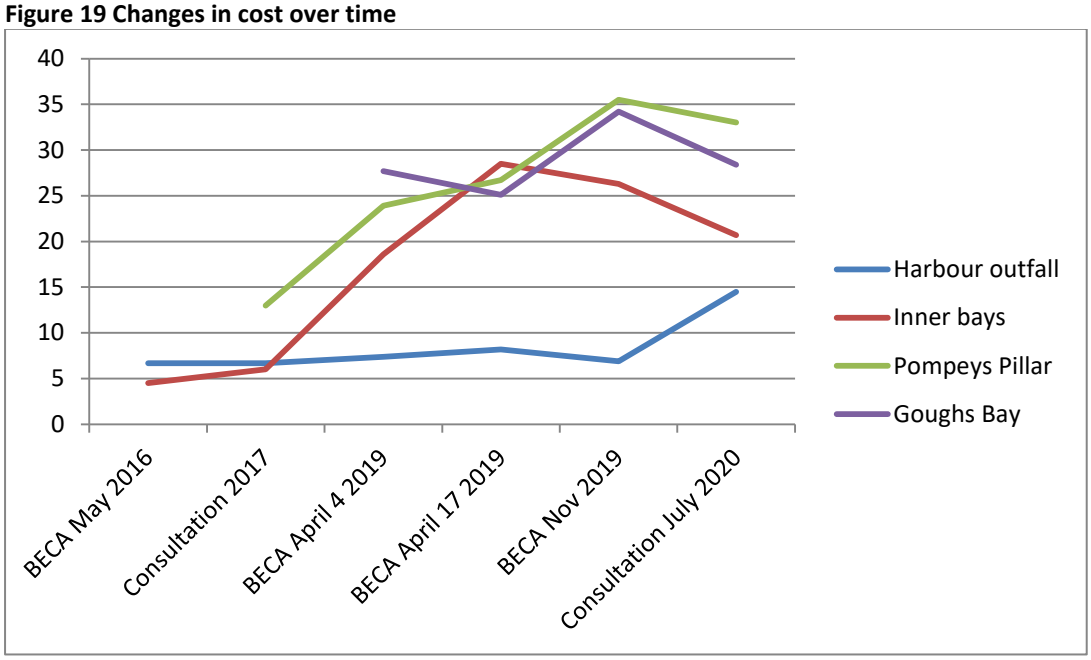
The cost per connection for this project is extremely high: Akaroa has around 830 connections[48], so the total cost is $57,000 - $68,000 per connection. This is substantially higher than the cost of a modern on-site wastewater system such as an Oasis Clearwater.

Given that such a high cost is already being borne by Council to relocate and rebuild the Treatment plant, we submit that the further costs for the disposal need to be both carefully reviewed and weighed against the overall benefits and risks of the options.

8.2 Cost variability

During the past four years of investigation, the costs of the various disposal options have not only risen dramatically, they have also varied significantly relative to each other. The chart below shows the varying cost of each option, presented at different times to the Working Party.

Figure 19 Changes in cost over time



[48] Pers comm, Kylie Hills Consultation meeting 13 July 2020

The options proposed are similar to those proposed in 2017 but costs have increased by between 116% - 245% since then. This is in part due to the increased volumes since faulty flow meter was replaced and accurate readings taken, meaning that storage ponds and land area required are now much larger

The details of the options have also changed over time, including Pompeys Pillar and Goughs Bay changing from pasture to trees, and the inclusion of a wetland in the Inner Bays option with subsequent reduction in the scale and construction cost of the storage dam.

8.3 Council cost revision

The final CAPEX costs presented in the Beca report (July, 2020) were prepared by Council staff, who reviewed and revised the costs previously prepared by Beca's quantity surveyors in their November 2019 report. The table below lists and the November 2019 Beca estimates and the costs after revision by the Council and listed in the consultation document.

Note: the costs given in the consultation document include the $30 million for construction of the new treatment plant and modifications to the network that are common to all options. We have removed this from the costs below to better illustrate the comparative cost of the disposal options.

Option	Capital cost Beca most recent estimates	*Capital cost* *Council staff revised estimates*
Inner Bays	$32 million	*$27 million*
Goughs Bay	$40 million (irrigation to pasture)	*$35 million*
Pompeys Pillar	$41 million (irrigation to pasture)	*$40 million*
Harbour outfall	$10 million	*$18 million*

For the two outer bays options, the estimated cost has reduced, which would be expected given the change from pasture to tree irrigation. However, the cost of the inner bays option has also fallen substantially, despite the scheme remaining essentially unchanged. The largest change, however, is the escalation of the harbour outfall cost by 80%.

The following significant changes were made by Council staff in this revision:

- Overland pipeline costs have all risen significantly, from $300-$550 per metre to as high as $1600 per metre, particularly those required for the harbour outfall which have more than doubled. As a result the cost of the 4.24km pipeline from the Treatment Plant to Glen Bay is now almost as expensive as the 5.25km *high pressure* pipeline to the cabstand, and *more expensive per kilometre*.
- The cost of planting irrigation areas has almost halved. The previous Beca costings included $9 per tree, which is in broad agreement with the costs reported by native forest regeneration groups such as Tāne's Tree Trust, while the new Council-provided cost is only $5 per tree which is low by industry standards .[49]
- The amount of **contingency and overhead** relative to raw build cost has remained relatively unchanged (at 71-80% of construction costs) for the land-based options, but has **increased dramatically for the harbour outfall from 82% to 125%.** Most of this is additional design cost (including $1.9m or 40% of construction costs for the harbour outfall pipeline) despite substantial design having already been carried out for this option prior to the resource consent application in 2015. If the additional design is because of the changed route via Glen Bay, the original outfall from Childrens Bay option should also be included, as it would be the cheapest.

The above changes are significant because they strongly affect the relative cost of the harbour outfall versus land-based disposal. Given the overall level of cost variability, and especially the sudden final change in relative costs, we question their dependability and strongly urge that these changes and the costs in general be reviewed by an independent quantity surveyor.

[49] Thompson 2019, p22

8.3.1 Anomalies

We also note the following anomalies and issues in the costings:

- The pipe from the fire station (PS-615) to the domain (PS-614) is calculated as 240m, but this distance is over 700m in a straight line
- The I&I reduction cost has very little contingency, and commentary indicates the work will be constrained to budget. Given the critical nature of this component to the Inner Bays option in particular, this adds substantial risk of failure
- The original Beca costings contained a substantial list of assumptions and waivers which highlight the uncertainty in the costings overall.[50]

8.4 Different options have different risk mitigation factored in

When deciding which option to pursue, the Council will need to weigh up the relative cost of each option against the known or potential risks. However, this is made difficult by the uncertainty in the costings.

The land-based disposal options all share the risk that the system will be undersized, which is why Eco Eng recommend a phased approach over many years to determine the true water uptake that can be borne by the chosen site.

However, the two outer bays options have additional land available: at Pompeys Pillar there is an additional 42 ha of further irrigable land closer to the coast that has been excluded because it falls within the coastal and high natural character landscape areas (by way of contrast, the Hammond Point irrigation area also falls within the coastal and high natural character areas, but has not been excluded from the Inner Bays option)[51]; at Goughs Bay a total of 45 ha of year-round irrigating and a total of 112 ha (including areas that can be irrigated in summer only) was identified for spray irrigation to pasture – more would be available for dripper irrigation to trees because of reduced site setback and slope constraints. This means their stated cost includes this risk mitigation factor.

In contrast, the Inner Bays option involves the purchase of the minimum land area required to make the scheme viable, and even securing some of the land identified is in doubt (Takamatua, Hammond Point). To compare like with like, the Inner Bays option should include *double* the current land purchase cost, i.e. include another $3 million as contingency for additional land purchase.

The Harbour Outfall is a low-risk option because it does not have a finite capacity, and the impact on the environment of the harbour and risk to health has already been extensively studied in 2015 prior to the consent application being made (NIWA 2014). We further note that the treatment standard proposed is now higher because the membrane filter has been upgraded from microfiltration to ultrafiltration. In addition bypass flows during very wet weather have been eliminated, so the health impact will be even lower.

8.5 Cost of decommissioning Takapūneke

We note that the project CAPEX costs for moving the treatment plant do not include the cost of the demolition of the existing wastewater treatment plant at Takapūneke, which is likely to be substantial.

8.6 OPEX costs

Unlike the harbour outfall, all of the land-based options have operational costs, ranging from $44,000 to $177,000 per annum, and equating to an additional $53-$213 per connection per year.

[50] Quantity Surveyor

[51] Beca Report DRAFT Nov 2019 Appendix G

Chapter 9 Consideration of carbon

One of the arguments presented in favour of the land-based options is that the native trees would store more carbon than the scheme would emit, thus supporting the Council's carbon neutral goal. In contrast, Council staff argue that the Harbour Outfall option conflicts with this goal because it is carbon negative, i.e. it generates more emissions than it sequesters.

These assertions require some context.

The emissions listed for each option in the consultation document are not just those from the construction and operation of that option. They include the carbon emitted from constructing and operating the treatment plant.

9.1 Emissions from Harbour Outfall

The operational emissions of the Harbour Outfall itself are zero, so on its own the Harbour Outfall disposal releases emissions during construction only.

The amount released by its construction (a total of 157 tonnes)[52] equates to 4.4 tonnes per annum over the scheme's lifetime; this is around *one quarter the total emissions of a single typical house (20.56 tonnes)*[53].

This could be offset by planting just 0.54 hectares of native trees (e.g. on pond site 10). Offsetting the entire operating emissions including those from the treatment plant would require around 5 hectares of planting (assuming one hectare sequesters 286 tCO2e)[54.]

9.2 Emissions from land based schemes

The net emissions sequestered by the land-based schemes over their lifetime range from 4,459 to 8,879 tonnes.

Whilst this is a positive outcome, the benefit needs to be weighed against the cost.

The marginal capital cost of the land-based disposal systems (i.e. over and above the cost of a Harbour Outfall) per tonne of carbon sequestered ranges between $1,092 and $3,856 per tonne depending on the option selected, compared to the current market cost of $25 per tonne.

If the Council wishes to use the treated wastewater's water and nutrients to sequester carbon, it should be seeking to maximise, not minimise the area of trees being established.

For example, the Council could elect to spend the additional funds required for the land-based options for purchasing marginal land to revert to native bush, following the Hinewai model. Based on the current RV for Hinewai of $2,400 per hectare, the additional funds spent on land disposal could instead purchase between 4,000 and 9,000 hectares of marginal land for native regeneration and carbon offsetting, which could offset between 1 million and 2.5 million tonnes over the scheme's lifetime.

9.3 Cost effective carbon sequestration

We strongly support the Council's desire to become carbon neutral, and agree that native forest is an excellent way to achieve this.

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[52] BECA Report July 2020, Table 11-10
[53] MOTU April 2014, p12
[54] Beca report July 2020, p143

However, we would argue that this aim could be better met through the purchase of marginal land at low cost, and the natural regeneration process, rather than via a land-based wastewater disposal system and planting native trees at very high cost.

We therefore consider that the carbon benefits presented in the consultation document are simplistic and misleading.

Chapter 10 Summary of views on options

In this section we consider and weigh up the extent to which the options proposed meet the requirements of the Local Government Act to take a sustainable development approach and take account of the social, economic environmental and cultural wellbeing of communities now and in the future.

We then consider whether the Council has considered all reasonably practical options and the advantages and disadvantages of each, including the relationship of Māori to their ancestral land and water sites, and the views and preferences of people likely to be affected or with an interest in the decision.

We consider whether each option is consentable under the Resource Management Act and the risks associated with it.

10.1 Sustainable development approach

We do not consider that the options presented in the consultation document have taken a sustainable development approach.

10.1.1 I&I levels remain unsustainable

As discussed throughout this submission, the Akaroa wastewater network suffers from excessive infiltration. None of the options presented deal with this problem in a manner that is sustainable and provides for the wellbeing of communities now or in the future.

While a 20% I&I reduction is proposed for the land based options, funds have not been prioritised to this, but are subject to a cap. This means the approach is equivocal – 20% might be achieved for the $3million allocated or it might not.

Regardless, the result of not comprehensibly fixing the I&I issue is that storage ponds are much bigger, more expensive and create greater impacts than necessary and more land is required for the disposal than necessary.

In the case of the Harbour Outfall no I&I reduction is planned.

In either case, raw sewage overflows are anticipated at least every 10-15 years based on historical rainfall patterns[55] and the entire system is vulnerable to an increase in raw overflows under the increased intensity of storms and sea level rises that are now inevitable due to climate change.

10.1.2 Water shortages

None of the options address the water shortages experienced by Akaroa every summer, or the increased intensity and frequency of droughts forecast for the area.

The land based options all seek to pump water far away from Akaroa to places where it is not needed, rather than recycling it back into the town for summer use.

The Harbour Outfall option at least facilitates some re-use in Akaroa at minimal cost and the infrastructure created would enable future expansion, but unless there is a clear commitment to this, it too will have little impact on water shortages.

10.1.3 Climate mitigation

The options do not take climate change into account – as described above, leaving the pipes in their current leaking state makes the entire system more vulnerable to the impacts of climate change. The

[55] Beca Report July 2020, p115

sizing calculations have not taken into account either fixing the I&I properly, or conversely that unfixed, the I&I issues are likely to worsen. Nor do they address Akaroa's potable water shortages.

10.1.4 Wise use of funds

For the above reasons, none of the options presented are a wise use of funds. What is proposed is a wastewater system that is extraordinarily expensive, especially when considered on a per connection basis, but still does not address Akaroa's water supply, sewer pipe network or its future resilience to climate change.

We also submit that the costs require a careful review.

- There are mistakes in the cost of Pompeys Pillar that inflate the cost.
- The Goughs Bay cost assumes the Council retains or recoups nothing from the sale of the excess farmland. If this is done to provide expansion capacity this should be noted as an advantage. If it is an error it should be corrected.
- The costs of tree planting used for all the land-based systems are well below the industry norms.
- The Harbour Outfall has much higher design and contingency overheads than the other options, despite being the simplest.

10.2 Four well beings

The following table summarises our consideration of the options under the four wellbeings:

Option	Social	Economic	Environmental	Cultural
Inner Bays	Ongoing impacts on residents and communities Risk of odour, midges, dam break. Destruction of heritage site	High cost option Some required sites may not be available. Sunk cost directed away from re-use. Impact on property values	Significant environmental risk from intensity of irrigation, nutrient load and proximity to streams draining to mudflats	Directs most flows to land and includes wetland. However, risk that it will not function as intended. Impacts on heritage values.
Goughs Bay	Impacts on residents during construction. Impact on landowner	High cost option. Sunk cost directed away from re-use	Irrigation is some distance from streams and these drain to open ocean.	Directs all flows to land
Pompeys Pillar	Impacts on residents during construction. High impacts on landowner	High cost option. Sunk cost directed away from re-use	Irrigation is some distance from streams and these drain to open ocean.	Directs all flows to land
Harbour Outfall	Minimum impacts as construction disruption in town concurrent with treatment plant network upgrade	Least expensive, but still over budget Sunk cost directed toward re-use	Minimum impacts from highly treated wastewater (purple pipe standard). Mid-harbour outfall maximises dilution	Directs most flows to Akaroa Harbour Directs some flow to purple pipe re-use

While Goughs Bay and the Harbour Outfall rate the best, we do not consider any of the options to be appropriate because they do not take a sustainable development approach.

10.3 Have all reasonably practical options been considered

We do not consider that all reasonably practical options have been considered.

10.3.1 Lack of I&I reduction

Because the faulty flow meter was not addressed back in 2010, land based options were developed based on false data and then retro-fitted once the true volume of water was known. This means that the poor state of the pipe network and the levels of inflow and infiltration have not been the primary consideration of the Council, and the problem has only been half-heartedly addressed at the end of the process as part of this attempted retro-fit. The Mahaanui Iwi Management plan very sensibly lists "***Reducing volume of wastewater "***[56] as its first policy, but this has not been addressed first. If this was done comprehensively, then land-contact options of any kind become much more feasible and practical because volumes and variability are greatly reduced.

10.3.2 Treatment standard not meeting public expectations

The public has consistently asked for the treatment standard to be higher – at a minimum so that vegetable gardens can be irrigated and more recently to a potable standard.

The Mahaanui IMP explains: *"We would not put treated wastewater on our vegetable gardens so why would we discharge it to the sea where we get our mahinga kai?"*[57]

Our consultation with the local community indicates that if the water was treated to a standard where it was safe to water and eat salad vegetables then they would indeed like to use this on their gardens. The vegetable garden test is a salient one, determining how people feel about water re-use.

Reducing the volume of wastewater entering the system, principally through I&I reduction and also through water conservation measures enables a higher treatment standard as it reduces the treatment plant size and the amount of retentate left from the cleansing process.

10.3.3 No focus on re-use

Despite overwhelming support for re-use expressed in the 2017 consultation exercise[58], none of the options have re-use as their focus.

We submit that if the I&I reduction had been tackled and the treatment standard improved to a potable level then there would be multiple pathways to re-use of the water including non-potable re-use through the purple pipe, indirect potable re-use via MAR or stream replenishment or direct potable re-use by returning the water to the intake reservoir. A combination of these could then be used to provide sustainable management for all the wastewater flow.

10.3.4 Other cultural solutions have not been explored

A late development was the introduction of a constructed sub-surface wetland to purify and restore the mauri of the water prior to it being piped to the nearest surface water body to drain naturally to the harbour. This raises the question of what other similar solutions would ameliorate cultural concerns and enable wastewater treated to a potable standard to be re-used or dispersed to the harbour at times when re-use uptake is not sufficient.

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[56] Mahanui IMP 2013, p280
[57] Mahanui IMP 2013, p281
[58] Beca Report July 2020, p154

10.4 Consideration of consenting issues

10.4.1 Inner Bays

Friends of Banks Peninsula considers that it would be difficult to obtain consent for the Inner Bays option as it is a non-complying activity that has high social, cultural and environmental impacts, fails to provide a resilient wastewater and water supply infrastructure for Akaroa and fails to provide sustainable management. It does not comply with the permitted standards of the Canterbury Regional Air Plan.

The scheme is hugely complex, puts wastewater infrastructure much too close to communities, is highly constrained by the availability of suitable land and at high risk of failure if any one of the many design parameters on which it is based proves inaccurate. Such failure could lead to direct run-off of wastewater and nutrients to streams and to the Harbour and a need to acquire further expensive and difficult to procure land.

In our view the Council pursues this option it would be at serious risk of saddling itself and the community with a myriad of unachievable consent conditions and a costly white elephant. We recommend that the Council does not proceed with this option.

10.4.2 Goughs Bay

Notwithstanding that the Goughs Bay option could be designed in a much better way we submit that this option is consentable. It has lower social and environmental impacts and risks and does not rely on any form of discharge to waterways. It fails in sustainable management because it does not address the resilience of Akaroa's water supply or sewer network, but mitigates this to some extent by having scope for expansion on the site should the current sizing prove insufficient. It complies with the permitted standards of the Canterbury Regional Air Plan.

It is a discretionary application because it does not rely on any form of discharge to waterways and is much simpler than the Inner Bays option. It puts the wastewater at some distance from communities and sensitive activities meaning that it does not carry the same risks of odour, midges etc impacting on people in the long term, is less constrained in terms of its expansion potential and does not put downstream infrastructure or the environment at risk.

In our view, although this option is more expensive to establish and to operate, it carries less risk, and there is plenty of room for expansion.

We suggest that if the Council considers proceeding with this option it:

- Works with Dr Hugh Wilson and the Wildside community to design a native tree system that enhances the Wildside
- Includes high level fire ponds as an integral part of the system
- Works with the landowner to provide adequate compensation for loss of farm areas and find ways for him to gain a benefit from the scheme
- Provides some compensation to the residents affected during the road construction and works with them to identify when it would be least disruptive to work on the narrow Hickory Bay road.
- Finds ways to minimise the cost of pumping the water over the hill through the use of renewable energy.

10.4.3 Pompeys Pillar

Pompeys Pillar is also a discretionary application, but we argue it is less consentable than Goughs Bay because there would be greater social impacts on the landowner, and establishing native trees on the coastal headland is likely to be more difficult, slow and prone to failure. We recommend that the Council does not proceed with this option.

10.4.4 Harbour Outfall

As discussed, the Harbour Outfall rates the best under the social and environmental considerations and risks, and in its new proposed configuration takes the first step towards a sustainable future for Akaroa, but fails to provide for cultural wellbeing.

The fundamental issue for a harbour discharge is consistent across all the relevant planning documents and the Council's Integrated Water Strategy. Put simply - discharge of wastewater to waterbodies or the marine area is to be avoided unless there is no practical alternative.

A new wastewater system must be safe and efficient and serve the community well into the future. In considering practicality and weighing costs the Council must consider the establishment cost, on-going operational and maintenance costs and the risk of future costs if the system does not perform as required, or greater capacity is needed. Council should also take into account the additional funds that will still be needed to improve Akaroa's water supply and to fix the sewer pipe network.

Our view is that the Inner Bays scheme is not technically, socially, culturally or environmentally practical.

Goughs Bay and Pompeys Pillar have higher costs, do not support sustainable development, and may be technically challenging because of the difficulty establishing planted native trees at these locations. Pompeys Pillar imposes a severe social injustice upon the owners via compulsory purchase of their seventh generation land. Council needs to decide whether they consider them to be practical options; in our view they are not.

If a Harbour Outfall is found to be the only practical option, we ask the Council to take all available measures to mitigate the cultural concerns by passing all the water through a wetland system or other land contact system prior to discharge mid-harbour.

We suggest that this becomes achievable if wastewater volume is reduced by fixing I&I, encouraging household water conservation and by enabling re-use in Akaroa

We note that there is flat land on the Takamatua Headland opposite Pond Site 10 previously identified in 2016 as suitable for a wetland. There are also flat areas on the Council's large Misty Peaks Reserve that could potentially be used, if this fitted in with a distributed re-use system, for example.

While the Harbour Outfall takes a first step toward a sustainable future by enabling purple pipe re-use, and the process has now thrown up a method by which cultural concerns could be addressed, we would disappointed if this was the option selected by the Council. Although much cheaper than the other options it is still very costly and leaves the Council with little incentive to spend more on extending the purple pipe and repairing the sewer network. ***It is therefore likely to remain predominantly an unsustainable disposal system.***

10.5 Options not sustainable management

We oppose all the options presented as none of them represent sustainable management, are hugely expensive and fail to prepare Akaroa for a resilient future.

It would be a misuse of public funds for the Council to construct a costly new wastewater disposal system based on any of the options proposed in its consultation document. We cannot see how it could be sustainable and integrated management to spend many millions of dollars building a wastewater system that is extremely expensive per connection, but leaves Akaroa with its sewer network of broken pipes, increasingly vulnerable to climate change effects, raw sewage overflows, and with worsening water shortages.

We strongly urge the Council to stop and rethink its path forward. It needs to set aside the current options and instead adopt a new integrated solution, focussed on reducing the wastewater volume, re-using treated wastewater where it is needed and wanted and recycling pure water

back to the Akaroa catchment. We believe a solution can be found that is acceptable to the whole community, addresses Akaroa's issues and creates resilience for future generations.

Chapter 11 Building blocks for an integrated solution

We suggest that most of the building blocks to a sustainable solution have been identified during the long process of getting to this point.

11.1 Opportunity to address sustainability issues is now

It is critical that infrastructure of the size, complexity and cost of the proposed wastewater scheme is fit for purpose for the long haul under the climate and pandemic changed future that we face.

The costs of adaptation to climate change and now the global pandemic crisis mean that Council funds will be more and more stretched.

The decision on the new Akaroa Wastewater system made by Council now provides the opportunity to change the current paradigm – in tandem with the country – and to find a holistic solution.

The community seeks to use this window of opportunity when major capital is being committed to set Akaroa on a sustainable path.

People have consistently asked for the solution to include treatment to a potable standard so that the water can be used for drinking or any other uses without health concerns.

Now they are also demanding that the sewer pipe network is fixed first.

Failing to make this decision now will saddle the area with an unsustainable system and all the problems this will bring for many years, as seen in Auckland and Wellington[59].

An alternative solution to the four discharge/disposal mechanisms currently proposed would achieve improved and broader benefits that *promote the social, economic, environmental, and cultural well-being of their communities, taking a sustainable development approach*.

11.2 Fixing the network

The Council have estimated the amount of I&I reduction that can be reasonably expected from their planned targeted repairs (such as manhole repairs/replacement and some main pipe replacement) as 20%. This will only reduce the average I&I from 61% to 55%, (because the reduction of 20% applies only to the I&I component, it is not a 20% reduction in total volume). This still leaves a much greater level of I&I that the Water New Zealand trigger value of 30%[60] beyond which system rehabilitation is likely to be successful. To reduce I&I to even the recommended upper limit of 40% would require a 57% reduction. On this basis the 20% target is an unreasonable baseline[61].

Further, the level of I&I indicates the existing network regime is in a poor state and, long-term, the current network is likely to be further compromised. It is appropriate to consider other approaches that achieve greater reductions at this stage, before investing in the Treatment plant and disposal system. It may be more cost-effective in the long term to replace part or all of the network with a pressure sewer regime, or to line the existing pipes[62]. This would provide several benefits (including future climate and earthquake resilience), but specifically, a significant reduction in I&I to bring down the size and therefore cost of the new system.

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[59] https://www.rnz.co.nz/news/national/414409/wellington-council-to-borrow-up-to-16m-to-fix-broken-pipes
[60] Water New Zealand I&I Vol 1 2015 p33
[61] Tektus 2020 3.19
[62] Tektus 2020 4.7, 4.8

We note that Beca considered the possibility of replacing some or all the network with a pressure sewer, but ruled it out on the basis of cost and disruption. Given the direct relationship between the volume of wastewater to be treated and the cost of that treatment and disposal (both capital and operating costs), improvements to the network could likely pay for themselves.

There are two alternatives for achieving a major reduction in I&I:

- **Cured In Place Pipe (CIPP)**: Tektus consultants estimate physical works cost of around $4.5 million to line the entire network. However, this may not be necessary: lining the lower portion only is likely to achieve most of the reduction, with the funds left over available to deal with intrusions in the private network. A similar approach is being taken in Opotiki, where it was found that lining the main pipes was the most cost-effective solution[63].
- **Replace some of or the entire network with a low pressure system**: this approach is significantly more expensive (around $27 million to replace the entire network), but has the advantage of being completely sealed, so is impervious to infiltration, and is a more permanent solution providing greater resilience against climate change. The additional cost may therefore be recouped in the long term. Again, a partial solution to address the lower section of the network may be appropriate and more cost-effective. Tektus estimate a partial solution could cost around $6.1 million for the physical works.

Fixing the network may be costly; building and operating a treatment plant and disposal system that is twice the size needed is also costly. Taking into account the risks associated with continuing to service a network that is deteriorating and susceptible to climate change, *not* fixing the network may be more expensive in the long run.

11.3 Focus on re-use

Council staff and engineers have looked at non-potable re-use via a purple-pipe network, but appear to have focussed on non-potable re-use for toilet flushing only. Experience overseas has shown there are many ways to recycle highly treated wastewater, including:

- Stream replenishment (returning the treated water to the stream just below where it was taken)
- Managed Aquifer Recharge
- Non-potable network (purple pipe) to the gate for outdoor uses such as garden watering
- Non-potable network (purple pipe) to the houses for toilet flushing (and potentially other uses such as washing machines if the treatment level is high enough)
- Indirect potable reuse: treat to potable standard and return to the streams *above* the intake
- Direct potable re-use: treat to a potable standard and return to the potable supply reservoir

Any of the options could be combined with some form of land contact to address cultural concerns. We now consider the feasibility of each of these options.

11.3.1 Stream replenishment

In summer Akaroa often has water shortages, leading to watering restrictions. This year the problem was particularly acute, with a total watering ban coming abruptly into force. As a first step towards genuine recycling, the treated wastewater could be returned to the Grehan Stream, just *below* from where it was taken, avoiding concerns around contamination of the water supply.

A well-designed stream discharge solution, similar to the subsurface wetland proposed for the Inner Bays option, would seem to align with the Ngāi Tahu position that it is appropriate to pass even

[63] Tektus 3.18

highly treated wastewater through or across land for Papatūānuku to cleanse. We suggest it could be worth additional discussion with Ngāi Tahu representatives to consider options for some continuous flow through a wetland, before conveying the water back to the Grehan Stream.

Tektus suggest an ecological evaluation to assess erosion risk in response to grade and substrate, and to quantify existing stream condition. They note that the length of watercourse allows for consideration detention time to interact with the stream substrate. Flow dispersal to the stream could be via further land contact, such as a filtered strip or vegetated swale[64].

11.3.2 Managed Aquifer Recharge

Managed Aquifer Recharge (MAR) is an indirect re-use method where highly treated wastewater is returned to aquifers, usually through either infiltration beds or by injecting it into deep bores[65].

The Council considered MAR as a possible solution, but did not proceed beyond initial investigations. The primary concerns related to potential contamination of water supplies and the underlying geology in Banks Peninsula not being conducive to injection: deep bore injection disposal options were also explored, but only based on one exploratory bore at the site of the treatment plant, and discounted on the basis of a lack of open connected fractures and low permeability ground conditions.

The geology of Banks Peninsula is highly complex, and exhibits great variability between locations. The two deep bore injection test bores were located close together, in an area thought to be a major vent, and less likely to be fractured[66]; other locations may be more favourable for this method.

Furthermore, the Beca report explains that in the context of MAR, Council staff determined that potential connectivity between the groundwater injection and groundwater abstraction for potable supply presented a significant risk to water supply security in Akaroa, and determined that the option should not be considered further. Research indicates positive pathogen removal capacities across a 40-80m separation distance between the infiltration and abstraction well locations[67], suggesting it should be entirely feasible to safely return highly treated wastewater to the Akaroa basin, given the size of the area and the relatively low number of water extraction points – there are only three stream collection points and two active wells in the entire Akaroa basin[68]. Any residual risk could be further mitigated by treating the wastewater to a potable standard.

With regard to cultural acceptance, the Beca report indicated a neutral/medium score for deep bore injection, and a worst score for MAR relative to cultural acceptance. However, with further understanding of this solution, potentially together with ground-level pre-treatment via a sub-surface wetland or similar, this may be a more acceptable approach for mana whenua than water body discharges and, potentially, comparable to discharge to land[69].

Given the reduced footprint and potential cost benefits, this represents a lost opportunity to find a more practical solution[70].

We suggest Council considers re-looking at MAR as a potential method for reusing Akaroa's wastewater in a way that is low impact, sustainable and culturally acceptable. If water is treated to a potable standard then reuse of Akaroa's existing unused bores presents an opportunity that would not contaminate water supplies.

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[64] Tektus 2020 4.30
[65] Lundh 2009
[66] Hampton, S communication to the Working Party
[67] Lundh 2009
[68] Canterbury Maps (water supply)
[69] Tektus 2020 3.36
[70] Tektus 2020, 3.34

11.3.3 Non-potable re-use network (purple pipe)

The Beca report states *"A fully reticulated non-potable reuse network has not been used before in New Zealand and is not currently supported by the Ministry of Health and the Canterbury District Health Board."*[71] For this reason the consultation document proposes only a modest re-use system for municipal watering and toilets, and even this is optional. The key concern cited is that plumbers may incorrectly cross-connect the potable and non-potable pipes and contaminate the drinking water supply.

However, there are examples of purple pipe re-use already being implemented in NZ on a smaller scale, such as Golden Valley subdivision, Kuaotunu, Coromandel Peninsula[72.] Very high-quality effluent is in part disinfected and returned to each lot as non-potable reclaimed water for toilet flushing. On-site recycling is also becoming more common, such as Oasis Clearwater systems for sewage and Hydraloop for grey water.

Some regions (such as Kapiti Coast) have included a water conservation requirement for new developments into their district plan, which may include a greywater diversion system and rainwater collection (KCDC, 2009a). The ECan Land and Water Regional Plan does not specifically prohibit reuse, and the use of alternate systems is provided for within the wider objectives and policies of the Regional Plan: reuse is promoted to reduce the residual effects of discharges of contaminants, and ECan aims to enable water conservation and water efficiency through the collection, use and reuse of water, and alternative sewage disposal technology. It further promotes that local authorities should encourage water conservation and water efficiency through the collection, use and reuse of water, provided that the health of individuals of the community is not put at risk.

We urge the Council to lobby central government to put the regulatory framework in place to support treated wastewater "purple pipe" re-use, for both toilet flushing and external uses such as garden watering; the latter has the potential to take a significant proportion of the water.

11.3.4 Reverse Osmosis treatment and potable re-use

We recognise that New Zealand is not yet legally or culturally ready to drink recycled wastewater, however the recent severe water shortages in Auckland have prompted the mayor to declare that Aucklanders need to "get used to" the idea of recycling wastewater.[73.]

As envisaged for Auckland, full recycling of wastewater would see the water coming out of the wastewater treatment plant given further treatment and passed through a natural filter such as a wetland, before another round of treatment to ensure it was at a drinkable standard. In Akaroa the options are then to return it to the drinking water reservoir, to the Grehan stream upstream of the water supply intake, or into the ground to replenish the aquifers.

Reverse Osmosis can be and is successfully used for large scale wastewater treatment, such as at Bedok, Singapore, where industrial effluent and municipal wastewater is recycled into pure water for high-tech industrial use and drinking water replenishment. Many other examples can be found including in Australia and the United States. The maintenance cost and energy usage of Reverse Osmosis is comparable to the Ultrafiltration MBR already proposed[74].

In addition to cost, Council staff have highlighted the issue of retentate requiring disposal. Retentate volumes can be minimised by recycling it back through the treatment plant, similar to what Beca propose for the ultrafiltration membrane; again this is common practice, and technology continues to improve[75].

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[71] Beca July 2020 piii
[72] MfE 2003, p103
[73] https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12330425
[74] Tektus TO DO
[75] Tektus TO DO

We strongly encourage the Council to add Reverse Osmosis as a final purification stage, which would recycle the treated wastewater back to clean water, making it safe for re-use in all ways, including indirect or direct potable re-use. Doing this would alleviate Akaroa's water shortages and make it a showcase for sustainable water management.

11.4 Putting the building blocks together

We consider that the building blocks needed for a sustainable solution have all been identified. Some, such as Reverse Osmosis and MAR need some further research and the estimated costs being made public.

The issue for the Council is how to implement it in an affordable manner and to get through the consenting process to do so.

The baseline for the cost and timeframe of an alternative solution comes from the existing proposals on the table. The cheapest of the land based options proposed is a capital cost of $54 million to $63 million. The timeframe for implementation is 8 years before this is fully operational and the existing plant at Takapūneke could close. The harbour discharge would cease at about the same time as it would for the land-based options proposed.

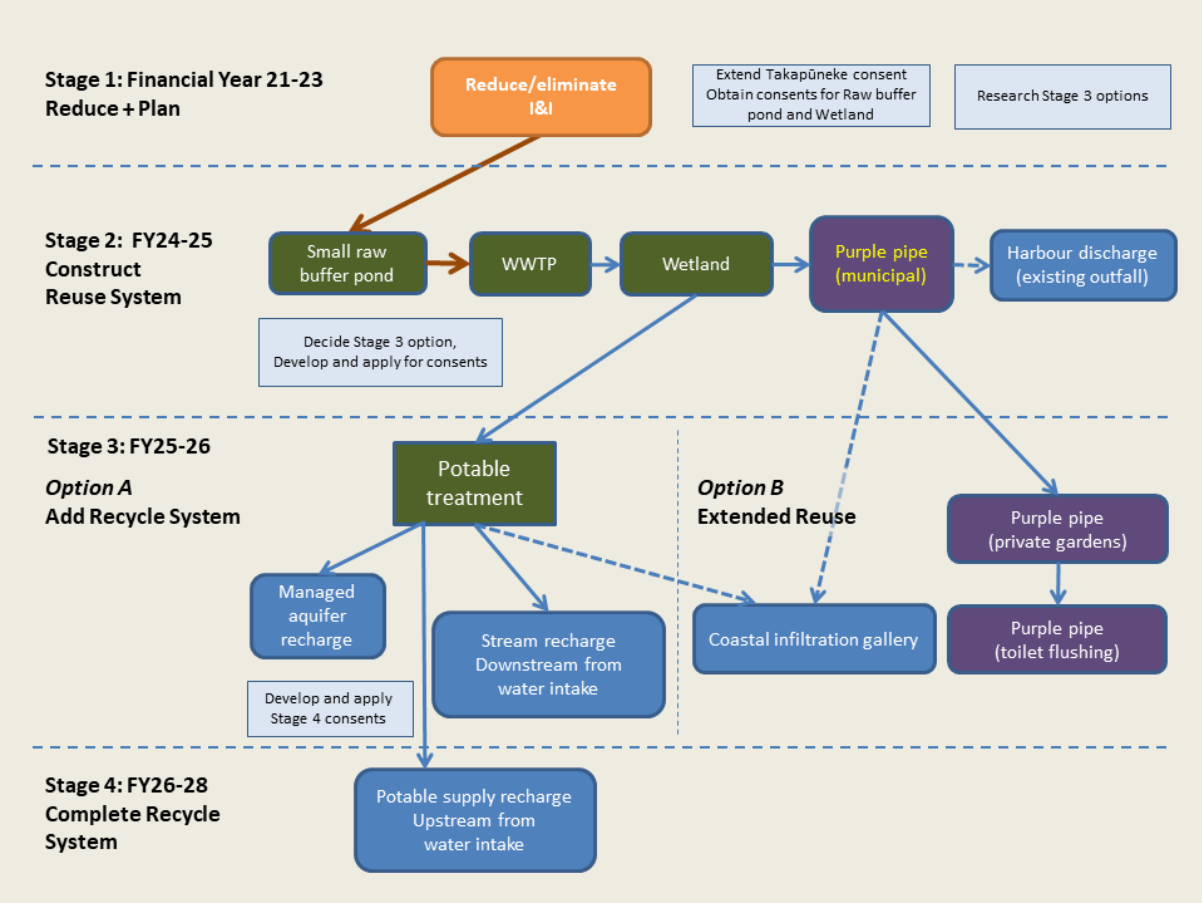
This creates a large baseline budget and the timeframe needed to develop an integrated system for Akaroa that solves issues with all three waters and sets it on a resilient future path. We suggest how this might be staged in the final chapter of our submission. We have called our proposal an "Integrated Reduce Reuse Recycle" system.

Chapter 12 Taking a staged approach

The system we proposed takes a classic approach to waste minimisation – starting with reducing the waste, then reusing waste, and finally recycling what cannot be reused back to its original form, in this case pure water.

We envisage the Council implementing this system over an 8 year period, enabling the costs to be spread over time. The timeframe could also be extended if needed for financial reasons, as the principal cultural issues driving the need to shift the plant and eliminate offensive harbour discharges are making steady progress.

Figure 20 Integrated Akaroa Wastewater concept based on a Reduce, Reuse and Recycle philosophy



12.1 Stage 1 Reduce and Plan

Use budget already allocated to reduce the volume of water as much as possible, principally by tackling the I&I issues thoroughly. This is the key to future resilience, to designing an appropriately sized system, to minimising raw sewage overflows and to provide headroom for future growth. It deals with a problem that must be addressed and frees up limited space at the treatment plant site for other components.

As already noted, the focus needs to be on the lower parts of the town where groundwater infiltration is likely to be highest, and where rising sea levels will exacerbate the problem, and the Council could either line the existing pipes at a cost of $4.5 million or replace part or all of the network with a pressure system for a cost of $6.1-$27 million

While the I&I work is in progress, there is time to gain consents for new components of the treatment plant (the raw buffer pond and the wetland), consent to extend the life of the existing plant and to research and plan later stages.

We do urge the Council to reconsider the location of the Terminal Pump Station and move it from its current vulnerable location on the coastal reclaimed landfill site, and to amend the consent accordingly.

Collaborate with the Ngāi Tahu parties to reach consensus on how to make both re-use and the disposal of excess flows culturally acceptable via a wetland or other land contact approach.

This work can commence using funding already allocated in the LTP and aim to complete over two years.

12.2 Stage 2 Construct a reuse system

We envisage this stage commencing in the 2024 LTP and being the highest cost component, as it would involve building the new WWTP at the top of Old Coach Road. However, this is likely to be a smaller plant than currently costed and there may no longer be the same need for raw sewage storage due to the I&I reduction. This would give more space at Pond Site 10 to construct a **wetland to further treat all of the wastewater after the ultrafiltration process, restoring mauri**.

If space is still constrained, then alternative locations for wetlands have been previously identified, including to the flat land across the State Highway from Pond Site 10.

The outflow from the wetland would be to a pipe running through Akaroa to the *existing* outfall. This can be laid at the same time as the new pipe taking wastewater to the Terminal Pump Station. The pipe will provide an initial purple pipe reuse network through Akaroa, enabling the watering of public parks and flushing public toilets. The water will be treated to a very high standard, as the inclusion of purple pipe in the system means water will be UV treated and tested prior to entering the wetland. It may need some filtering to remove any grit particles that have been introduced by the wetland to avoid clogging irrigation jets.

The plant at Takapūneke will be able to close once the new plant is in place. This would be several years earlier than under any of the proposed land-based options, and represent a major step toward reducing the cultural offensiveness of the current Akaroa system.

12.3 Stage 3 Introduce recycling or extend reuse

We envisage Stage 3 commencing in 2025, subject to funding being available and the regulatory framework being in place.

We suggest two possible options at Stage 3. Either to add potable treatment to enable water recycling or to extend the purple pipe reuse network. Use of the existing harbour outfall would cease during Stage 3 under either option.

Option A: treat to a potable standard and introduce recycling

Our preference is for potable treatment. We have held many meetings with **the community who repeatedly and consistently request that the water be treated to a potable standard.** This would turn the water from a waste product into a desirable and worry-free resource, opening up many options for direct beneficial reuse and alleviating Akaroa's water shortage issues. It would be a low footprint option as once the water had been treated to a potable standard there is no need to contain it in a separate pipe network.

We envisage potable treatment being achieved through the addition of reverse osmosis (RO) to the already highly treated water that has been through the ultra-filtration plant and the wetland. Issues

raised by the Council staff have been the cost of reverse osmosis and the level of retentate remaining that still has to be dealt with. However, reverse osmosis is used widely for wastewater reclamation, particularly in conjunction with membrane filtration, which removes most of the contaminants and reduces maintenance of the RO membranes. Retentate volumes can be minimised by sending it back through the treatment plant, similar to Beca's design for the MBR ultrafiltration system; again this is standard practice[76].

Potable treatment opens many possibilities of recycling such as:

- **Managed Aquifer Recharge**: this was supported by the Working Party, but trials that were about to commence were cancelled by Council due to health concerns. Treatment to a potable standard alleviates these concerns. As well as providing further land contact, recycling the water through the aquifers brings the added advantage of boosting their levels to prevent salt water incursion resulting from sea level rise.
- **Stream recharge (downstream)**: currently stream takes in Akaroa are limited by the need to retain minimum flow levels, which is often not possible in summer. Returning potable water to the streams would replace the flows taken and may be a way to reduce water shortages. Grehan Stream is the obvious candidate to be recharged because of its proximity to the treatment plant.

Option B: extend the purple pipe network for non-potable reuse

An alternative for reuse is to extend the purple pipe system to include private properties throughout Akaroa:

- **Reticulate non-potable water to property boundaries**: Council staff have identified that a substantial portion of the potable water supplied in summer is used for outdoor use. Therefore, reticulating non-potable water to the property boundary maximises the amount of reuse during summer when pressure on the water supply is at its greatest, and minimises disruption by avoiding the need to re-plumb existing buildings.
- **Extend non-potable reticulation to houses for toilet flushing and other internal use:** this increases the level of reuse still further (and all year round) but comes at a significantly higher cost and with substantial disruption as houses would require re-plumbing.

This option would require standards and regulation of reclaimed non-potable water to be put into place first.

Common to both options: coastal infiltration gallery

Both options are likely to require some form of disposal for water that cannot be reused. For Option A, this might result from the need to temporarily suspend stream recharge owing to stream flow conditions, while for Option B some form of disposal will be required for when reclaimed wastewater volumes exceed demand.

A coastal infiltration gallery could be used to disperse excess flows. This idea has was previously suggested in 2016 and not taken up[77], however there is a key difference between the situation then and now: the water is treated to a higher standard (minimum of purple pipe standard under Option B or potable standard under Option A), and all of the wastewater receives full treatment (no bypass flows).

[76] Engineering consultants to supply references
[77] Beca report July 2020, p18

12.4 Stage 4 Introduce full recycling

The final stage closes the loop and achieves full recycling, by returning the fully treated water to the potable supply by one of two means:

- **Indirect potable reuse**: recharge the Grehan stream some distance above the water supply intake, or
- **Direct potable reuse**: return the recycled water to the reservoir at L'Aube Hill.

Indirect potable reuse is by far the most common method used worldwide, because it ensures the recycled water is constantly blended with fresh water to alleviate any issues around degradation over time, and it substantially reduces the "yuck factor" of drinking recycled wastewater. Direct potable reuse would only be considered if there were reasons why stream recharge might not be possible or desirable.

This step would require standards and regulation of reclaimed potable water to be put into place first. We envisage this step being introduced in FY 2026 or later.

12.5 Conclusion

At the end of this path, Akaroa would have a `truly resilient and future focussed wastewater system integrated with its potable water supply system. The cultural issues of a wastewater treatment plant on a sensitive site and harbour discharges would be addressed, the stormwater infiltration into the wastewater system greatly improved, a more resilient potable water supply for Akaroa in place and the flow levels of its main stream better assured.

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Appendix 2 Tektus Consultants Engineers Memo

<see separate link on website>